GRUYERE GOLD PROJECT

ASSESSMENT ON PROPONENT INFORMATION (REVISED)

PREPARED FOR:

GOLD ROAD RESOURCES LIMITED

OCTOBER 2016
VERSION 3

PREPARED BY:

Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005
Ph: (08) 9226 3166
Fax: (08) 9226 3177
Email: info@mbsenvironmental.com.au
Web: www.mbsenvironmental.com.au

GRUYERE GOLD PROJECT
ASSESSMENT ON PROPONENT INFORMATION

Distribution List:

Company	Contact name	Copies	Date
Environmental Protection Authority	Peter Tapsell, Principal Environmental Officer Maree Heath, Environmental Officer EPA Registrar	[01] [Electronic]	13 October 2016
Gold Road Resources	Glenn Firth, Approvals Manager Sim Lau, Project Manager	[01] [Electronic]	13 October 2016

Document Control for Job Number: GRRGAPI

Document Status	Prepared By	Authorised By	Date
Draft Report for client review	Jonathon Barker Nicole Garbin	Kristy Sell	8 June 2016
Draft Report for client review	Jonathon Barker Nicole Garbin	Kristy Sell	5 August 2016
Draft Report for Yilka review	Jonathon Barker Nicole Garbin	Kristy Sell	10 August 2016
Final Report	Jonathon Barker Nicole Garbin Talia Warda	Kristy Sell	4 October 2016
Final Report, Revised, Version 2	Jonathon Barker Nicole Garbin Talia Warda	Kristy Sell	7 October 2016
Final Report, Revised, Version 3	Nicole Garbin Jonathon Barker	Kristy Sell	13 October 2016

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

The Gruyere Gold Project is located approximately 200 km north east of Laverton in Western Australia. It is accessed from Laverton, east along the Laverton–Warburton Highway, commonly known as the Great Central Road and then south along the existing Mt Shenton–Yamarna Road.

The project will comprise mining of gold from the Gruyere open pit over a 10 – 15 year life of mine (LoM) with potential to transition to underground mining operations at depth in the future. Ore will be processed at 7.5 Mt/a for fresh ore and up to 8.8 Mt/a for oxide ore using standard CIL processing methods. Two borefields (Yeo Borefield and Anne Beadell Borefield) will be developed within the Yeo Palaeochannel to abstract groundwater from the Werillup Aquifer at a rate of 5 GL/a. Additional infrastructure will be constructed to support the mining and ore processing facilities.

The Gruyere Gold Project was referred to the Environmental Protection Authority (EPA) by the proponent on 3 March 2016 and a revised referral and additional information was provided to the EPA on 31 March 2016. Further additional information was provided to the EPA on 20 May 2016 and 1 June 2016.

The level of assessment was set as an Assessment on Proponent Information (API) (Category A) on 15 June 2016. The EPA identified four preliminary factors, these being subterranean fauna, flora and vegetation, heritage and rehabilitation and decommissioning, however requested that only further information regarding subterranean fauna need be provided in the API.

In the interim Gold Road submitted a revised Section 43a Amendment letter for the Gruyere Gold Project on 27 September 2016 for a change in boundaries of development envelopes and an addendum to the Section 43a letter was submitted to the EPA on 29 September 2016. During this timeframe further botanical surveys were undertaken for the project area with the results of these being addressed in Section 5 and 6 of this document.

In order to understand the distribution and habitat of subterranean fauna, ten rounds of sampling were conducted in and around the Yeo Palaeochannel and Mine Site area between 2012 and 2016, with a total of 242 samples collected from 118 bores. A total of 4,263 stygofauna individuals were collected, representing 61 species and 12 higher taxonomic groups.

Fifty one of these species are known only from the Yamarna area with three of these currently only occurring in the proposed Yeo Borefield impact area. All species identified within the Anne Beadell borefield impact area and Mine Site have been found at other locations. The restricted species consist of two worms belonging to the family Enchytraeidae (*Enchytraeidae sp. B07* and *Enchytraeidae sp. B10)* and one Syncarid belonging to the family Parabathynellidae (*Parabathynellidae gen. nov. 1 sp. B07*).

Of these three species:

- *Enchytraeidae sp. B07* and *Parabathynellidae gen. nov 1 sp. B07* were found within bore 16GYWB0019 which is predicted to have more than 69% of its calcrete habitat remaining saturated at project completion, thus providing sufficient habitat for the survival of these two species.
- *Enchytraeidae sp. B10* was found within a fractured rock aquifer system (fresh rock) within bore 16GYWB0016 and thus will be able to move through the hydraulic connections in the aquifer as its habitat changes, thus providing sufficient habitat for the survival of this species.
- *Parabathynellidae gen. nov. 1 sp. B07* which was also found within bore 16GYWB0025 in the southern part of the Yeo borefield. The finding of this species within two bores separated by approximately 30 km suggests that there is interconnectivity between the habitat the bores intersect and should further sampling be undertaken, the likelihood is considered high that further specimens would be found.

In order to protect stygofauna habitat, Gold Road will implement an adaptive management program for saline groundwater abstraction from the Werillup Aquifer within the Yeo Palaeochannel whereby pumping locations and rates can be readily changed to manage drawdown impacts across the borefield.

Gold Road has commenced collecting baseline groundwater data through installation of monitoring bores within the Quaternary Detrital (shallow) and Werillup (deep) Aquifers within the Yeo Palaeochannel. This will continue throughout the construction phase of the project (estimated to be two years), during which time the Yeo borefield will remain non-operational. Data obtained from this monitoring will be utilised to develop bore specific trigger levels and threshold limits. These will be incorporated into the 'Preliminary Integrated Groundwater and Stygofauna Habitat Management Plan'. This will allow Gold Road to actively manage their impact upon the Yeo Palaeochannel and thus minimise the loss of subterranean fauna habitat and consequently minimise impacts on stygofauna species.

Based on the studies undertaken to date, and the Environmental Impact Assessment (EIA) undertaken in this API and associated 'Preliminary Integrated Groundwater and Stygofauna Habitat Management Plan', Gold Road believes that it can maintain representation, diversity, viability and ecological function at the species, population and assemblage level with regards to subterranean fauna found within the Yeo Palaeochannel and as such believes the Gruyere Gold Project will not be at variance with the EPA's objective for subterranean fauna.

1. INTRODUCTION

Section 1 provides proponent information, purpose and scope of this document and the key characteristics associated with the Gruyere Gold Project.

1.1 PROPONENT

The Gruyere Gold Project (the project) will be developed by Gold Road Resources Limited (Gold Road, or the Proponent). Gold Road is a gold explorer and developer, headquartered in Perth, Western Australia. It is listed on the Australian Securities Exchange (ASX) as GOR.

The Proponent can be contacted at:

Gold Road Resources Limited
Level 2, 26 Colin Street
West Perth WA 6005

PO Box 1157
West Perth WA 6872

The key contact for the project is:

Mr Glenn Firth
Approvals Manager
Telephone: (08) 9200 1600
Email: glenn.firth@goldroad.com.au

1.2 PURPOSE AND SCOPE

The project was referred to the Environmental Protection Authority (EPA) by the proponent on 3 March 2016 and a revised referral and additional information was provided to the EPA on 31 March 2016. Additional information letters were provided to the EPA on 20 May 2016 and 1 June 2016.

Advertising of the project on the EPA website and the 7 day public comment period began on 11 April 2016 and concluded on 18 April 2016. The level of assessment was set as an Assessment on Proponent Information (API) (Category A) on 15 June 2016 (EPA Assessment Nº. 2083). The EPA identified four preliminary factors, these being subterranean fauna, flora and vegetation, rehabilitation and decommissioning and heritage. A revised Section 43a Amendment letter for a change in development envelopes was submitted to the EPA on 27 September 2016 and an addendum to the Section 43a letter was submitted to the EPA on 29 September 2016.

This API has been prepared in order to fulfil the requirements for assessment of the project pursuant to Part IV of the *Environmental Protection Act 1986* (*EP Act*). The API has been prepared in accordance with the:

- *EP Act Environmental Impact Assessment (EIA) Administrative Procedures* (EPA 2012).
- *Environmental Assessment Guideline for Defining the Key Characteristics of a Proposal (EAG 1)* (EPA 2012a).
- *Environmental Assessment Guideline for Preparation of an API – Category A Environmental Review Document (EAG 14)* (EPA 2015).
- Consultation with the OEPA.

The 'Preliminary Integrated Groundwater and Subterranean Fauna Habitat Management Plan' has been prepared in accordance with the:

- *Environmental Assessment Guideline for Preparation of Management Plans under Part IV of the EP Act (EAG 17)* (EPA 2015a).

1.3 KEY PROPOSAL CHARACTERISTICS

The project is located approximately 200 km north east of Laverton in Western Australia (Figure 1). It is accessed from Laverton, east along the Laverton–Warburton Highway, commonly known as the Great Central Road and then south along the existing Mt Shenton–Yamarna Road.

Key proposal characteristics for the project are shown in Table 1 and are consistent with EAG 1 (EPA 2012a). Three development envelope areas totalling 18,629 ha have been defined for the project which includes 'Mine Site development envelope', 'Yeo Palaeochannel development envelope' and 'Access Corridor development envelope'. These envelopes reflect the geographically separated Mine Site components (including the Anne Beadell borefield), Yeo Palaeochannel borefield and the Access Corridor which links these two components. The development envelopes are shown in Figure 2 and the mine site layout is presented in Figure 3 with the accommodation village and Yeo Palaeochannel borefield layout presented in Figure 4.

The approximate land areas (not clearing footprint) for each development envelope are:

- Mine Site (including the Anne Beadell borefield) – 8,010 ha.
- Access Corridor – 3,102 ha.
- Yeo Palaeochannel Borefield – 7,517 ha.

Table 1: Key Proposal Characteristics

Summary	
Proposal Title	Gruyere Gold Project
Proponent Name	Gold Road Resources Limited
Short Description	This proposal is for open pit mining and processing of gold bearing ore at the Gruyere Gold Project, located approximately 200 km northeast of Laverton in Western Australia. Ore will be processed using conventional Carbon in Leach (CIL) treatment methods. The project will result in a Preliminary Integrated Waste Landform (IWL) *i.e.* a Tailings Storage Facility (TSF) within a Waste Rock Dump (WRD) being constructed to store mine and process wastes. The proposal also includes construction of associated mine infrastructure including an explosives magazine, emulsion compound, Run of Mine (ROM) pad, crushing area, stockpiles, waste rock landforms (WRLs), an above ground Tailings Storage Facility (TSF) built within the footprint of a WRL (*i.e.* IWL), water storage ponds and tanks, processing plant, reagent storages, concrete batch plant, laydown and storage areas, landfill facility, workshops, fuel facilities, wash down and waste oil facility, Wastewater Treatment Plant (WWTP), spray fields, turkey's nest dam, borrow pits, process and non-process water borefields, laboratory, bioremediation pad, gas and/or diesel power station, airstrip, accommodation village, reverse osmosis (RO) plant, buildings, offices, telecommunications infrastructure, access roads, tracks, internal roads and parking areas.

Summary		
Physical Elements		
Element	**Location**	**Proposed Extent Authorised**
Mine Site Development Envelope		
Waste Landforms (*i.e.* TSF and Waste Rock Landforms)	Figure 3	Clearing up to 800 ha within the 8,010 ha Development Envelope.
Minesite Infrastructure (*i.e.* Processing and Mining infrastructure including the Anne Beadell Borefield)	Figure 3	Clearing up to 700 ha within the 8,010 ha Development Envelope.
Open Pit	Figure 3	Clearing up to 130 ha within the 8,010 ha Development Envelope.
Yeo Palaeochannel Development Envelope		
Process Water Borefield	Figure 4	Clearing up to 250 ha within the 7,517 ha Development Envelope.
Access Corridor Development Envelope		
Borefield Access and Infrastructure Corridor	Figure 4	Clearing up to 380 ha within the 3,102 ha Development Envelope.
Operational Elements		
Element	**Location**	**Proposed Extent Authorised**
Mine Site Development Envelope		
Ore Processing Waste	Integrated Waste Landform Figure 3	Total storage capacity 92.4 Mt or 61.6 Mm3.
Mining Waste	Waste Rock Dump Figure 3	300.2 Mt.
Ore Processing	Processing Plant Figure 3	7.5 Mt/a conventional SABC gravity CIL plant with capacity to treat 8.8 Mt/a of oxide ores.
Dewatering and Abstraction	Non-Process Borefield Figure 3	0.8 GL/a (i.e. 0.4 GL/a abstraction from the Anne Beadell Borefield and 0.4 GL/a from pit dewatering)
Power Supply	Processing Plant Figure 3	40 MW (installed capability) - gas power plant and diesel backup of three x 1.0 MW units, or 40 MW (installed capability) - diesel powered generator sets.
Open Pit	Open Pit Figure 3	1,900 m long x 1,000 m wide x 450 m deep.
Yeo Palaeochannel Development Envelope		
Abstraction	Process Borefield - Figure 4	5 GL/a.

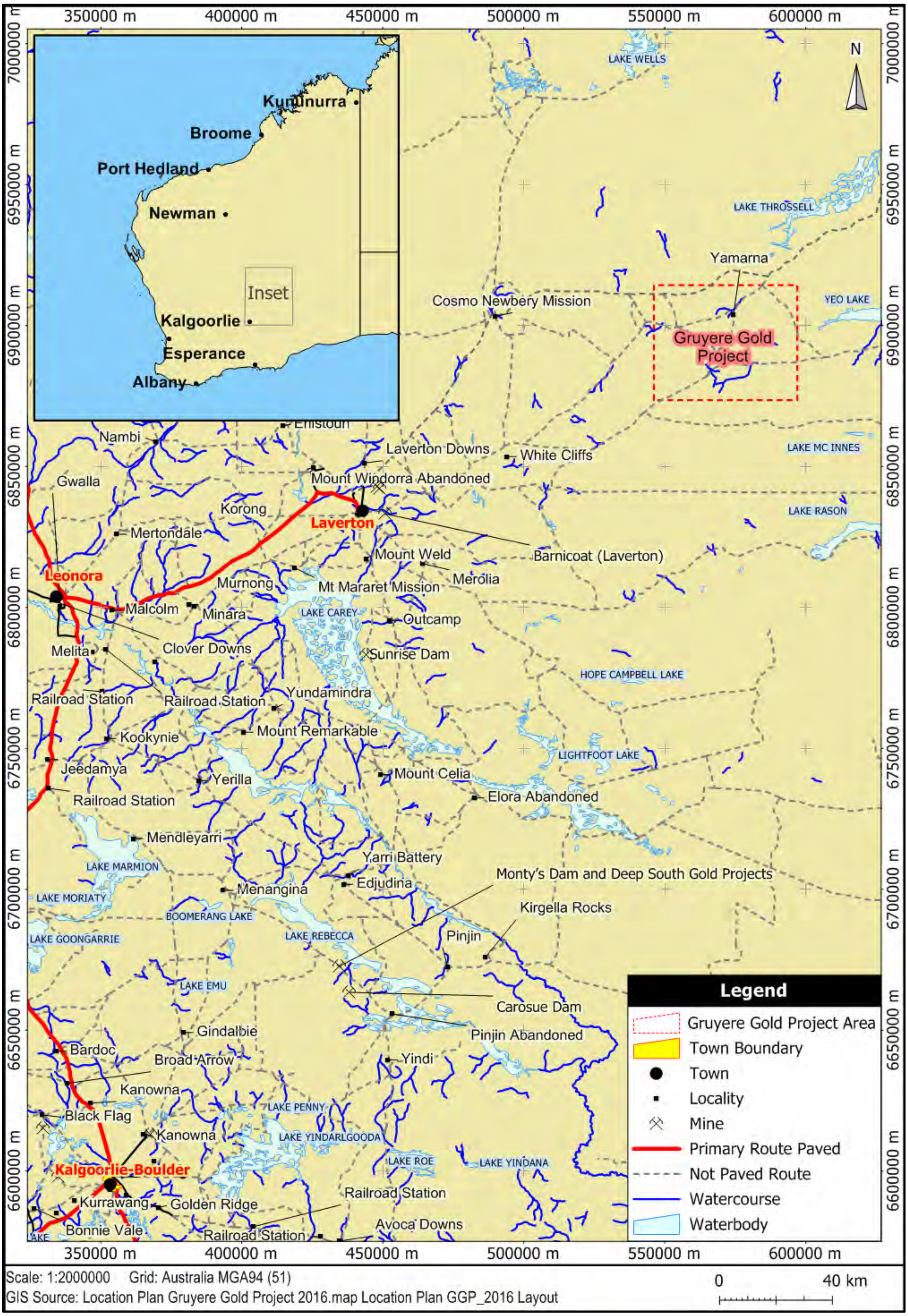


Figure 1: Location Plan

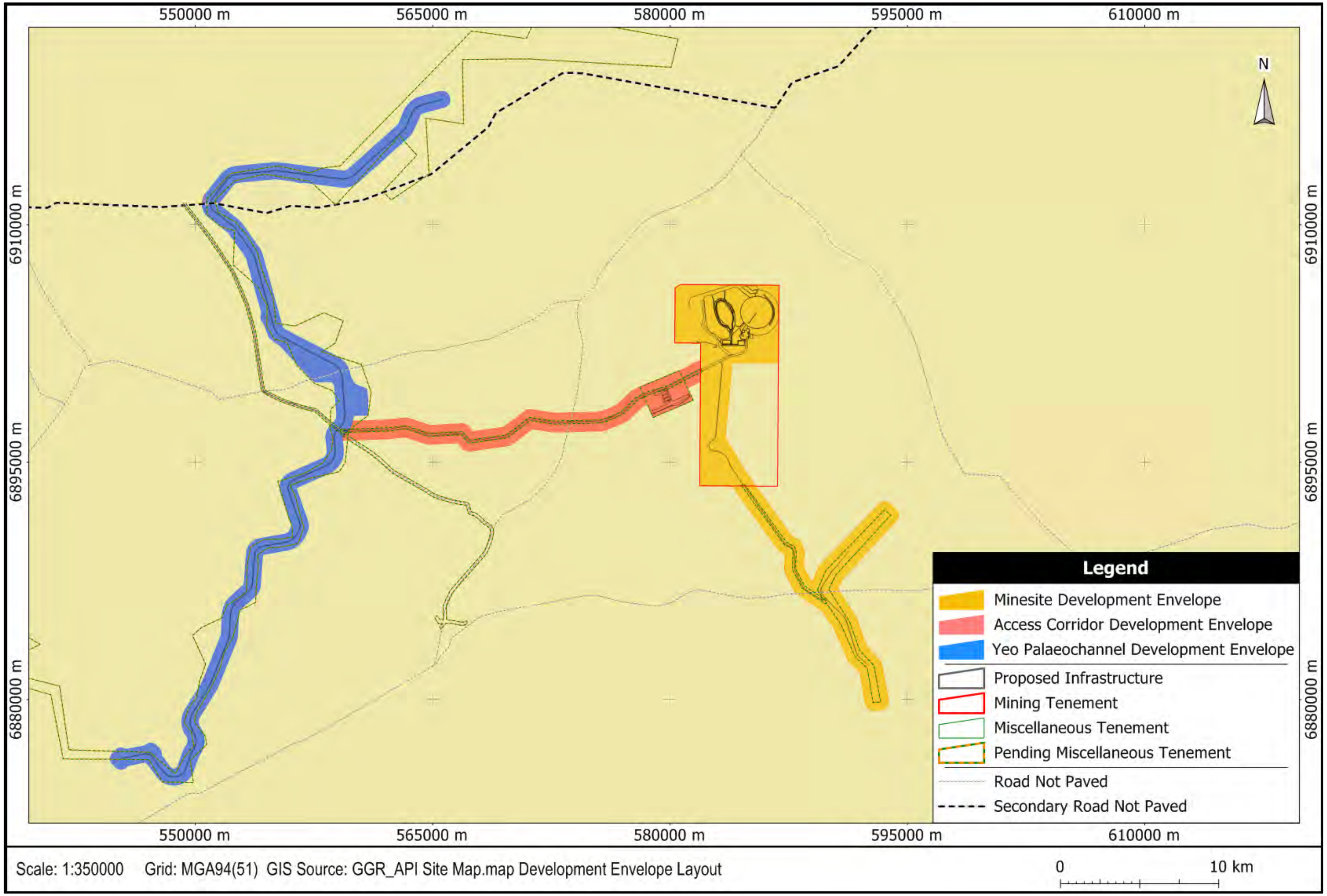


Figure 2: Development Envelopes Layout

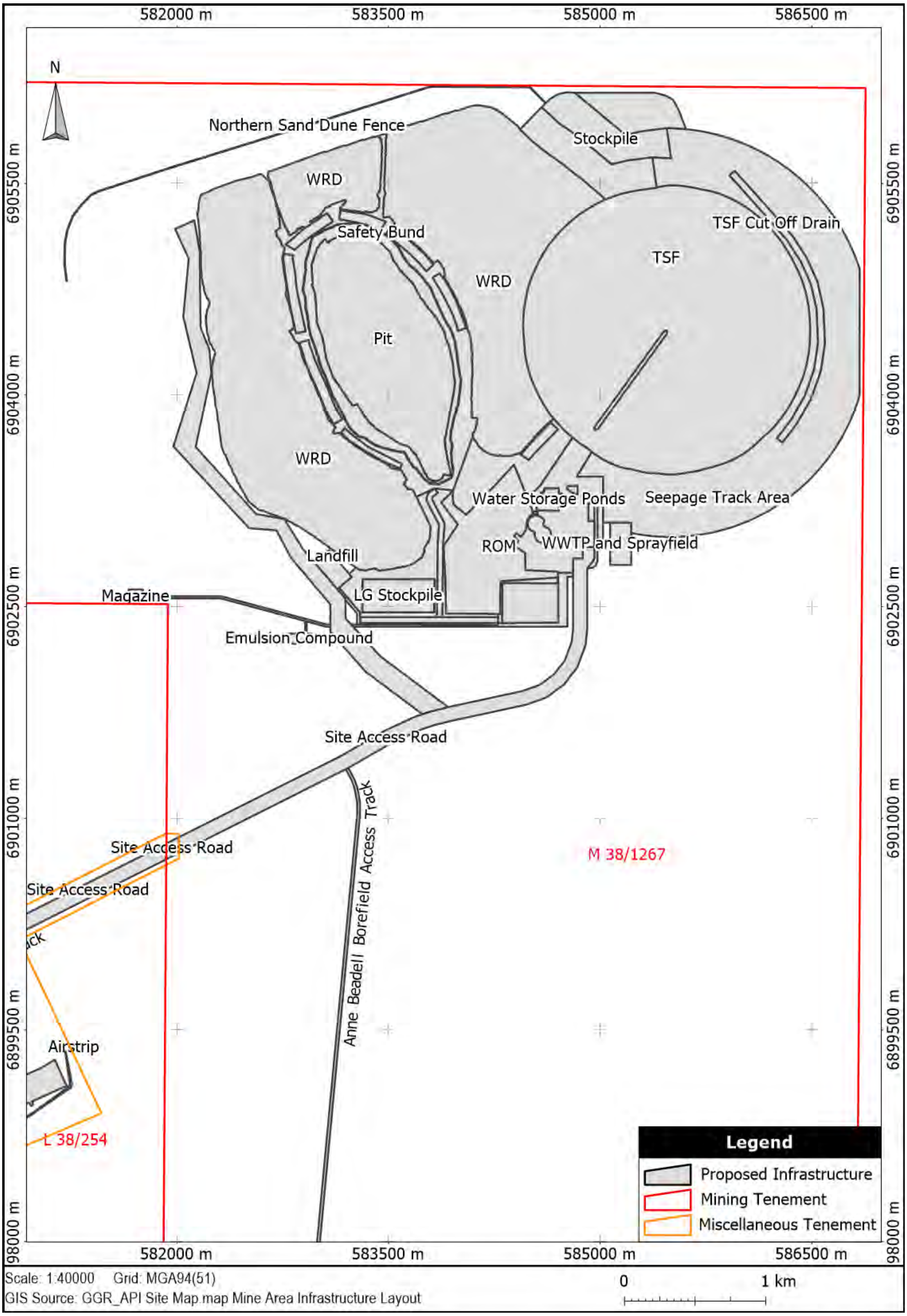


Figure 3: Mine Site Layout

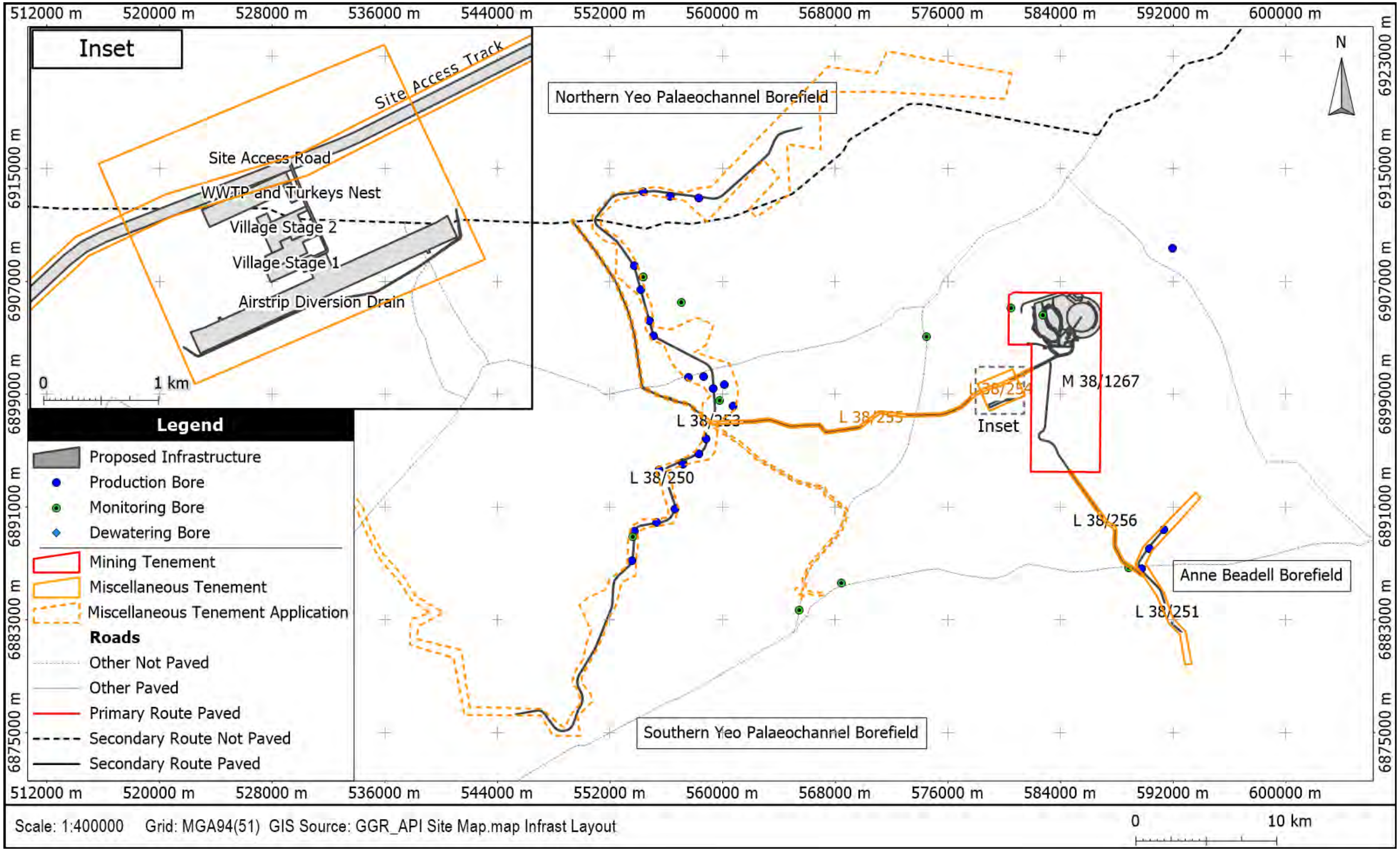


Figure 4: Yeo Palaeochannel Borefield Layout

2. GENERAL DESCRIPTION OF PROPOSAL

Section 2 provides a summary of the project's infrastructure and construction and operation of the project.

2.1 PROJECT DESCRIPTION

The project will comprise mining of gold from the Gruyere open pit over a 10 – 15 year life of mine (LoM) with the potential to transition to underground mining operations at depth in the future. The processing facility will be designed to process 7.5 Mt/a of Gruyere fresh ore and up to 8.8 Mt/a of oxide ore using CIL processing methodology (Figure 3). In addition, the project will involve the construction and use of:

- An integrated waste landform (IWL) *i.e.* a combined tailings storage facility (TSF) and waste rock landform (WRL) (Figure 3).
- A brackish-saline water borefield located within an eastern branch of the Yeo Palaeochannel (Anne Beadell borefield) to be used in the raw water system during the construction phase (1 - 2 years) and thereafter to supply non-process water requirements during the operational phase (10 - 15 years) (Figure 4).
- A northern and southern hypersaline water borefield located within the Yeo Palaeochannel (Yeo borefield) to be used for process water during the operational phase (10 - 15 years) (Figure 4).
- Support infrastructure including a run of mine (ROM) pad, workshops, laydown areas, power station, reagent storages, explosives magazine, washdown facility, fuel facility, stormwater management infrastructure (bunds and drains), water storage ponds and tanks, wastewater treatment plant (WWTP), landfill, accommodation village, buildings, offices, telecommunications infrastructure, access road, internal mine roads and an airstrip (Figure 3 and Figure 4).

A project summary is shown in Table 2.

Table 2: Project Summary

Aspect	Description
Clearing	Topsoil will be stripped and stockpiled from areas to be disturbed. Similar to topsoil material, overburden will be stripped and placed in designated stockpile areas for future rehabilitation works or for immediate use in constructing internal pit bunds or for backfilling the pit void.
Mining	Gold Road proposes to mine gold from the Gruyere Deposit using conventional drill, blast, load and haul open pit mining methods. The maximum dimensions of the open pit will be 1,900 m long by 1,000 m wide by 450 m depth and there is potential to transition to underground mining operations at depth in the future. Mining equipment will include excavators, haul trucks, surface drill rigs, dozers, water trucks, service trucks and graders. Dozer ripping will be utilised in the oxidised upper layers, with light drilling and blasting in the transitional zones and conventional drilling and blasting in the fresh rock. Waste rock will be utilised in the construction of a ROM pad at the processing plant. Ore will be brought from the pit to the ROM pad by truck. Waste material will be stockpiled for use during rehabilitation activities. Waste material will be used in the construction of the IWL; excess materials will be used to create the west WRD. An explosives magazine will store explosives for open pit blasting activities.

Aspect	Description
Processing	The processing facility will be designed to process 7.5 Mt/a of Gruyere fresh ore and up to 8.8 Mtpa of oxide and blends of ore in a CIL processing plant. The processing plant will be located near to the ROM pad and outside of the blast zone around the pit. The processing circuit will comprise the following unit processes: • Single staged crushing to a P80 of 135 mm. • Semi-autogenous grinding (SAG) and ball milling with pebble crushing and cyclone classification to a P80 of 125 micron. • Centrifugal gravity concentration and intensive cyanidation of the resulting gravity concentrate. • Pre-leach thickening. • Leaching and CIL adsorption of gold onto activated carbon. • Recovery of loaded carbon, elution and electrowinning of gold from the pregnant eluate. • Smelting doré. • Tailings will be thickened and disposed to an above ground IWL.
Water Abstraction	The majority of water for the project will be supplied from two Water Supply Areas (WSA), namely the Yeo Borefield and the Anne Beadell Borefield. The bulk of the raw water supply for the process facility will be sourced from an 80 km long borefield in the Yeo Palaeochannel located 25 km west of the Project known as the Yeo borefield. The Yeo borefield (which will not be operational until the start of the operational phase of the Project) will supply the 5 GL/a for the Project's process water demand at a salinity of less than 100,000 mg/L TDS from two areas, namely the northern and southern Yeo borefields. The Yeo borefield is anticipated to require a minimum of 23 duty bores, plus nine standby bores located nominally 2 km apart and delivering an average bore yield of 1,050 kL per day (12 L/s), sustainable over a period of 13 years. Bores will deliver water via a header pipe which will terminate at the raw water break tank (3,000 m3 capacity) at the intersection of the project access road. From this point water will be transferred parallel to the access road to the raw water pond at the processing plant. The Anne Beadell Borefield will consist of six bores (4 duty and 2 standby) and will provide brackish raw water a raw water break tank with a total storage capacity of 266 m^3. From this location a pair of raw water transfer pumps will deliver the water through a HDPE pipeline to the reverse osmosis (RO) feed water tank at the processing plant. Water will be processed at 1,100 m3/day through the RO plant, producing 700 m3/day of permeate which will supply the operation and accommodation village with fresh and potable water. The borefield pipeline will be buried wherever possible for fire protection and all bore compounds will be fenced.

Aspect	Description
Ancillary Infrastructure	In addition to the infrastructure detailed above and given the remote location of the project, the following support infrastructure is needed as part of the project: • Borefields (*i.e.*, a brackish-saline water borefield and a hypersaline water borefield). • Power station. • Buildings and Administration offices. • Workshops and Laydown Areas. • Communications facilities. • Accommodation village. • Airstrip. • Landfill and Recycling Facility. • Reverse Osmosis (RO) Plant. • Wastewater Treatment Plants (WWTP). • Washdown Facility. • Fuel Facility. • Roads.

For a detailed description of the following aspects relating to the project, please refer to the original Section 38 Referral document which was submitted to the EPA on 31 March 2016:

- Mining.
- Ore processing.
- Integrated waste landform.
- Water source and infrastructure.
- Power supply.
- Supporting facilities.
- Access roads.
- Closure, decommissioning and rehabilitation.

2.2 TENURE

The project is located within the Yamarna Pastoral Lease (PL N49674) which is wholly owned and managed by Gold Road. Gold Road currently holds one Mining Lease (M38/1267), totalling approximately 6,846 ha over the project area. Two miscellaneous licence applications are pending for the Yeo borefield (L38/250) and Mt Shenton-Yamarna road access (L38/253) (Figure 5). A tenement summary is provided in Table 3.

Table 3: Gruyere Gold Project Tenement Summary

Tenement	Area (ha)	Grant Date	Expiry Date	Purpose
M 38/1267	6,845.5	05/05/2016	05/05/2037	Mining
L38/250	13,090	Pending	Pending	Yeo Borefield
L38/251	789.9	03/10/2016	02/10/2037	Anne Beadell Borefield
L38/253	788.5	Pending	Pending	Mt Shenton-Yamarna Road Access
L38/254	568.8	27/09/2016	26/09/2037	Accommodation Village and Airstrip
L38/255	482.8	27/09/2016	26/09/2037	Main Access Road
L38/256	190.2	03/10/2016	02/10/2037	Anne Beadell Borefield Access Road

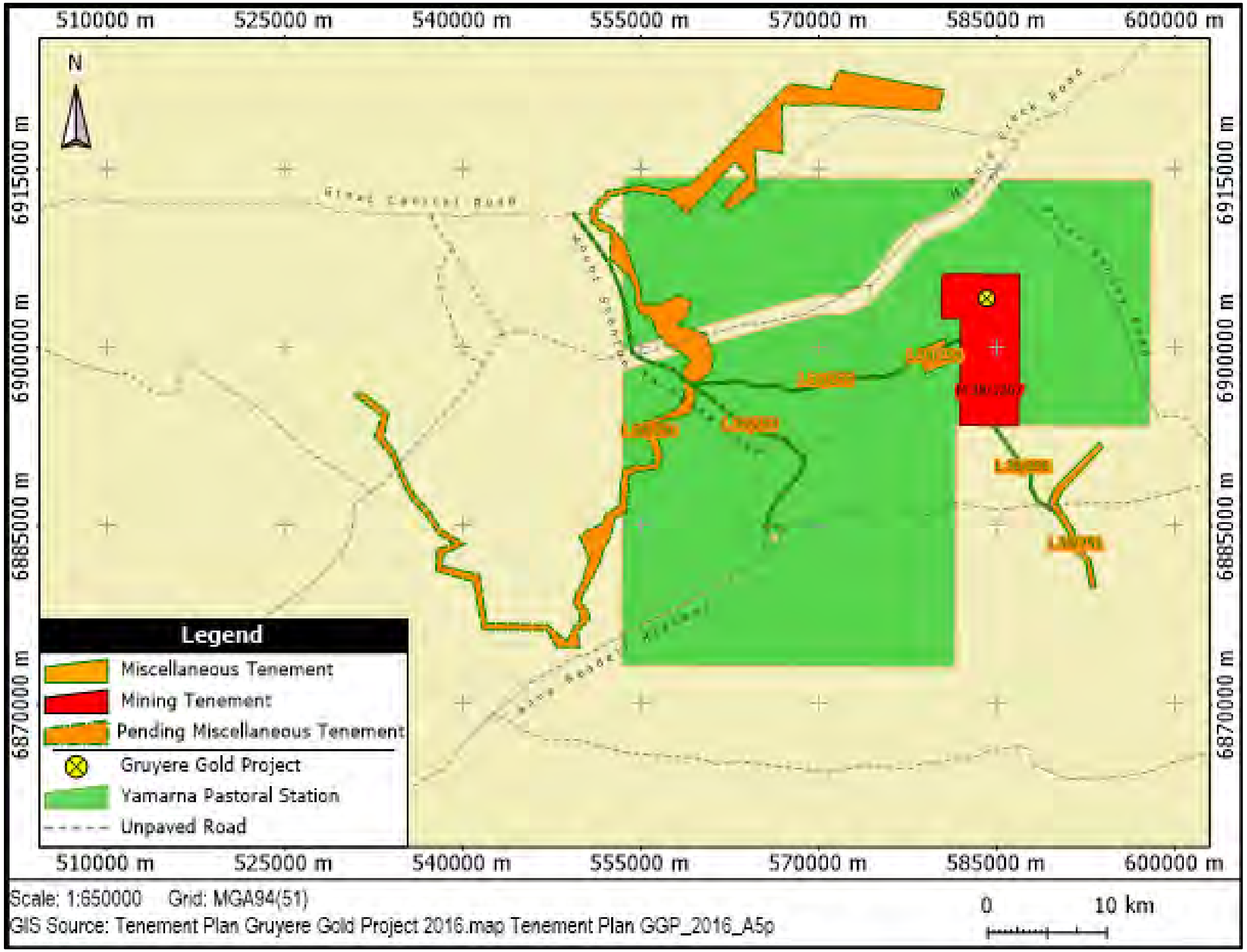


Figure 5: Tenement Plan

2.3 PROPOSED LAND DISTURBANCE

Land disturbance required for implementation of the project will be located on M38/1267 and miscellaneous licenses listed in Table 3.

The estimated total land disturbance is up to 2,260 ha for the project with the breakdown of this per development envelope shown in Table 4.

The approximate land areas for each development envelope are:

- Mine Site (including the Anne Beadell borefield) – 8,010 ha.
- Access Corridor – 3,102 ha.
- Yeo Palaeochannel Borefield – 7,517 ha.

Table 4: Estimated Land Disturbance for Key Project Components

Project Component	Estimated Land Disturbance Area (ha)
Mine Site Development Envelope (8,010 ha)	
Minor Infrastructure (causeway, explosive magazine, landfill, power station, pump station, tanks, ponds, WWTP)	30
Access Tracks	65
Access Tracks/Pipeline and Powerline Corridors	60
Flood Diversion Drains	55
Growth Media Stockpiles	90
Miscellaneous Disturbance	110
Open Pit and Safety Bund	130
Ore Stockpiles	20
Process Plant	35
ROM	45
TSF	365
TSF Monitoring Bores and Tracks	175
Waste Rock Landforms	435
Workshops and Laydowns	15
Total	**1,630**
Yeo Palaeochannel Development Envelope (7,517ha)	
Access Tracks	12
Borrow Pits	4
Pump Station and Water Holding Tanks	4
Yeo Palaeochannel Borefield (including Access Track/Process Water Borefield Pipeline and Powerline)	230
Total	**250**

Project Component	Estimated Land Disturbance Area (ha)
Access Corridor Development Envelope (3,102 ha)	
Access Tracks	260
Borrow Pits	15
Communications Tower	1
Spray field	14
Growth Media Stockpiles	5
Accommodation Village	20
RO Plant, WWTP and Turkeys Nest Dam	5
Airstrip and Terminal	60
Total	**380**
Grand Total	**2,260**

3. STAKEHOLDER CONSULTATION

Section 3 identifies the project's stakeholders and extensive consultation undertaken to date.

3.1 STAKEHOLDER IDENTIFICATION

A comprehensive consultation program was commenced by Gold Road upon the discovery of the Central Bore Deposit in 2009 and has since been expanded following the 2014 discovery of the Gruyere Deposit and Gold Road's decision to develop it. The program was designed to ensure all relevant stakeholders, from Federal, State and local government authorities, through to Traditional Owners, underlying tenement holders and environmental interest groups were all identified and effectively consulted with to address potential stakeholder concerns or requirements in regards to the project.

Table 5 lists the stakeholders identified and consulted for the project.

Table 5: Key Stakeholders for the Gruyere Gold Project

Stakeholder Sector	Organisation	Interest
State Government Departments and Agencies	Office of the Environmental Protection Authority (OEPA).	• Administers *EP Act*. • Part IV (*EP Act*) Environmental Impact Assessments.
	Department of Aboriginal Affairs (DAA).	• Indigenous and native title requirements. • Heritage, cultural, ethnographic and archaeological sites.
	Department of Mines and Petroleum (DMP). Mine Safety Inspectorate.	• Administers *Mining Act 1978* (*Mining Act*) and Regulations. • Level 2 Lead Agency Status. • Tenement conditions. • Mining proposals, programmes of work. • Mining rehabilitation fund. • Rehabilitation standards. • Safety in resource sector.
	Department of Water (DoW).	• Provision of licences to take and abstract water. • Groundwater quality and quantity.
	Department of Environment Regulation (DER).	• Administers Part V (*EP Act*), *Industry Regulation and Licensing and Contaminated Sites Act 2003*.
	Department of Parks and Wildlife (DPaW).	• Administers *Wildlife Conservation Act 1950* (*WC Act*). • Flora, fauna and habitat conservation. • Interest in Projects that are located on DPaW-managed land only. • Baseline surveys and licences to take flora and fauna.
	Department of Fire and Emergency Services (DFES).	• Fire breaks. • Provision of emergency services.
	Department of Health (DoH).	• Environmental health, building and planning compliance.
	Pastoral Lands Board (PLB).	• Pastoral leases, stations.
	Main Roads Western Australia (MRWA).	• Use of public roads.

Stakeholder Sector	Organisation	Interest
Federal Government Departments	Civil Aviation Safety Authority (CASA).	• Airstrip certification.
	Department of the Environment (Commonwealth, Territories and Assessment Branch) (DoE).	• Administers *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).* • Part 7 (Referral) and Part 8 (assessment) environmental impact assessments of matters of national environmental significance.
Local Government Authorities	Shire of Laverton (SoL).	• Use of public roads and infrastructure.
Indigenous Groups	Yilka Native Title Claimant Group. Cosmo Newberry Aboriginal Corporation.	• Access to and use of Traditional Owner land. • Cultural heritage values. • Native Title rights.
Underlying Land/Tenement Owners	Breaker Resources. Eastern Goldfields Mining Company. Magnis Resources. Montezuma Mining Company Ltd. Landslide Investments. MRG Metals Exploration.	• Land access approvals for baseline surveys and installation of liner infrastructure.
Environmental Interest Groups	Wildflower Society of Western Australia. Conservation Council of Western Australia (CCWA). Goldfields Naturalist Club. Great Victoria Desert (GVD) Biodiversity Trust.	• Potential interest in baseline surveys and significance of data.

3.2 CONSULTATION

Since the implementation of the stakeholder consultation program in 2009, regulatory authorities and Traditional Owners (Yilka, Cosmo Newberry Aboriginal Corporation (CNAC) and *Wati* Senior Men) have been thoroughly and effectively consulted with in relation to all of Gold Road's exploration activities in the Yamarna region and more recently with respect to the project.

Details of consultation outcomes with stakeholders listed in Table 5 are provided in the 'Stakeholder Consultation Register' in Appendix 1. Gold Road will continue to genuinely engage with relevant stakeholders on matters associated with the project to ensure stakeholder concerns are addressed and that potential impacts will be managed through implementation of best practice environmental management measures.

4. ENVIRONMENTAL STUDIES AND SURVEY EFFORT

A number of baseline surveys have been commissioned to date for the project including the Yeo Palaeochannel and Central Palaeochannel (Anne Beadell) borefield areas, which have greatly contributed to the scientific understanding of the western part of the Great Victoria Desert (GVD). These studies have been included as appendices within the original Section 38 Referral submitted to the EPA on 31 March 2016 and any recent and updated surveys have been included as appendices within the API document.

Additional environmental information which is relevant on a regional scale has been collected by Gold Road as part of earlier investigations into the Central Bore area which is located approximately 21.5 km to the southwest of the project.

Baseline surveys undertaken to date and their completion status are shown in Table 6.

Table 6: Summary of Baseline Surveys Undertaken at Central Bore and Gruyere

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
Flora	Level 1 flora and vegetation survey - proposed haul road (Autumn) 2011.	Central Bore	Botanica Consulting	2011	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). The only limitation to this survey was that fieldwork was not completed during the EPA's recommended time period. It was noted however that above average rainfall had occurred in the months prior to the survey and as such many plants were in flower.
	Level 2 flora and vegetation survey (Spring) 2011.	Central Bore	Botanica Consulting	2011	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002).
	Level 2 flora and vegetation survey (Autumn) 2012.	Central Bore	Botanica Consulting	2012	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002).
	Level 1 flora and vegetation survey (Autumn) 2014.	Gruyere	Botanica Consulting	2014	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). There were two minor limitations to the survey these were: – Timing of survey, weather and season - above average rainfall had been received before the survey; however the survey was conducted outside of optimal flowering period for the majority of species.

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
					– Survey intensity – Additional survey work may be required during optimal flowering periods.
	Level 2 flora and vegetation survey (Spring) 2014.	Gruyere	Botanica Consulting	2014	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). The only limitation to this survey was the fact that rainfall for the winter months preceding the survey were below average. This was considered a minor limitation.
	Level 2 flora and vegetation survey (Autumn) 2015.	Gruyere	Botanica Consulting	2015	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). The only limitation to this survey was relating to PATN data analysis due to BC staff only having basic statistical training. This was considered a minor limitation. The potential limitation was addressed by a peer review by an experienced statistician.
	Level 1 flora and vegetation survey (Autumn) 2015.	Gruyere Borefields	Botanica Consulting	2015	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). There were two minor limitations to the survey these were: – Mapping reliability – high quality ortho aerial images were unobtainable, however aerials used were considered sufficient. – Area disturbance – vegetation was in various stages of fire regrowth.
	Level 1 flora and vegetation survey (Autumn) 2016.	Gruyere Borefields	Botanica Consulting	2016	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
					Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). There was one minor limitation to the survey: – Area disturbance – vegetation ranged from health rating 2 to 3 due to being in various stages of fire regrowth.
	Level 1 flora and vegetation survey (Autumn) 2016.	Gruyere Accommodation Village and Airstrip	Botanica Consulting	2016	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). There was one minor limitation to the survey: – Area disturbance – vegetation had a health rating of 3 due to some signs of damage caused by human activities since European settlement.
	Level 1 Flora and Fauna Survey Gruyere Borefields	Borefields	Botanica Consulting	2016	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). There was one minor limitation to the survey: – Area disturbance – vegetation ranged from health rating 2 to 3 due to being in various stages of fire regrowth.
Fauna	Level 1 vertebrate fauna survey (Autumn) 2011.	Central Bore	Greg Harewood/ Botanica Consulting	2011	• Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). • Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (EPA 2010).
	Level 2 vertebrate fauna survey (Spring 2011, Autumn 2012).	Central Bore	Keith Lindbeck & Associates	2011 2012	• Guidance Statement No. 20: Sampling of Short Range Endemic Vertebrate Fauna for Environmental Impact in Western Australia. (EPA 2009)

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
					• Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). • Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (EPA 2010). The single limitation noted during this survey was the inability to access and dig pit traps into the granite areas.
	Level 1 vertebrate fauna survey (Autumn) 2014.	Gruyere	Greg Harewood/ Botanica Consulting	2014	• Guidance Statement No. 20: Sampling of Short Range Endemic Vertebrate Fauna for Environmental Impact in Western Australia (EPA 2009). • Guidance Statement No. 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Assessment in Western Australia (EPA 2003). • Guidance Statement No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia (EPA 2007). • Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). • Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (EPA 2010). Limitations for this survey included: – No seasonal sampling being undertaken. – Some fauna species have been reported to potentially occur in the survey area based on there being suitable habitat.
	Level 2 vertebrate fauna survey and SREs (Spring) 2014.	Gruyere	Rapallo Environmental	2014	• Guidance Statement No. 20: Sampling of Short Range Endemic Vertebrate Fauna for Environmental Impact in Western Australia (EPA 2009). • Guidance Statement No. 56: Terrestrial Fauna Surveys for

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
					Environmental Impact Assessment (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). • Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (EPA 2010). Two limitations were noted during this survey, they are: – Proportion of fauna identified/recorded – Lower than anticipated numbers of species from common taxonomic groups were recorded. – Timing – hot, dry conditions may have contributed to lower than anticipated faunal abundance although survey timing did conform to EPA (2010) recommendations.
	Level 1 vertebrate fauna survey (Spring) 2015.	Gruyere Borefields	Greg Harewood	2015	• Guidance Statement No. 20: Sampling of Short Range Endemic Vertebrate Fauna for Environmental Impact in Western Australia (EPA 2009). • Guidance Statement No. 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Assessment in Western Australia (EPA 2003). • Guidance Statement No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia (EPA 2007). • Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). • Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (EPA 2010).
	Level 1 flora and vegetation survey (Autumn) 2016.	Gruyere Borefields	Botanica Consulting	2016	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
					Element of Biodiversity Protection (EPA 2002). There was one minor limitation to the survey these were: – Area disturbance – vegetation ranged from health rating 2 to 3 due to being in various stages of fire regrowth.
	Level 1 flora and vegetation survey (Autumn) 2016.	Gruyere Accommodation Camp and Airfield	Botanica Consulting	2016	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). There was one minor limitation to the survey: – Area disturbance – vegetation had a health rating of 3 due to some signs of damage caused by human activities since European settlement.
	Level 1 Flora and Fauna Survey Gruyere Borefields	Borefields	Botanica Consulting	2016	• Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b). • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). There was one minor limitation to the survey: – Area disturbance – vegetation ranged from health rating 2 to 3 due to being in various stages of fire regrowth.
Short Range Endemics	Level 2 SRE survey (Spring) 2015.	Gruyere	Greg Harewood.	2015	• Guidance Statement No. 20: Sampling of Short Range Endemic Vertebrate Fauna for Environmental Impact in Western Australia (EPA 2009). • Guidance Statement No. 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Assessment in Western Australia (EPA 2003) • Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA 2004b) • Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002) • Environmental Assessment Guideline12: Consideration of

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
					Subterranean Fauna in Environmental Impact Assessment in Western Australia (EPA 2013a).
Subterranean Fauna	Desktop review and pilot-scale stygofauna survey 2013.	Central Bore/ Borefield	Bennelongia	2013	• Guidance Statement No. 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Assessment in Western Australia (EPA 2003). • Guidance Statement No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia (EPA 2007).
	Subterranean fauna assessment 2013.	Central Bore/ Borefield	Bennelongia	2013	• Environmental Assessment Guideline12: Consideration of Subterranean Fauna in Environmental Impact Assessment in Western Australia (EPA 2013a). • Guidance Statement No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia. (EPA 2007).
	Subterranean fauna survey (mine area) 2015.	Gruyere	MBS Environmental	2015	• Guidance Statement No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia. (EPA 2007) • Environmental Assessment Guideline12: Consideration of Subterranean Fauna in Environmental Impact Assessment in Western Australia (EPA 2013a).
	Subterranean fauna survey 2015/2016	Gruyere Borefields	Bennelongia	2015/2016	• Guidance Statement No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia. (EPA 2007)
				Early to Mid-2016	• Guidance Statement No 54a: Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia. (EPA 2007).
Water	Hydrogeological desktop study 2011.	Central Bore	Golder Associates	2011	• N/A
	Hydrogeological scoping study 2011.	Central Bore	Pennington Scott	2011	• State-wide Policy No. 5.12 – Hydrogeological Reporting Associated with a Groundwater Well Licence (DOW2009).
	Hydrogeological study 2012.	Central Bore	Pennington Scott	2012	• State-wide Policy No. 5.12 – Hydrogeological Reporting

Aspect	Survey	Project	Undertaken By	Year Undertaken	Applicable Policy and Limitations
					Associated with a Groundwater Well Licence (DOW2009).
	Hydrogeological study 2015.	Gruyere	Pennington Scott	2015	• State-wide Policy No. 5.12 – Hydrogeological Reporting Associated with a Groundwater Well Licence (DOW2009).
	Hydrogeological summary 2016.	Gruyere	Pennington Scott	2016	• State-wide Policy No. 5.12 – Hydrogeological Reporting Associated with a Groundwater Well Licence (DOW2009).
	H3 Hydrogeological report updated 2016.	Gruyere	Pennington Scott	2016	• State-wide Policy No. 5.12 – Hydrogeological Reporting Associated with a Groundwater Well Licence (DOW2009).
Soil and Landform	Soil and landform assessment 2015.	Gruyere	MBS Environmental	2015	• Guideline on Laboratory Analysis of Potentially Contaminated Soil. Schedule B3 (NEPM 2013a). • Guideline on Investigation Levels for Soil and Groundwater. Schedule V1 (NEPM 2013 b).
Waste Characterisation	Waste geochemical characterisation 2013.	Central Bore	Coffey	2013	• Guidelines for Fresh and Marine Water Quality (ANZECC 2000).
	Waste rock characterisation 2015.	Gruyere	MBS Environmental	2015	• Guidelines for Fresh and Marine Water Quality (ANZECC 2000)
	Tailings geochemical characterisation 2015.	Gruyere	MBS Environmental	2015	• Global Acid Rock Drainage Guide (INAP 2009)
Heritage	Heritage survey 2004.	Yamarna Exploration Area	Traditional Owners Archaeologists	2004	• N/A
	Ethnographic Cultural Mapping survey (Spring) 2015.	Gruyere	Anthropologists Senior Men	2015	• Guidance for the Assessment of Environmental Factors - Assessment of Aboriginal Heritage No. 41) (EPA, 20004).

5. ASSESSMENT OF PRELIMINARY ENVIRONMENTAL FACTORS

Section 5 discusses and undertakes an assessment of the project's preliminary environmental factors and principals.

5.1 PRELIMINARY ENVIRONMENTAL FACTORS

On the basis of the *EPA Environmental Assessment Guideline No. 8: Environmental Factors and Objectives* (EPA 2015b), the EPA identified four preliminary environmental factors for the project, namely:

- Flora and Vegetation.
- Subterranean Fauna.
- Heritage.
- Rehabilitation and Closure.

Of these, the EPA has requested further information be provided in the API for only one factor, namely Subterranean Fauna (as per conversation and follow up email on 29 June 2016 between MBS and EPA and meeting held between the EPA, MBS and Gold Road on 5 July 2016). The single preliminary environmental factor required to be addressed in this document is presented in Table 7. The remaining three preliminary environmental factors have been briefly updated (Section 6) where new data has become available since information was provided in the Referral process.

Table 7: Preliminary Environmental Factors for the Gruyere Gold Project

Key Factor	Development Envelope	Environmental Aspect	Impact
Subterranean Fauna	Yeo Palaeochannel	Groundwater Levels	Alterations to stygofauna habitat due to changes to groundwater levels.
		Groundwater Quality	Alterations to stygofauna habitat due to changes to groundwater quality.
		Groundwater Quality	Alterations to stygofauna habitat due to contamination of groundwater.

5.2 SUBTERRANEAN FAUNA

Baseline surveys undertaken for the project addressed both troglofauna and stygofauna and considered impacts associated with mine dewatering and groundwater abstraction via purpose developed borefields.

The geology of the project area and immediate surrounds above the water table, comprise of lithologies that do not typically provide subterranean habitat suited to troglofauna. This has been substantiated by nil recordings during project specific baseline surveys. Risks to troglofauna from the project are considered to be low to negligible given that no excavation of habitat is planned to occur in either the Anne Beadell or Yeo borefields associated with the project. Drawdown of the water table from abstraction within the borefields is unlikely to lead to significant reduction in above water table humidity and in fact, drawdown may increase the amount of troglofauna habitat available (Bennelongia 2016).

Baseline surveys have identified stygofauna populations within the mine site and borefield development envelopes. On this basis, information presented in the following subsections specifically addresses stygofauna.

5.2.1 Studies and Investigations

5.2.1.1 Yeo Palaeochannel

Ten rounds of sampling were conducted in and around the Yeo Palaeochannel between 2012 and 2016 by Bennelongia (Appendix 2), with a total of 242 samples collected overall from 118 bores. Figure 6 shows sampling locations and which of these bores recorded the presence or absence of stygofauna.

A total of 4,263 stygofauna individuals were collected representing 61 species and 12 higher taxonomic groups occurring in the Yeo Palaeochannel. These included worms in the groups Nematoda (1 species), Aphanoneura (1 species), Oligochaeta (11 species) and Turbellaria (1 species), as well as rotifers (2 species), crustaceans belonging to the orders Copepoda (33 species), Ostracoda (1 species), Syncarida (5 species), Amphipoda (3 species), and diving beetles in the insect family Dytiscidae (3 species). Copepods and amphipods made up a significant portion of all specimens collected representing 77% and 18% respectively (Table 8).

Four (*Tubellaria sp., Nematoda sp., Bdelloidea sp. 2:2* and *Lecane ludwigii*) of these 61 species belong to groups of stygofauna that are not assessed in Environmental Impact Assessment in Western Australia) due to poor taxonomic frameworks and difficulties in identification. A further six species collected (*Dussartcyclops uniarticulatus*, *Dussartcyclops* nr *uniarticulatus, Fierscyclops fiersi*, *Halicyclops kiefer,* Phreodriliidae with similar ventral chaetae, *Sarscyprisopsis* sp. BOS615 and Calanoida sp.) have ranges that are known to extend well into the Yilgarn and north Western Australia.

The remaining 51 species are known only from the Yamarna area with three of these currently only occurring in the proposed Yeo Borefield impact area. All species identified within the Anne Beadell borefield impact area have been found at other locations within the Yeo Palaeochannel. The restricted species consist of:

- Two Enchytraeidae worms (*Enchytraeidae sp. B07 and Enchytraeidae sp. B10)* identified as different species through DNA analysis a number of animals belonging to the *Enchytraeidae sp. 1* complex.
- A Syncarid (*Parabathynellidae gen. nov. 1 sp. B07*) which was collected as a single specimen from one bore in the southern and northern Yeo borefield impact areas.

Bennelongia considered biological surrogates and the EPA's definition of them. Bennelongia confirmed there are no biological surrogates available for these three species (pers. comm 03/10/2016).

Table 8: Stygofauna Species Collected from the Yeo Palaeochannel

Higher Group	Family	Species	Distribution
Primitive Worms			
Turbellaria	-	Turbellaria sp.	Not assessed in impact assessment
Nematoda	-	Nematoda sp.	Not assessed in impact assessment
Rotifers			
Rotifera	-	Bdelloidea sp. 2:2	Not assessed in impact assessment
	Lecanidae	*Lecane ludwigii*	Not assessed in impact assessment (Cosmopolitan)
Worms			
Aphanoneura	Aeolosomatidae	Aeolosomatidae sp.	Yamarna
	Enchytraeidae	*Enchytraeidae* sp. B07	Yeo Borefield
		Enchytraeidae sp. B08	Yamarna
		Enchytraeidae sp. B09	Yamarna
		Enchytraeidae sp. B10	Yeo Borefield
		Enchytraeidae sp. B11	Yamarna
		Enchytraeidae sp. B12	Yamarna
		Enchytraeidae sp. B13	Yamarna
		Enchytraeidae sp. B14	Yamarna
		Enchytraeidae sp. B15	Yamarna
	Phreodrilidae	*Insulodrilus* sp.	Yamarna
	Tubificidae	Tubificidae sp. B02	Yamarna
Crustaceans			
Calanoida		Calanoida sp.	Unknown*
Cyclopoida	Cyclopidae	*Dussartcyclops uniarticulatus*	Yilgarn
		Dussartcyclops nr uniarticulatus	North-west WA
		Fierscyclops (Fierscyclops) fiersi	Yilgarn
		Halicyclops eberhardi a	Yamarna
		Halicyclops eberhardi b	Yamarna
		Halicyclops eberhardi c	Yamarna
		Halicyclops kieferi	North-west WA
Harpacticoida	Ameiridae	Ameiridae gen. nov. 4 sp. B01	Yamarna
		Nitocrella sp. B06	Yamarna
		Nitocrella sp. B07	Yamarna
		Nitocrella sp. B10	Yamarna
		Nitocrella sp. B11	Yamarna
		Nitocrellopsis sp. B04	Yamarna
		Nitocrellopsis sp. B05	Yamarna
		Nitocrellopsis sp. B06	Yamarna
		Nitocrellopsis sp. B07	Yamarna
		Nitocrellopsis sp. B08	Yamarna
		Nitocrellopsis sp. B09	Yamarna
		Nitocrellopsis sp. B10	Yamarna
		Nitokra lacustris sp. B02	Yamarna
		Nitokra lacustris sp. B03a	Yamarna
		Nitokra lacustris sp. B03b	Yamarna

Higher Group	Family	Species	Distribution
		Nitokra lacustris sp. B06	Yamarna
		Nitokra sp. B04	Yamarna
		Stygonitocrella sp. B05	Yamarna
	Canthocamptidae	*Australocamptus* sp. B12	Yamarna
	Miraciidae	*Schizopera* sp. B08	Yamarna
		Schizopera sp. B09	Yamarna
		Schizopera sp. B11	Yamarna
	Parastenicarididae	*Kinnecaris* sp.	Yamarna
		Parastenocaris sp. B24	Yamarna
		Parastenocaris sp. B33	Yamarna
Ostracoda	Cyprididae	*Sarscypridopsis* sp. BOS615	Yilgarn
Syncarida	Parabathynellidae	*Atopobathynella* sp. B13	Yamarna
		Kimberleybathynella sp. B07	Yamarna
		Parabathynellidae gen. nov. 1 sp. B04	Yamarna
		Parabathynellidae gen. nov. 1 sp. B07	Yeo Borefield
		Parabathynellidae gen. nov. 1 sp. B08	Yamarna
Amphipoda	Chiltoniidae	*Chiltoniidae sp. B01*	Yamarna
		Chiltoniidae sp. B02	Yamarna
		Chiltoniidae sp. B03	Yamarna
Insects			
Coleoptera	Dytiscidae	*Limbodessus* sp. B05	Yamarna
		Limbodessus sp. B06	Yamarna
		Nirripirti sp. B01	Yamarna

** It is considered likely that Calanoida sp. is a species of Calamoecia with a predominantly surface occurrence and a moderately large, inland range but all animals collected were female and not readily identifiable.*

5.2.1.2 Mine Site

During the Level 1 survey of the "Orebody" Aquifer (MBS 2015); three stygofauna species were recorded from five of ten sampling sites which included:

- One species of Tubificida (Class *Oligochaete*).
- One species of Syncarida *(nr Atrpobathynella* sp. B19).
- One species of Copepoda (*Parastenocaris* sp. B30).

Figure 6 shows sampling locations and which of these bores recorded the presence or absence of stygofauna.

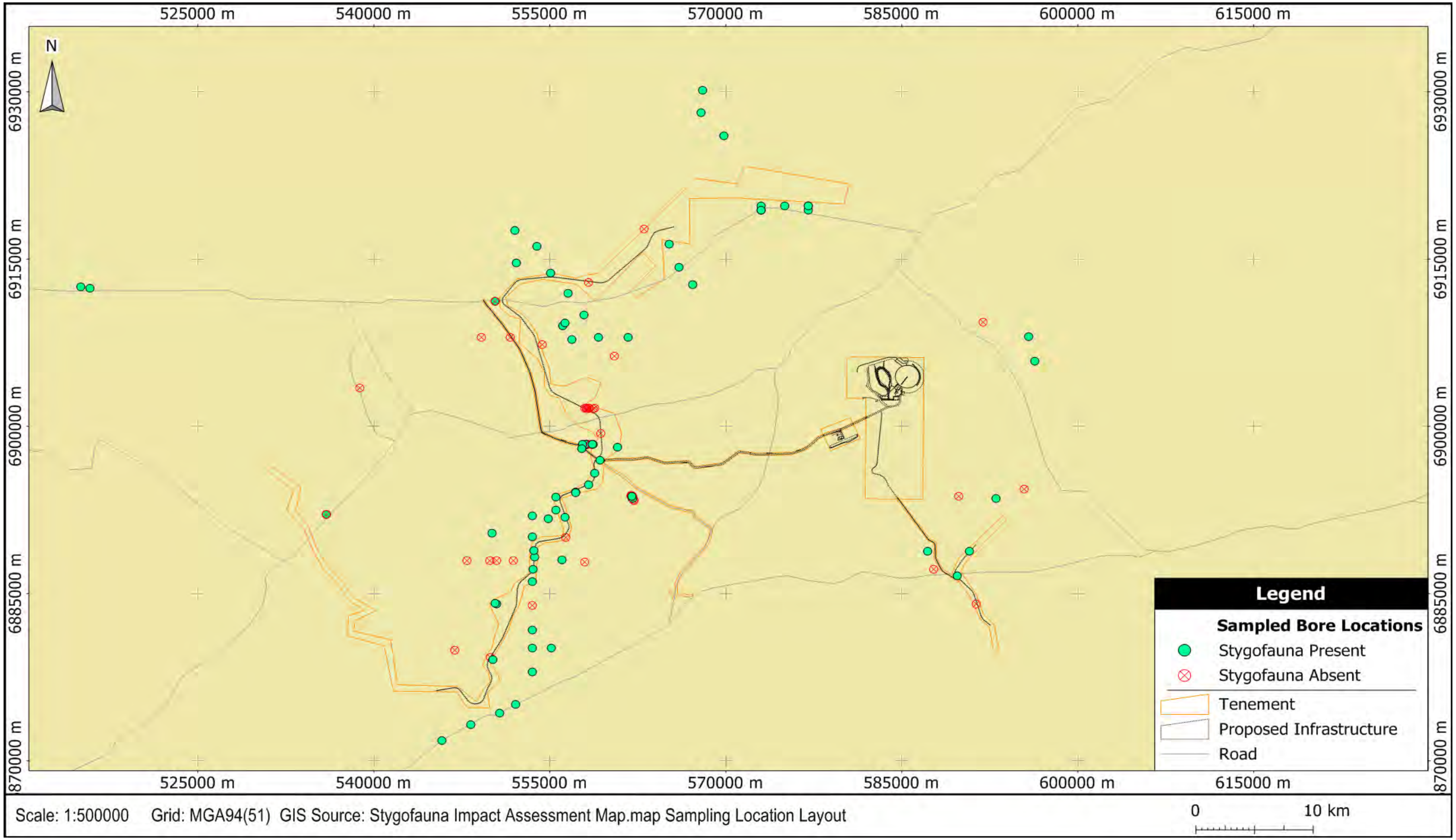


Figure 6: Stygofauna Sampling Locations of the Yeo Palaeochannel

5.2.2 Stygofauna Habitat

5.2.2.1 Yeo Palaeochannel

Within the Yeo palaeochannel, the Quaternary Detritals aquifer, which lies within colluvium, alluvium, Aeolian and saturated calcrete (hereafter referred to collectively as the calcrete habitat), are considered the main habitats for stygofauna. The Perkolilli Shale Aquitard that lies between the Quaternary Detritals and the Werillup Formation reduces opportunities for colonisation by stygofauna and also reduces inflow of nutrients and carbon. Thus, while stygofauna species may be present below the aquitard, they would be expected in low numbers and to be relatively insensitive to changes in the upper aquifer (Bennelongia 2016).

The calcrete unit is not continuous along the length of the palaeovalley and also varies in width across the valley with significant variability in thickness. The extent of the alluvial valley and near surface calcrete is shown in Figure 7.

The depth to water within the Quaternary aquifer has been shown through baseline studies to be variable within the Yeo Palaeochannel WSA with an average depth to ground water of zero to ten metres over the calcrete (Figure 8). Water within the Ann Beadell WSA is deeper at about 15 to 30 m below ground level. Figure 9 shows an interpretation of the geological long and cross section through the Yeo borefield moving north to south along the proposed Yeo and Anne Beadell borefields, whilst Figure 9 depicts the depth of the mapped calcrete extent (both saturated and unsaturated). From this it can be seen that the calcrete extent ranges from only a few metres thick, particularly at the extremities, up to 44.5 m in the northern Yeo borefield and 22 m in the Anne Beadell borefield.

The optimal salinity for stygofauna varies according to the particular species that occur at a site. While saline groundwater would be expected to have fewer species than fresh groundwater, the species occupying brackish and saline groundwater mostly have relatively narrow salt tolerances that will occupy only part of a palaeochannel that exhibits a large salinity gradient, as is the case with the Yeo Palaeochannel. Given that groundwater salinity is variable over time, it is possible species will occur in a series of disjunct areas along the palaeochannel where salinity is favourable. However, relatively few stygofauna species are likely to occur at groundwater salinities greater than 35,000 mg/L and probably no species occur at salinities >50,000 mg/L (Bennelongia 2016).

As can be seen in Figure 11, salinity in the Anne Beadell borefield is approximately 6,000 to 14,000 mg/L TDS with carbonate content relatively high whilst groundwater salinity at depth in the Yeo borefield is approximately 14,000 to 25,000 mg/L TDS. There is often a vertical gradient of salinity in the Yeo Palaeochannel, with the top metre of groundwater having a salinity that is approximately half that found at depth. Groundwater in the valley flanks outside the palaeochannel is fresh.

Although Figure 11 presents salinity as a parameter with broad gradients, in reality levels are often heterogeneous at a fine scale and can show variation as a result of a number of elements. As a result of this, salinity levels of a species may sometimes only occur in small portions of the Palaeochannel and the species will have a patchy distribution.

5.2.2.2 Mine Site

Within the vicinity of the Gruyere orebody, the aquifer system generally occurs within the weathered profile (saprolite and saprock) and fractured bedrock. The weathered profile and underlying fractured bedrock often form moderately permeable aquifers, and are characterised by secondary porosity and permeability through the break-down of the primary rock material. The fractured rock aquifer within the vicinity of the Gruyere Project area represents the main stygofauna habitat.

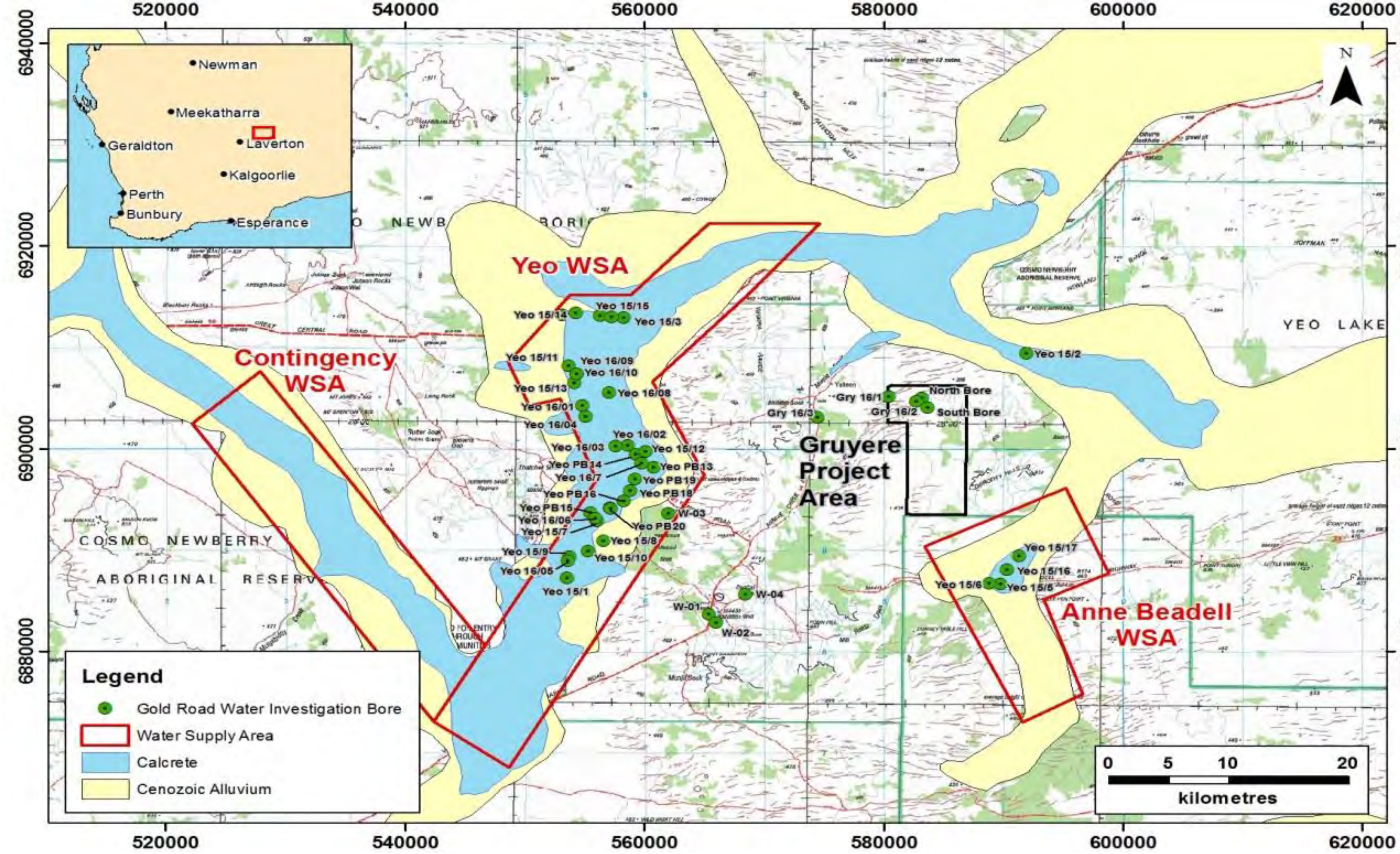


Figure 7: Extent of the Alluvial Valley and Near Surface Calcrete over the Yeo Borefield

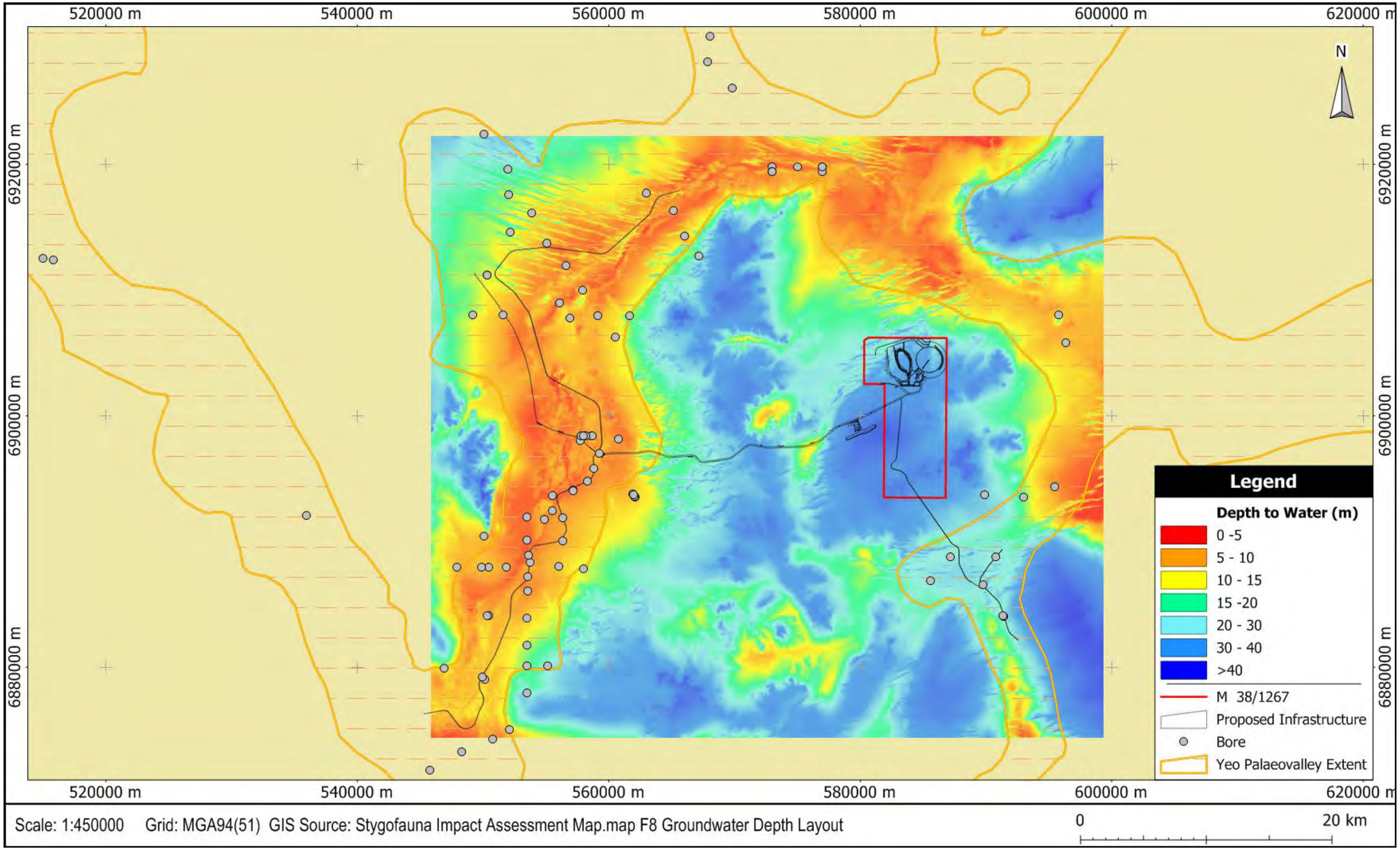


Figure 8: Depth to Groundwater within the Yeo Palaeochannel

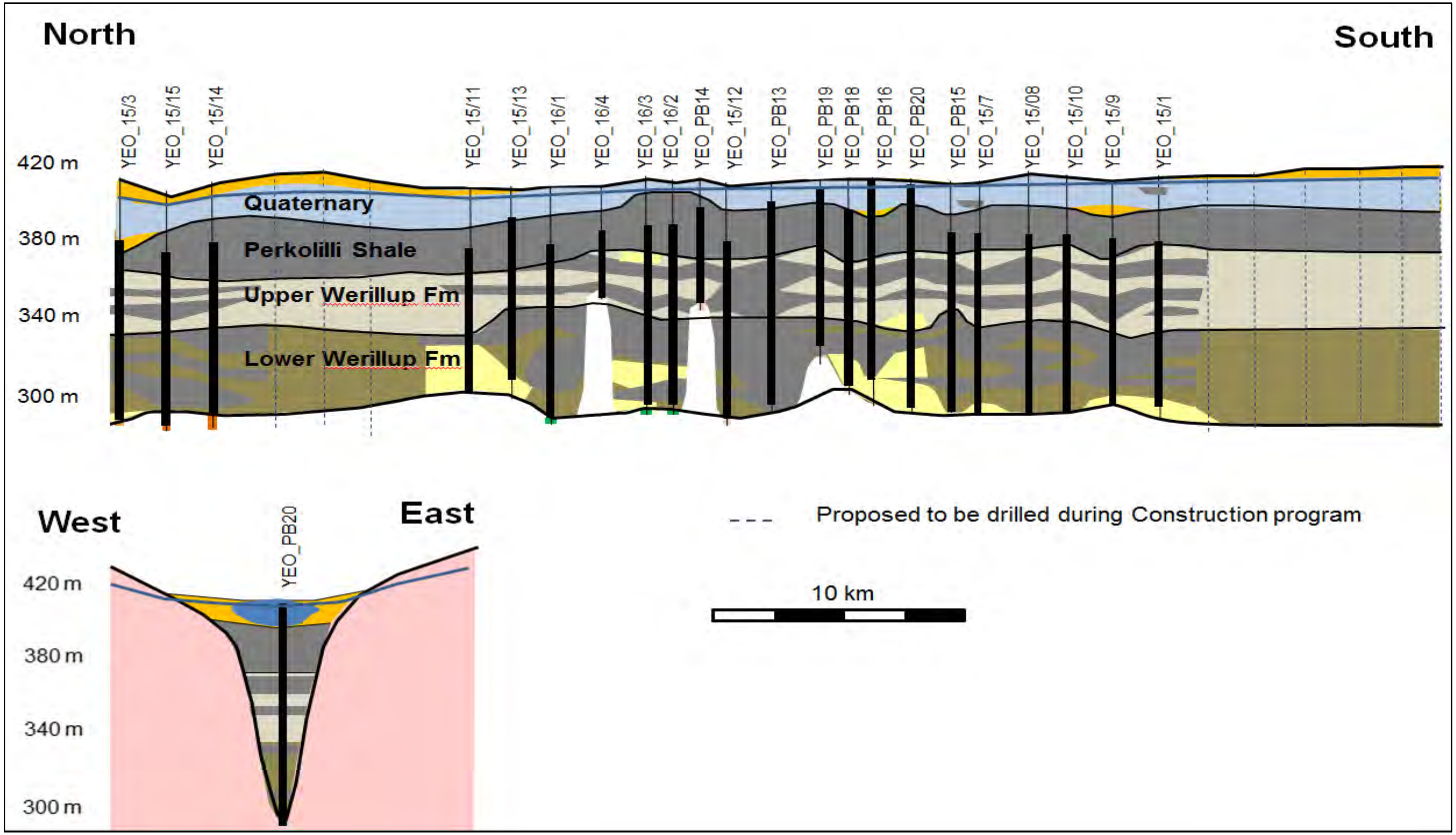


Figure 9: Geological Long and Cross Section through the Yeo Borefield

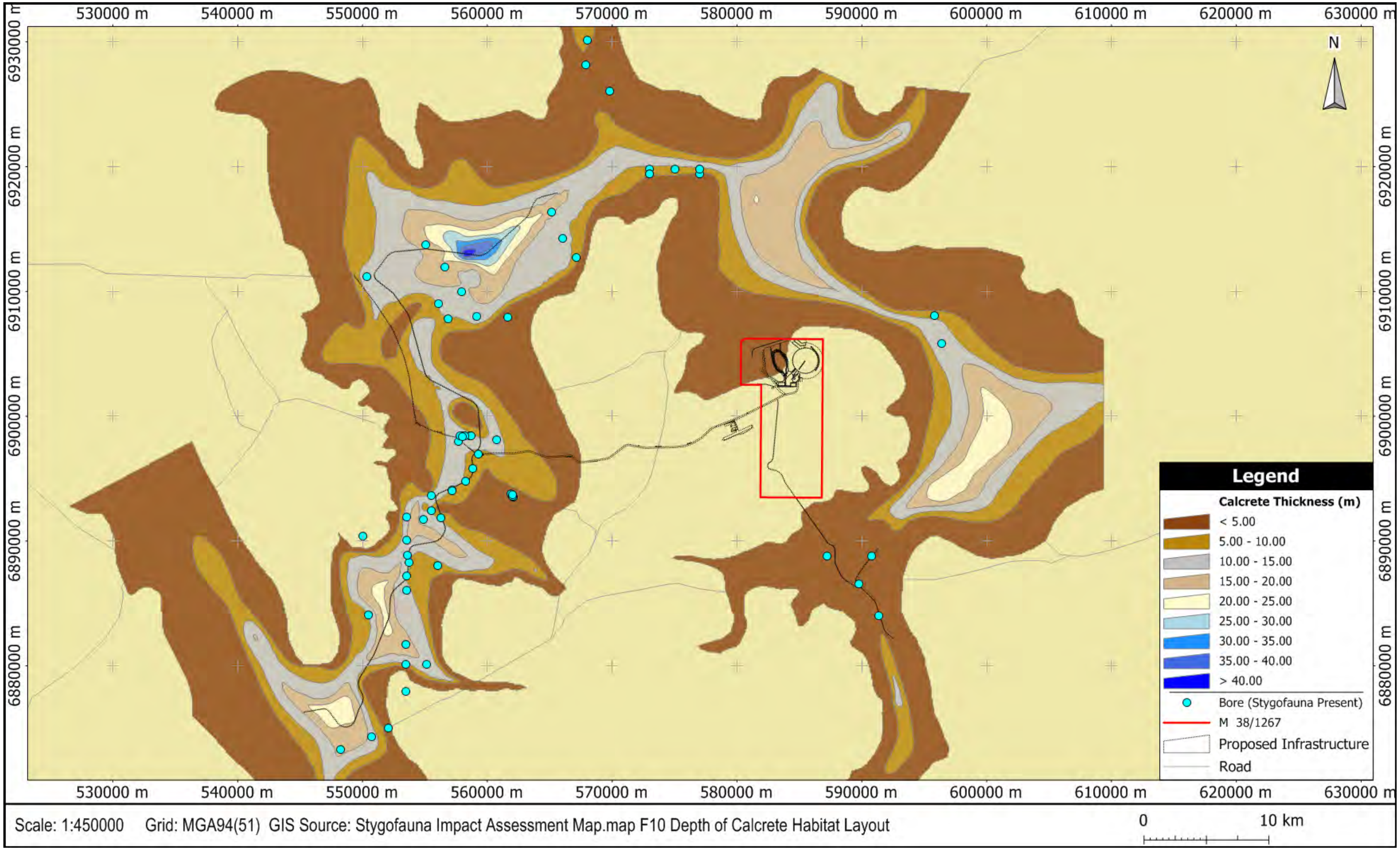


Figure 10: Depth of the Calcrete Extent (Saturated and Unsaturated) of the Yeo Palaeochannel

5.2.3 Impact Assessment

5.2.3.1 Yeo Palaeochannel

Figure 12 displays the location of all stygofauna sampling undertaken for the project, including species per bore, percentage of habitat remaining at project completion and the predicted groundwater drawdown contour of 2 m for the Quaternary detritals aquifer. Stygofauna populations and distribution patterns for all species identified from the Yeo Palaeochannel are presented in the Bennelongia report provided in Appendix 2.

Impact on stygofauna has been considered in terms of impact on:

- Stygofauna habitat within the Yeo Palaeochannel and mine site areas.
- Individual species, focusing primarily on impacts on the three species identified during baseline studies as being restricted to the Yeo Palaeochannel.

Impacts may be:

- Direct in terms of complete removal of habitat by mining.
- Indirect in terms of lowering of the water table thereby reducing the amount of saturated habitat within the Quaternary aquifer in the Yeo Palaeochannel or mine site orebody aquifer.

This impact assessment has taken into consideration the location/bore/s (habitat) at which the potentially restricted species was found, the depth of the saturated calcrete habitat at these bore/s, the salinity and the impact of water drawdown of two meters. It has also considered the total loss of stygofauna habitat that will result from the drawdown associated with construction and operation of the Anne Beadell and Yeo (south and north) borefields.

No cumulative effects of drawdown are expected to result from interaction of borefield abstraction with mine dewatering due the difference in hydrogeological setting.

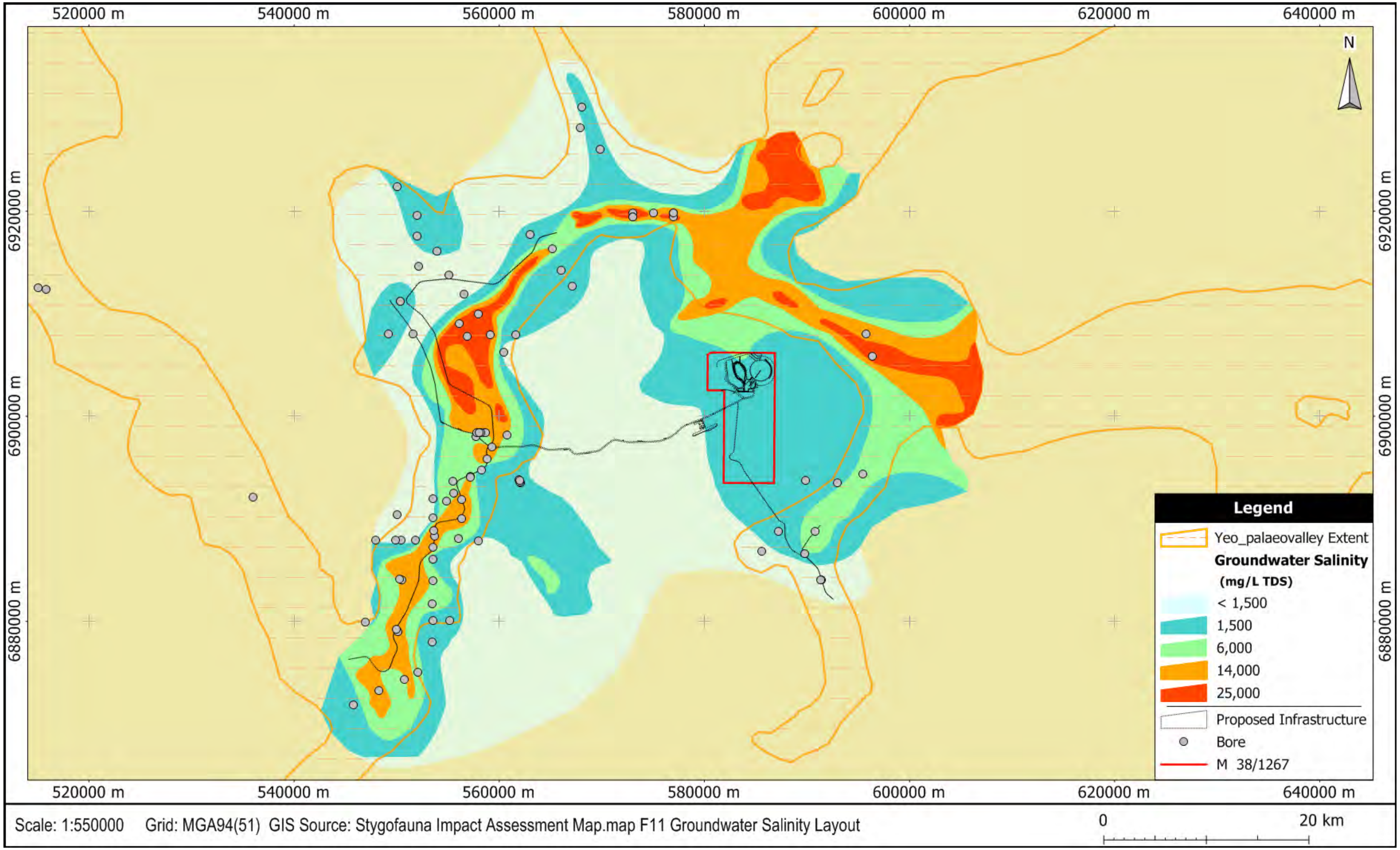


Figure 11: Groundwater Salinity (mg/L TDS) within the Quaternary Detrital Aquifer

Figure 12: Stygofauna Results, Species, Habitat and Predicted Drawdown Contours for the Gruyere Gold Project

Stygofauna Sampling Results
2, 5, 10 metre Drawdown Contours
Centre of Palaeochannel
Calcrete Habitat Image (Water Saturation)
Project: GRUYERE PROJECT
GOLD ROAD RESOURCES
kilometres
Projection: MGA Zone 51 (GDA 94)
Date: 30/09/2016
Scale: 1:75000
Originator:
Drawn:
Workspace:
Technical Report No.
Figure No.
LEGEND
Species Count
15 to 25 (7)
10 to 15 (8)
5 to 10 (13)
1 to 5 (47)
Drawdown Contours
2 m drawdown contour
5 m drawdown contour
10 m drawdown contour
Sampled - Stygofauna
No (40)
Centre of Palaeochannel (60-80m depth)
Yamarna Pastoral Lease
REMAINING HABITAT
100 % Calcrete Habitat- RED
50% Calcrete Habitat-ORANGE
0% Calcrete Habitat-CREAM
6,920,000 mN
6,900,000 mN
520,000 mE
540,000 mE
560,000 mE
580,000 mE
Bore_ID Species
16GYWB0033 Enchytraeidae sp. B08
16GYWB0032 Oligochaeta sp.
16GYWB0034 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0036 Halicyclops eberhardi s.l.
16GYWB0036 Nitocrellopsis sp. B09
11THAC013 Chiltoniidae sp. B02
11THAC013 Enchytraeidae sp. B12
11THAC013 Enchytraeidae sp. B13
11THAC013 Enchytraeidae sp. B14
11THAC013 Limbodessus sp. B06
16GYWB0029 Chiltoniidae sp. B02
16GYWB0029 Nitocrellopsis sp. B04
16GYWB0029 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0030 Chiltoniidae sp. B03
16GYWB0030 Halicyclops kieferi
16GYWB0049 Sarscypridopsis sp. BOS615
16GYWB0038 Chiltoniidae sp. B02
16GYWB0038 Halicyclops eberhardi b
16GYWB0038 Nitocrella sp. B11
16GYWB0038 Nitokra lacustris sp. B03 s.l.
16GYWB0038 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0038 Schizopera sp. B09
16GYWB0013 Oligochaeta sp.
16GYWB0052 Cladocera sp. unident.
16GYWB0052 Sarscypridopsis sp. BOS615
15GYWB0003 Limbodessus sp.
LIMESTONE BORE Chiltoniidae sp. B02
LIMESTONE BORE Kimberleybathynella sp. B07
LIMESTONE BORE Kinnecaris sp.
LIMESTONE BORE Limbodessus sp.
LIMESTONE BORE Nitocrellopsis sp. B04
LIMESTONE BORE Nitocrellopsis sp. B06
LIMESTONE BORE Parastenocaris sp. B24
LIMESTONE BORE Schizopera sp. B09
16GYWB0048 Sarscypridopsis sp. BOS615
11THAC043 Enchytraeidae sp. B08
11THAC043 Enchytraeidae sp. B11
11THAC043 Enchytraeidae sp. B15
11THAC043 Nitocrellopsis sp. B09
11THAC043 Nitokra lacustris sp. B02
11THAC043 Oligochaeta sp.
16GYWB0031 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0012 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0047 Acari sp.
16GYWB0047 Nematoda sp.
16GYWB0047 Sarscypridopsis sp. BOS615
16GYWB0014 Enchytraeidae sp. B08
16GYWB0020 Enchytraeidae sp. B12
YUNK02 Nematoda sp.
16GYWB0015 Ameiridae sp.
16GYWB0015 Nitocrella sp.
16GYWB0015 Nitocrella sp. B10
16GYWB0015 Nitocrellopsis sp.
16GYWB0015 Nitocrellopsis sp. B08
16GYWB0015 Nitocrellopsis sp. B09
16GYWB0015 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0015 Schizopera sp. B09
PB13 Ameiridae gen. nov. 4 sp. B01
PB13 Atopobathynella sp. B13
PB13 Halicyclops eberhardi s.l.
PB13 Nitocrella sp. B06
PB13 Nitocrella sp. B10
PB13 Nitocrellopsis sp. B04
PB13 Oligochaeta sp.
PB13 Schizopera sp. B08
PB13 Schizopera sp. B09
PB13 Schizopera sp. B11
PB13 Stygonitocrella sp. B05
16GYWB0035 Chiltoniidae sp. B02
16GYWB0035 Halicyclops eberhardi s.l.
16GYWB0035 Limbodessus sp. B06
16GYWB0035 Nitocrellopsis sp. B07
16GYWB0035 Nitokra lacustris sp. B03 s.l.
16GYWB0035 Nitokra lacustris sp. B03b
16GYWB0035 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0035 Schizopera sp. B09
11THAC135 Chiltoniidae sp. B03
11THAC135 Nitocrellopsis sp. B06
FYRC051 Halicyclops eberhardi s.l.
FYRC051 Nitocrellopsis sp. B08
16GYWB0016 Chiltoniidae sp. B01
16GYWB0016 Enchytraeidae sp. B10
16GYWB0016 Halicyclops eberhardi s.l.
16GYWB0016 Limbodessus sp. B06
16GYWB0016 Nitocrella sp.
16GYWB0016 Nitocrellopsis sp. B08
16GYWB0016 Nitokra lacustris sp. B03 s.l.
14GYWB003 Oligochaeta sp.
14GYRC0213 Atopobathynella sp. B19
PB19 Chiltoniidae sp. B01
PB19 Halicyclops eberhardi s.l.
PB19 Limbodessus sp.
PB19 Limbodessus sp. B06
PB19 Nitocrella sp. B06
PB19 Nitocrellopsis sp. B04
PB19 Nitocrellopsis sp. B05
PB19 Nitocrellopsis sp. B08
PB19 Nitokra lacustris sp. B02
PB19 Oligochaeta sp.
PB19 Schizopera sp. B08
PB19 Schizopera sp. B09
16GYWB0017 Schizopera sp. B09
AC269 Nitocrellopsis sp. B08
AC273 Ameiridae gen. nov. 4 sp. B01
AC273 Chiltoniidae sp.
AC273 Halicyclops eberhardi s.l.
14GYWB002 Oligochaeta sp.
14GYRC0130 Parastenocaris sp. B24
PB18 Ameiridae gen. nov. 4 sp. B01
PB18 Chiltoniidae sp.
PB18 Halicyclops eberhardi s.l.
PB18 Halicyclops kieferi
PB18 Limbodessus sp.
PB18 Limbodessus sp. B05
PB18 Limbodessus sp. B06
PB18 Nitocrella sp. B06
PB18 Nitocrellopsis sp. B04
PB18 Nitocrellopsis sp. B05
PB18 Nitocrellopsis sp. B06
16GYWB0019 Chiltoniidae sp.
16GYWB0019 Enchytraeidae sp. B07
16GYWB0019 Halicyclops eberhardi a
16GYWB0019 Halicyclops eberhardi s.l.
16GYWB0019 Limbodessus sp. B06
16GYWB0019 Nitocrella sp. B12
16GYWB0019 Nitocrellopsis sp.
16GYWB0019 Nitocrellopsis sp. B04
16GYWB0019 Nitokra lacustris sp. B03 s.l.
16GYWB0019 Nitokra lacustris sp. B03a
16GYWB0019 Oligochaeta sp.
16GYWB0019 Parabathynellidae gen. nov. 1 sp. B07
16GYWB0019 Schizopera sp. B08
16GYWB0019 Schizopera sp. B09
16GYWB0019 Schizopera sp. B11
AC267 Australocamptus sp. B12
AC267 Halicyclops eberhardi s.l.
AC267 Insulodrilus sp.
AC267 Nitocrella sp. B06
AC267 Oligochaeta sp.
AC272 Halicyclops eberhardi s.l.
14GYRC0026 nr Atopobathynella sp. B19
15GYWB0009 Chiltoniidae sp.
15GYWB0009 Halicyclops eberhardi c
15GYWB0009 Halicyclops eberhardi s.l.
15GYWB0009 Nitocrellopsis sp. B10
PB16 Ameiridae gen. nov. 4 sp. B01
PB16 Chiltoniidae sp.
PB16 Halicyclops eberhardi s.l.
PB16 Nitocrella sp. B06
PB16 Nitocrellopsis sp. B04
PB16 Nitocrellopsis sp. B06
PB16 Oligochaeta sp.
PB16 Parastenocaris sp. B24
12ALRC0117 Atopobathynella sp. B21
AC268 Chiltoniidae sp. B02
AC268 Halicyclops eberhardi s.l.
AC268 Nitocrella sp. B06
AC268 Schizopera sp. B09
AC280 Halicyclops eberhardi s.l.
AC280 Nitocrella sp. B06
YUNK04 Chiltoniidae sp.
YUNK04 Parastenocaris sp. B24
PB17 Ameiridae gen. nov. 4 sp. B01
PB17 Chiltoniidae sp. B01
PB17 Halicyclops eberhardi s.l.
PB17 Limbodessus sp.
PB17 Limbodessus sp. B05
PB17 Nitocrella sp. B06
PB17 Nitocrellopsis sp. B04
PB17 Nitocrellopsis sp. B05
PB17 Nitocrellopsis sp. B07
PB17 Oligochaeta sp.
PB17 Schizopera sp. B09
16GYWB0043 Nematoda sp.
RC0151 Parabathynellidae gen. nov. 1 sp. B08
RC0151 Parastenocaris sp. B24
AC283 Chiltoniidae sp.
AC283 Halicyclops eberhardi s.l.
AC283 Nitocrella sp. B06
AC283 Nitocrellopsis sp.
AC283 Oligochaeta sp.
16GYWB0010 Oligochaeta sp.
16GYWB0010 Tubificidae sp. B02
W03 Parabathynellidae sp.
W03 Parastenocarididae sp.
Bluey Nitocrella sp. B06
Bluey Nitocrellopsis sp. B04
Bluey Oligochaeta sp.
PB20 Ameiridae gen. nov. 4 sp. B01
PB20 Chiltoniidae sp. B02
PB20 Halicyclops eberhardi s.l.
PB20 Limbodessus sp. B05
PB20 Nitocrella sp. B06
PB20 Nitocrellopsis sp. B06
PB20 Oligochaeta sp.
PB20 Schizopera sp. B09
Soma Bore Bdelloidea sp. 2.2
Soma Bore Nematoda sp.
Mt Venn Bore Enchytraeidae sp. B09
Mt Venn Bore Parastenocaris sp. B33
15GYWB0006 Nitocrella sp. B06
16GYWB0011 Australocamptus sp. B12
16GYWB0011 Enchytraeidae sp. B09
16GYWB0011 Oligochaeta sp.
16GYWB0011 Tubificidae sp. B02
YUNK03 Chiltoniidae sp.
YUNK03 Halicyclops eberhardi s.l.
YUNK03 Halicyclops kieferi
YUNK03 Limbodessus sp.
YUNK03 Limbodessus sp. B05
YUNK03 Limbodessus sp. B06
YUNK03 Nitocrella sp. B06
YUNK03 Nitocrellopsis sp. B04
YUNK03 Nitocrellopsis sp. B06
YUNK03 Nitocrellopsis sp. B07
YUNK03 Oligochaeta sp.
YUNK03 Parabathynellidae gen. nov. 1 sp. B04
PB15 Aeolosomatidae sp.
PB15 Chiltoniidae sp.
PB15 Nitocrella sp. B06
PB15 Nitocrellopsis sp. B04
PB15 Nitocrellopsis sp. B06
PB15 Nitocrellopsis sp. B07
PB15 Nitocrellopsis sp. B08
PB15 Oligochaeta sp.
PB15 Parabathynellidae gen. nov. 1 sp. B04
15GYWB0012 Nitocrella sp. B10
Yeo 16/5 Limbodessus sp.
15GYWB0005 Chiltoniidae sp. B02
15GYWB0005 Halicyclops eberhardi a
15GYWB0005 Limbodessus sp.
15GYWB0005 Limbodessus sp. B05
15GYWB0005 Limbodessus sp. B06
15GYWB0005 Nitocrellopsis sp. B06
15GYWB0009 Chiltoniidae sp.
YEO 15/1 Nitocrella sp. B06
YEO 15/1 Nitokra sp. B04
YEO 15/1 Phreodrilidae sp.
16GYWB0007 Oligochaeta sp.
16GYWB0001 Ameiridae gen. nov. 4 sp. B01
16GYWB0001 Nitocrella sp. B06
15MNAC0169 Oligochaeta sp.
15MNAC0187 Oligochaeta sp.
16GYWB0027 Fierscyclops (Fierscyclops) fiersi
YE0008A Aeolosomatidae sp.
YE0008A Ameiridae gen. nov. 4 sp. B01
YE0008A Ameiridae sp.
YE0008A Chiltoniidae sp.
YE0008A Halicyclops eberhardi s.l.
YE0008A Limbodessus sp. B05
YE0008A Limbodessus sp. B06
YE0008A Nirripirti sp. B01
YE0008A Nitocrella sp. B07
YE0008A Nitocrellopsis sp. B04
YE0008A Nitocrellopsis sp. B07
YE0008A Nitokra lacustris sp. B02
YE0008A Nitokra lacustris sp. B06
YE0008A Oligochaeta sp.
YE0008A Phreodrilidae sp.
YE0008A Schizopera sp. B09
YE0008A Schizopera sp. B11
16GYWB0005 Canthocamptidae sp.
16GYWB0023 Ameiridae gen. nov. 4 sp. B01
16GYWB0023 Chiltoniidae sp. B02
16GYWB0023 Nitocrellopsis sp. B07
16GYWB0023 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0004 Enchytraeidae sp. B09
YEO 15/5 Nitocrella sp. B10
YEO 15/5 Oligochaeta sp.
15GYWB0011 Ameiridae gen. nov. 4 sp. B01
15GYWB0011 Chiltoniidae sp.
15GYWB0011 Limbodessus sp.
15GYWB0011 Nitocrella sp. B06
16GYWB0003 Chiltoniidae sp. B02
16GYWB0003 Tubificidae sp. B02
15GYWB0010 Cyclopoida sp.
16GYWB0002 Oligochaeta sp.
16GYWB0025 Parabathynellidae gen. nov. 1 sp. B07

Stygofauna Habitat

There are no universally accepted rules about what amount of groundwater drawdown is likely to result in an adverse impact on subterranean fauna. Recent research suggests that there is not a simple relationship between the degree of saturation in an aquifer and the survival of different stygofauna taxa (Stump and Hose 2013).

In Western Australia, it has generally been assumed that subterranean fauna habitat values can be maintained by limiting groundwater drawdown to an amount that is not significantly different to the naturally occurring year-to-year variability in water levels or by maintaining the saturated thickness of the aquifer at approximately 69% of the pre-mining saturated thickness, ensuring habitable geologies remain saturated (TORO 2015). As limited information is currently available for the Yeo Palaeochannel to understand naturally occurring water level variations over time, Gold Road has examined geological information for the palaeochannel to determine an appropriate groundwater drawdown level which is to be used as an indicator of the minimum amount of change likely to result in discernible impacts on stygofauna habitat. The nominal groundwater drawdown level established for the Yeo Palaeochannel is 2 m.

Hydrogeological modelling conducted to estimate the extent and magnitude of groundwater drawdown from the proposed 5 GL/a Yeo and 0.8 GL/a Anne Beadell borefields within the Yeo Palaeochannel is presented Appendix 3. It is estimated that a drawdown of 2 m would extend for a maximum distance of:

- 25 km to the north - south and approximately 18 km to the east - west of the northern component of the Yeo borefield.
- 18 km to the north – south and approximately 26 km to the east - west of the southern component of the Yeo borefield.
- 10 km to the north – south and approximately 8 km to the east - west of the Anne Beadell borefield.

The extent of the predicted drawdown for these borefields is shown in Figure 12.

Figure 13 shows the existing extent of saturated calcrete that is available to stygofauna as habitat. From this it can be seen there is considerable variability in terms of extent and depth within the Yeo Palaeochannel.

Figure 14 shows the predicted percentage of saturated calcrete habitat remaining at the end of project life based on modelled groundwater drawdown within the aquifer (Pennington Scott 2016). Light and dark colours indicate a lower and higher percentage of saturated calcrete respectively remaining at project completion (year 15). Groundwater drawdown contours have been overlain on this figure as well as the locations of the three potentially restricted stygofauna species.

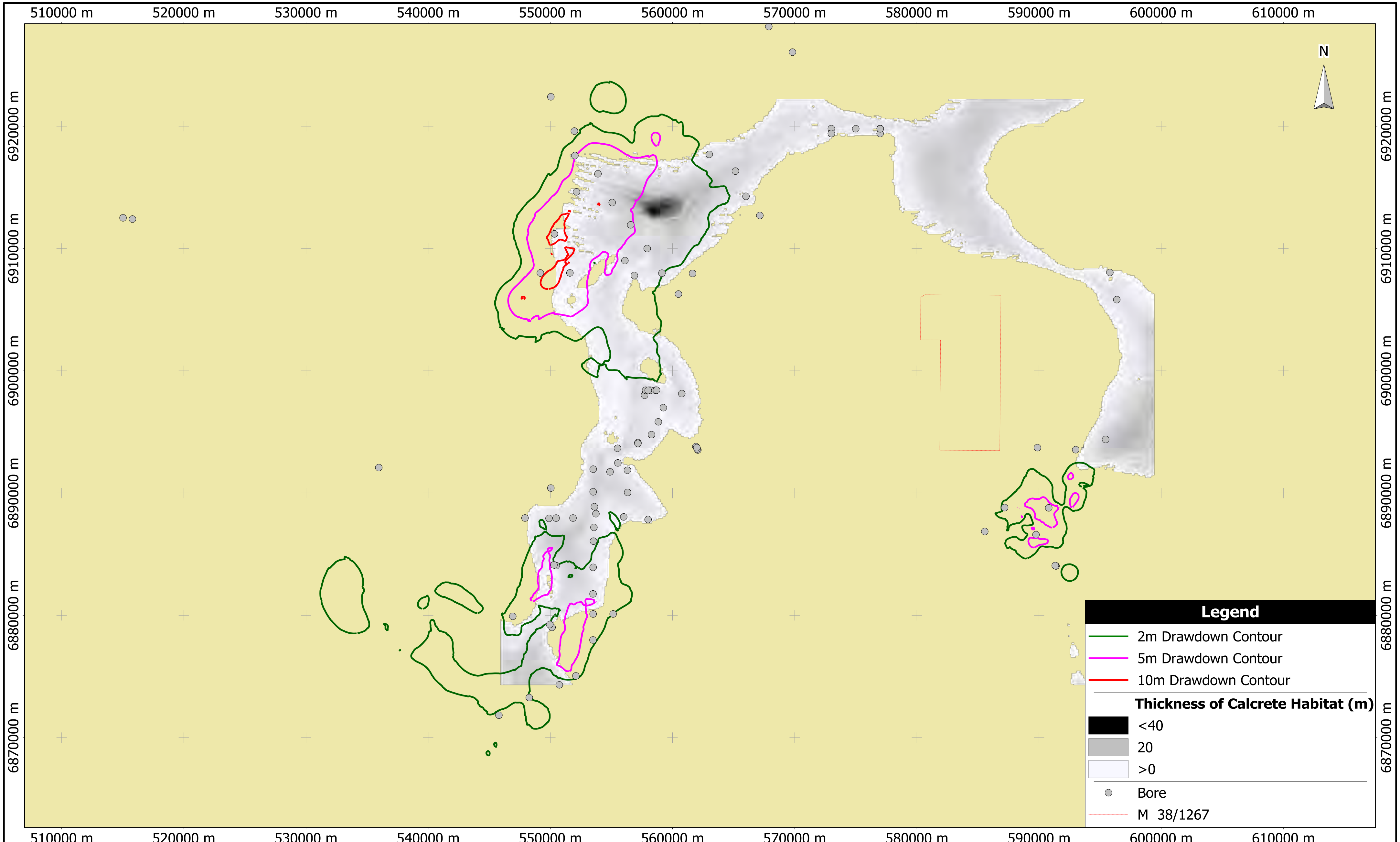
Table 9 lists those species within the Yeo borefield whose habitat is predicted to experience 80 – 100% groundwater drawdown by the end of project life as a result of groundwater abstraction. It further lists bores outside the impact area which contain these species, thus proving that the risk of loss of species as an entity is low. It is further expected that recolonisation will occur in the impacted bores once water levels have recovered after cessation of abstraction.

When considering groundwater drawdown it can be seen that the drawdown avoids the stygofauna rich areas of the Yeo Palaeochannel (middle portion) whilst at the same time maintaining a high percentage of saturated calcrete habitat at completion of the project. Calculations from groundwater models predict about 69% of existing saturated calcrete habitat will remain at end of project life (Pennington Scott 2016). This is considered a conservative estimate as areas where high resolution LiDAR data was not available at the extremities of the borefield were not included in the calculations and as the two borefields within the Yeo Palaeochannel reach maximum drawdown at different times *i.e.* the Anne Beadell maximum drawdown will be in Year 3 and the process borefield maximum drawdown will occur in Year 15. From Figure 14 it can also be seen that the majority of habitat reduction is confined to the north western portion of the northern Yeo Borefield area with a slight narrowing (east – west) of habitat in the southern Yeo borefield. The Anne Beadell borefield area is only slightly affected by water abstraction given the low abstraction rates, particularly after Year 3.

Table 9: Distribution of Stygofauna Species Where >80% Habitat Removal Predicted

Species	Bores Within Impact Area Within >80% Habitat Loss	Bores Outside of Impact Area
Parabathynellidae gen. nov. 1. Sp. B04	16GYWB0012	16GYWB0015 16GYWB0038 6GYWB0023 16GYWB0031 16GYWB0034 and 35 16GYWB0015 16GYWB0029 16GYWB0038 16GYWB0035
Sarscypridopsios sp. BoS615	16GYWB0049 16GYWB0052 16GYWB0048 16GYWB0047	Found in the Yilgarn outside the Gruyere Gold Project
Nematoda sp.	16GYWB0047	16GYWB0043 YUNK02 Soma Bore
Enchytraeidae sp. B10	16GYWB0016	Found within Fractured Rock Aquifer
Chiltoniidae sp. B01	16GYWB0016	PB17 PB19
Halycyclops ebhardie s.l.	16GYWB0016	15GYWB0009 16GYWB0019 16GYWB0035, 16GYWB0036, AC267 and 268 AC272 and 273 AC280 AC283 FYRC051 PB13 PB16, 17,18,19 & 20 YE0008A Yunk03
Limbodessus sp. B06	16GYWB0016	15GYWB0005 16GYWB0019 16GYWB0035 11THAC013 PB18 and 19 YE0008A Yunk03
Nitocrella sp.	16GYWB0016	16GYWB0015

Species	Bores Within Impact Area Within >80% Habitat Loss	Bores Outside of Impact Area
Nitocrellopsis sp. B08	16GYWB0016	15GYWB0015 AC269 FYRC051 PB15 PB18 PB19
Nitokra lacustris sp. B03 s.l.	16GYWB0016	16GYWB0019, 16GYWB0035 16GYWB0038
Chiltoniidae sp.	16GYWB0009	15GYWB0009 15GYWB0011 16GYWB0019 AC273 AC283 PB15, 16 and 18 YE0008A YUNK03 and 04
Parabathynellidae gen. nov. 1 sp. B07	16GYWB0025	16GYWB0019



Scale: 1:400000
Original Size: A4
Grid: MGA94(51)

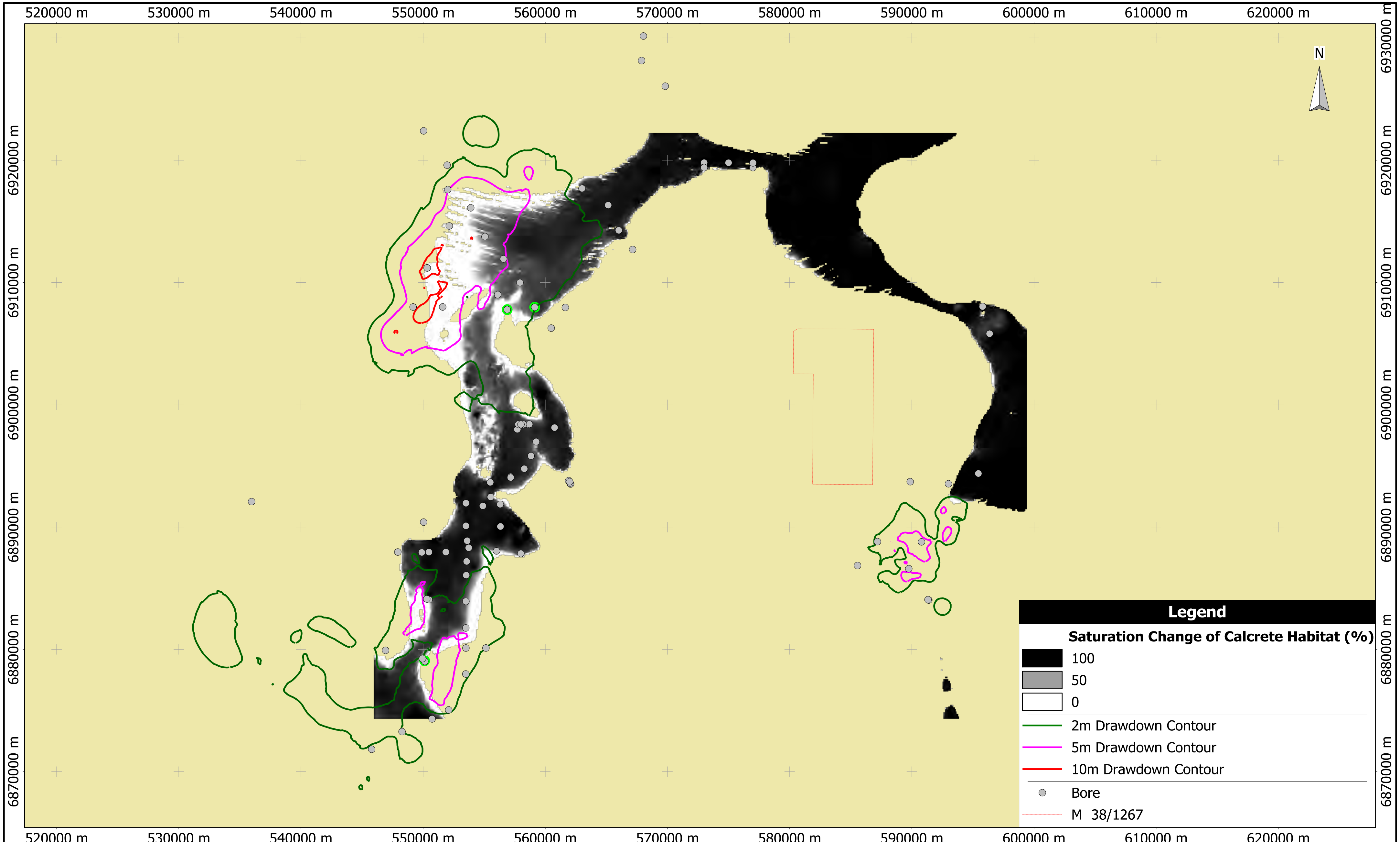
0 10 km

Gold Road Resources
Gruyere Gold Project
API

Figure 13

Existing Saturated Calcrete Habitat of the Yeo Palaeochannel

4 Cook St
West Perth WA 6005
Ph: (08) 9226 3166
Fax: (08) 9226 3177
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au



Scale: 1:400000
Original Size: A4
Grid: MGA94(51)

0 10 km

Gold Road Resources
Gruyere Gold Project
API

Figure 14

Predicted Change of Saturation of the Calcrete Habitat at Year 15 within the Yeo Palaeochannel

4 Cook St
West Perth WA 6005
Ph: (08) 9226 3166
Fax: (08) 9226 3177
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au
MBS ENVIRONMENTAL

Stygofauna Species

Studies of local stygofauna populations have shown that stygofauna species in the Yeo Palaeochannel appear to have relatively widespread occurrences for subterranean species in Yilgarn calcretes. Studies showed that 48 species were identified both within and outside of the predicted impact area associated with establishment of two borefields within the Yeo Palaeochannel. One species Chiltoniidae sp. B02 was recorded as having a linear range of >100 km. This suggests that the subterranean habitat within the Yeo Palaeochannel is homogeneous and that, if the ranges of all species were fully documented, most species may occupy moderately large areas (Bennelongia 2016).

Gold Road considered impacts on potentially restricted species by applying a 2 m drawdown. This results in three potentially restricted species being affected. Bennelongia has provided comment in their report as to the nature of these species and the potential for these to be found in areas outside of the proposed impact zone (Figure 15). The potential impacts on each of these species are assessed in the following sub sections.

Enchytraeidae sp. B07 and B10

Enchytraeids were speciose in the Yeo palaeochannel, with genetic lineages recorded on the basis of differences in CO1 sequences. Among the 33 enchytraeids that yielded sequences, only Enchytraeidae sp. B08 was abundant, being represented by 13 sequenced specimens in three bores. Three species occurred in moderate abundance (Enchytraeidae sp. B09, Enchytraeidae sp. B12, Enchytraeidae sp. B13). Enchytraeidae sp. B07 and Enchytraeidae sp. B10 are each known only from single holes within the northern section of the proposed Yeo borefield.

Enchytraeidae sp. B07 was identified from bore 16GYWB0019 in the northern Yeo borefield impact area. Depth to groundwater at this bore was measured at approximately 6.3 m (Figure 8) with a salinity of 25,000 mg/L (Figure 11). The bore log for bore 16GYWB0019 (and thus *Enchytraeidae sp. B07* habitat) is presented in Plate 1. Bore logs indicate that the saturated calcrete habitat extends for at least 20 m whilst the saturated calcrete habitat that remains after 15 years (Figure 16) from predicted modelling is predicted to be between 70 – 80% (*i.e.* 15-16 m).

Plate 1: Bore Log for Bore 16GYWB0019

Enchytraeidae sp. B10 was identified from bore 16GYMB0016 in the northern Yeo borefield impact area 2.5 km west of *Enchytraeidae sp. B07*. Standing Water Levels (SWL) were measured at 8.5 m (Figure 8), with salinity of approximately 25,000 mg/L (Figure 11). From the bore log linked to this species (Plate 2) it can be seen that saturation levels occur within fresh or fractured rock and not within calcrete habitat. The finding of this species within this habitat type would indicate their wider distribution, through hydraulic connections within the aquifer system and it is expected that this species will move between these hydraulic connections as its habitat alters during groundwater drawdown.

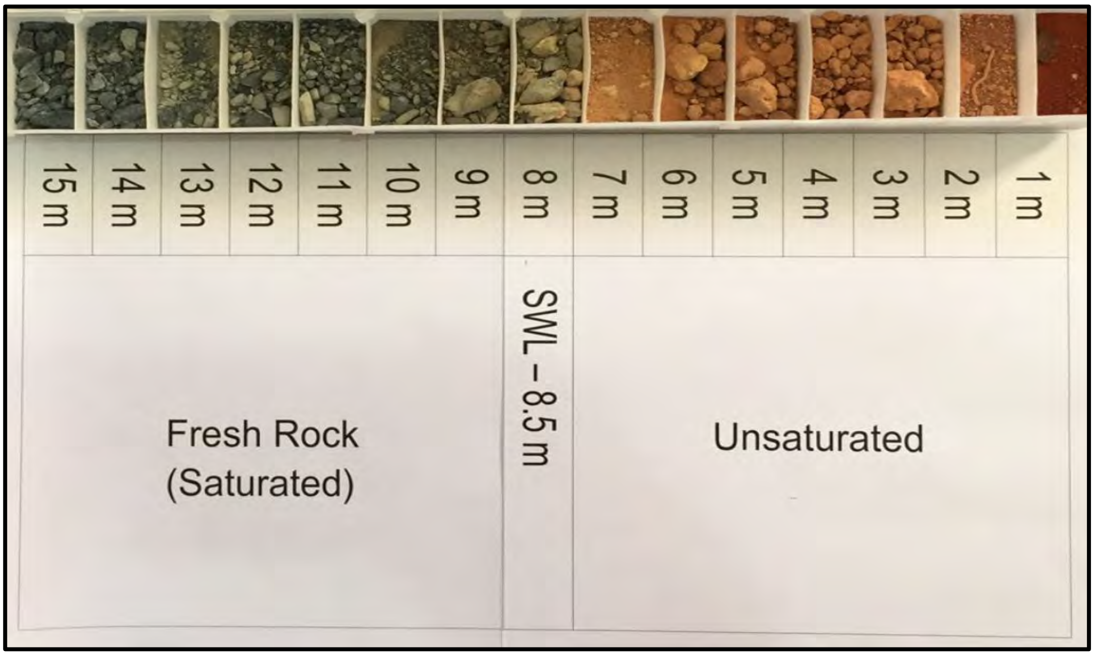


Plate 2: Bore Log for Bore 16GYWB0016

<u>*Parabathynellidae gen. nov. 1 sp. B07*</u>

Four species of Syncarid were recorded in the Yeo Palaeochannel with two of these being found within the Yeo borefield impact area. *Parabathynellidae gen. nov. sp. B07* was the only species to be potentially restricted to both the southern and northern Yeo borefield impact areas. Genetic analysis between two specimens from each area showed a CO1 divergence of 1%.

Parabathynellidae gen. nov 1. sp. B07 is known from two animals, one from bore 16GYWB0019 (Plate 1) and the other from bore 16GYWB0025 (Plate 3) of the northern and southern Yeo borefield impact areas. Depth to groundwater at the two bores where the species was collected was measured at 6.3 and 7.9 m (Figure 8) with a salinity of 25,000 and 14,000 mg/L respectively (Figure 11).

From Plate 3 it can be seen that the current saturated calcrete habitat for bore 16GYWB0025 is only 5 m thick and being on the fringes of the drawdown, it is predicted to be temporarily unsaturated at completion of the project until groundwater levels recover (Figure 16). The closest saturated calcrete habitat is approximately 300 m to the northwest of this bore.

It should be noted that this species was also found in bore 16GYWB0019 and as discussed above, between 70 – 80% (*i.e.* 15 - 16 m) of the calcrete habitat will remain at the completion of the project. This suggests that there is interconnectivity between the two bores and should further sampling be undertaken, the chances are high that further specimens will be found.

Plate 3: Bore Log for Bore 16GYWB0025

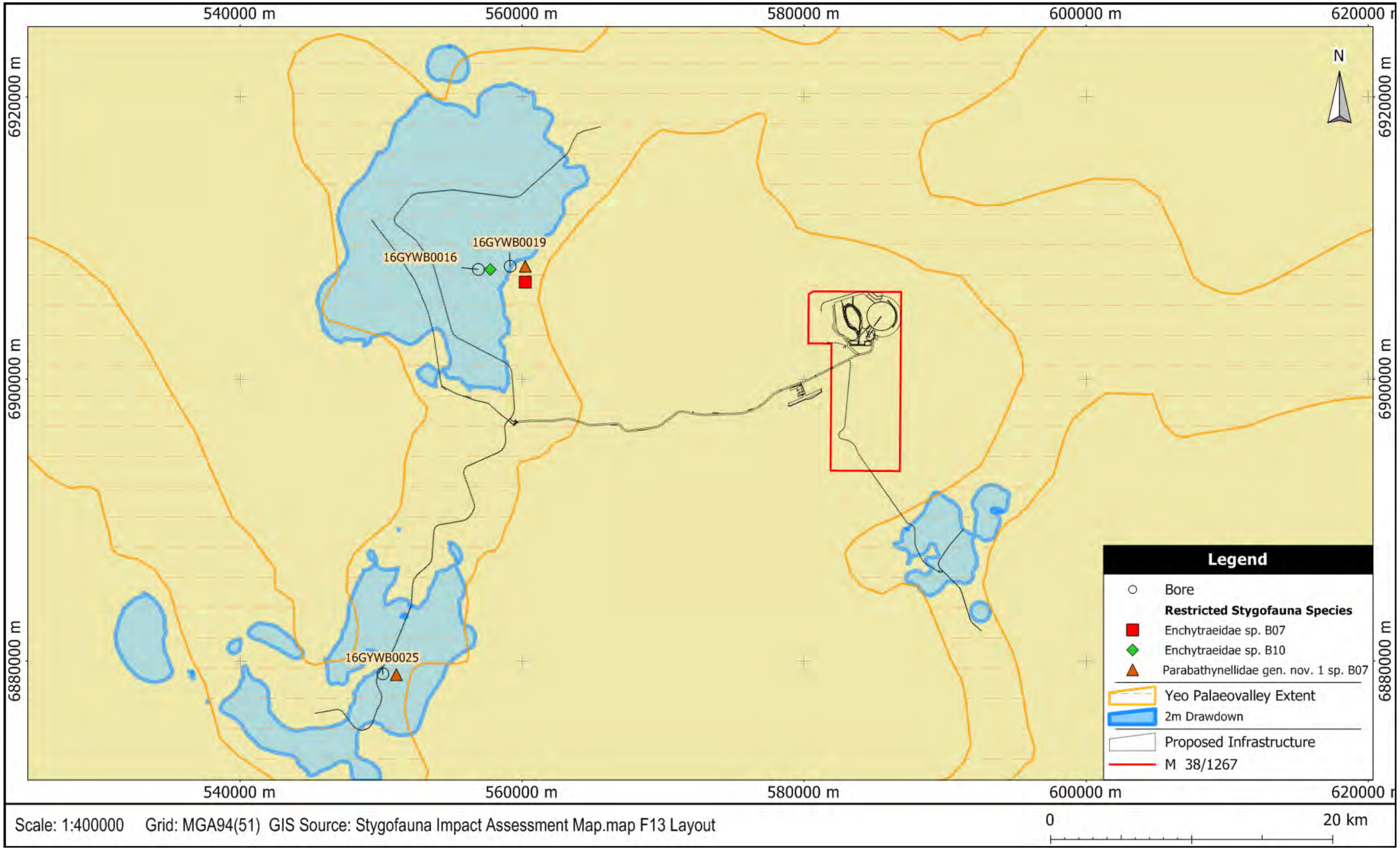
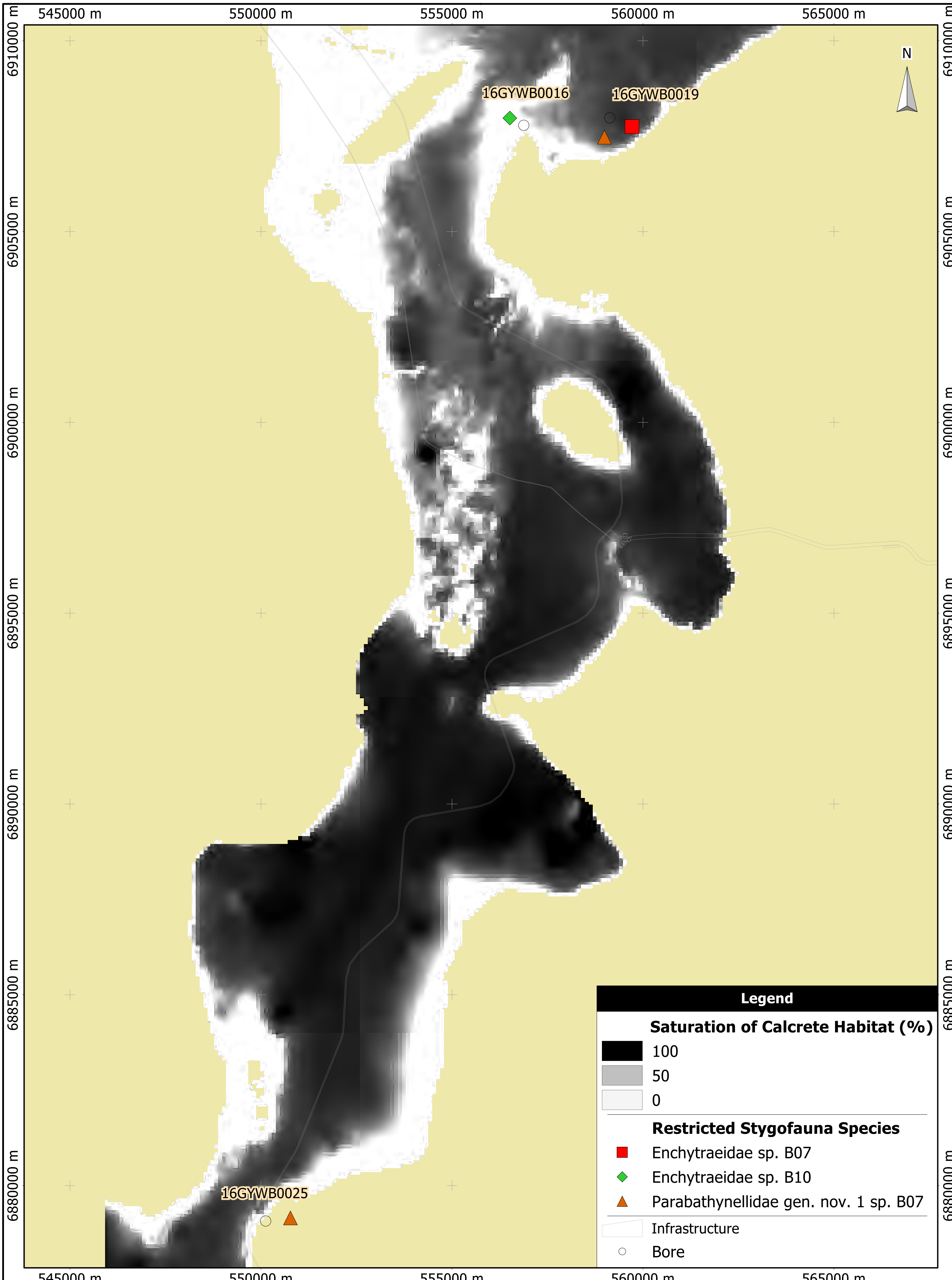


Figure 15: Habitat and Location of Restricted Stygofauna Species within the Yeo Borefield Impact Area

Figure 16: Depth of Saturated Calcrete Habitat Available for *Enchytraeidae sp. B07*, *Enchytraeidae sp. B10* and *Parabathynellidae gen. nov. 1. B04* at Completion of Abstraction



Scale: 1:130000 Original Size: A4 Grid: MGA94(51) 0 2 km	Gold Road Resources Gruyere Gold Project API	**Figure 16** Restricted Stygofauna Locations with Predicted Saturation of the Calcrete Habitat at Year 15 within the Yeo Palaeochannel	Martinick Bosch Sell Pty Ltd 4 Cook St West Perth WA 6005 Ph: (08) 9226 3166 Fax: (08) 9226 3177 info@mbsenvironmental.com.au www.mbsenvironmental.com.au

W:\Gold Road Resources\Gruyere\Approvals\API\Drawings\Stygofauna vs Drawdown Impact Assessment.map 7/10/2016 F16 Restricted Stygofauna Species and Habiatat Layout

5.2.3.2 Mine Site

The Tubificida worm (*Enchytraeidae* sp.) was collected from two locations (14GYWB002 and 14GYWB003) within the project pit footprint. These specimens were immature and were only identified to the family level. *Enchytraeidae* sp. are regarded as being widespread having been recorded in the Pilbara and South Coast bioregions (Subterranean Ecology Pty Ltd 2010; Rockwater Pty Ltd 2006) as well as 20 km northwest of Laverton at the Windarra Nickel Project (MBS 2011) and within the Northern Goldfields at Gidgee (MBS 2013).

The Syncarida and Copepoda are new undescribed crustacean species based on morphological differences. The new species of Syncarida (nr *Atopobathynella* sp. B19) was collected in two locations (14GYRC0026 and 14GYRC0213). The two sampling holes are located up to 2.5 km apart and hole ID 14GYRC0026 is approximately 800 m south and outside of the proposed pit footprint. The recording of this species at these locations indicates their wider distribution, through hydraulic connection within the “Orebody Aquifer” system (MBS 2015).

The new Copepoda species (*Parastenocaris* sp. B30) was collected from 14GYRC0130. The *Parastenocaris* sp. is a widespread species known from a number of locations across Western Australia including West Kimberley, East Kimberley, Pilbara and Murchison and northeastern Goldfields as well as 20 km northwest of Laverton at the Windarra Nickel Project (MBS 2011). The recording of this species at the southern extremity of the pit footprint between the two recorded locations of the Syncarida species would indicate that the Copepoda species is likely to be more widely distributed through hydraulic connection within the aquifer system.

5.2.4 Management and Mitigation Measures

Gold Road has carefully considered the results of hydrogeological and stygofauna studies, including modelled drawdown for the desired abstraction volume over time to understand potential impacts. Modelling results indicate impacts on specific areas of stygofauna habitat can be avoided or minimised with careful attention to placement of production bores and careful balancing of abstraction volumes and rates for individual bores within the Yeo Palaeochannel.

Management and mitigation measures that will be implemented to prevent or minimise adverse impacts on stygofauna are:

- Groundwater abstraction within the Yeo Palaeochannel will only occur from within the Werillup Aquifer.
- Groundwater will be abstracted from the Yeo Palaeochannel using an Adaptive Management Program compliant with an approved Groundwater Operating Strategy.
- Implementation of a Preliminary Integrated Groundwater and Stygofauna Habitat Management Plan. A draft has been provided in Appendix 4. Key features of this include:
  - Installation of monitoring bores within the Quaternary Detrital and Werillup aquifers prior to project construction.
  - Installation of automatic (telemetry) water level monitoring equipment within bores.
  - Installation of data transmission mechanisms to allow remote download of groundwater level monitoring data.
  - Collection of groundwater level data from the process water borefield for two years prior to commencement of abstraction.
  - Calculation of bore specific groundwater drawdown trigger levels and threshold limits for the process water borefield based on pre-abstraction water level data.

- Annual update/recalibration of the groundwater model based on input of actual monitoring and abstraction data. This will allow comparison of predicted versus actual groundwater drawdown, and where necessary update to impact assessment for stygofauna.
- Reinjection of saline groundwater into the Werillup Aquifer as a contingency measure if groundwater drawdown exceeds trigger levels and modelling indicates this will be required to maintain sufficient stygofauna habitat to prevent loss of stygofauna species.

The key management and mitigation measures are discussed in more detail in the sections below.

5.2.4.1 Adaptive Borefield Management

Gold Road intends to manage the borefield in an adaptive manner whereby pumping locations and rates can be readily changed to manage drawdown impacts across the borefield. This will require monitoring equipment to be installed in a number of key monitoring bores sited to provide information on both the Quaternary Detrital and Werillup aquifers' response to pumping throughout the borefield area and in areas of stygofauna habitat value.

Specifically the adaptive borefield management approach would include the implementation of the following:

- Design of the borefield based on a predictive model to achieve satisfactory water table management.
- Comparison of actual versus predicted groundwater drawdown levels throughout the project life.
- Comparison of baseline versus actual groundwater quality throughout the project life.
- Proactive adaptation of the spread of abstraction at any point in time across the borefield.

5.2.4.2 Comprehensive Borefield Monitoring

Seventeen monitoring bores have been installed within the Yeo Palaeochannel and five are currently being monitored for groundwater level and quality. This includes bores within the Quaternary Detrital and Werillup aquifers. The groundwater monitoring program will be extended to include installation of 18 additional monitoring bores within the process water borefield area of the Quaternary Detrital Aquifer prior to project construction commencing.

These bores (which are not required during the construction phase of the project) will be monitored on a "real time" basis, through telemetry, in order to obtain further baseline information. Of particular importance is the natural variation of groundwater levels within the saturated calcrete portion of the aquifer, and thus stygofauna habitat.

The water level information will then be used to determine appropriate trigger and threshold limits for the different areas of the process water borefield before abstraction occurs. These limits will be presented and discussed with the OEPA and DoW on completion of the construction phase of the project and will be incorporated into the Preliminary Integrated Groundwater and Stygofauna Habitat Management Plan (Appendix 4) associated with this API document.

5.2.4.3 Annual Groundwater Model Review and Reporting

Gold Road will review the groundwater model and update/recalibrate as necessary based on input of results from groundwater level and abstraction volume monitoring. Results of the annual model review will be used to guide ongoing water abstraction to ensure impacts on stygofauna habitat remain within predicted outcomes.

Gold Road will prepare an Annual Groundwater Report and provide the report to OEPA and DoW. The Annual review will present information on:

- Abstraction volumes.
- Groundwater level monitoring data.

- Groundwater quality monitoring data.
- Compliance with groundwater trigger levels and threshold limits.
- Model review outcomes.
- Planned ongoing abstraction program.
- Proposed changes to the groundwater monitoring program.

The results of the model review and report will be utilised in the adaptive borefield management plan.

5.2.4.4 Aquifer Reinjection

Although Gold Road does not believe that groundwater reinjection will be necessary to prevent adverse impacts on key stygofauna habitat, it is recognised that this could be used as a contingency measure if during operations groundwater monitoring showed that the aquifer drawdown was outside of predicted results.

Reinjection has been discussed in the Hydrogeological Report by Pennington Scott which has previously been supplied to the EPA as Appendix 1 of the EPA Referral document.

Reinjection of saline water into the Werillup Aquifer at key locations will have the response of limiting vertical leakage between the Quaternary Detrital and Werillup Aquifers, preventing ongoing groundwater drawdown with the aim of increasing the rate of groundwater recovery in these areas. Groundwater reinjection locations would be selected considering modelling predictions and monitoring data with focus likely to be on areas adjacent to significant stygofauna populations.

Reinjection will only be undertaken if:

- Trigger levels for drawdown have been exceeded in specific locations within the borefield.
- Other adaptive management measures are considered unlikely to achieve the required outcome in a timeframe sufficient to prevent potential adverse impacts on stygofauna habitat.

The duration and volume of reinjection will be designed and guided by a qualified hydrogeologist and is unlikely to be needed on a continuous basis. Monitoring would be undertaken to ensure results of reinjection are able to be quantified and the objective of achieving increased groundwater levels in a specific area is achieved.

5.2.5 Predicted Outcomes

Table 10 provides an assessment of several impacts the project may have on subterranean fauna and subterranean fauna habitat whilst at the same time providing management and mitigation measures to reduce these impacts. This table also discusses the predicted outcomes that Gold Road expect once management and mitigation measures have been applied.

Further to this, Gold Road has developed a Preliminary Integrated Groundwater and Subterranean Fauna Habitat Management Plan (Appendix 4). This preliminary management plan is a working document which will be refined during the first two years of the project (construction phase) which does not require groundwater abstraction from the Yeo borefield.

Table 10: Assessment of Preliminary Key Environmental Factors- Subterranean Fauna

Inherent Impact	Environmental Aspect	Mitigation Actions to Address Residual Impacts	Proposed Regulator Mechanism for Ensuring Mitigation	Outcome to Demonstrate that Proposal meets EPA Objective
To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.				
Direct disturbance and loss of potential subterranean fauna habitat due to borefield pumping activities.	Groundwater drawdown	• Designing the water abstraction network to minimise localised groundwater drawdown in the proposed Yeo borefield where three stygofauna species of restricted distribution have been identified. • Adoption of an adaptive borefield management approach and avoidance of stygofauna habitat through design. • Installation of telemetered monitoring bores to ensure groundwater levels approaching trigger levels is noticed before threshold limits being reached. • Implementation of an Preliminary Integrated Groundwater and Subterranean Fauna Habitat Management Plan (Appendix 4) consistent with EAG 17 that covers the following: – Implementing groundwater level monitoring program/s to determine if levels are changing in accordance with modelled predictions. – Implementing groundwater quality monitoring programs/s to determine if water chemistry is altering significantly.	Ministerial Condition under Part IV of the Act	Gold Road will ensure that the EPA's objective to maintain representation, diversity, viability and ecological function at the species, population and assemblage level is met based on the fact that the Preliminary Integrated Groundwater and Subterranean Fauna Habitat Management Plan will: • Provide trigger levels at which point Gold Road will be able to implement management measures (as discussed in the plan) to ensure the impacts to subterranean fauna are minimal. • Provide detailed results as to the impacts of the project on subterranean fauna habitat, including groundwater levels and quality. • Monitor stygofauna species over time should water quality and quantity monitoring identify that this is needed.
Alteration of groundwater chemistry associated with dewatering.	Groundwater chemistry			
Contamination of groundwater through spillage of chemical or hydrocarbons.	Groundwater quality			

6. OTHER ENVIRONMENTAL FACTORS

6.1 FLORA AND VEGETATION

A number of flora and vegetation surveys have been undertaken for the project and its associated borefields as listed in Table 6. This includes two additional surveys that were undertaken for part of the borefields and accommodation village areas after submission of the EPA Referral in March 2016. Reports for the additional surveys are provided in Appendix 5. No new vegetation communities or species of conservation significance were identified during the additional surveys.

None of the project areas occur in Environmentally Sensitive Areas or Schedule 1 Areas, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Botanica 2014, 2015a, 2015b, 2016a and 2016b). The project areas are not located within any DPaW managed land; however the Yeo Lake Nature Reserve which is listed as a Class “A” Nature Reserve and is managed by DPaW is located approximately 13 km to the east of the project area.

Baseline surveys identified 56 vegetation communities within and adjacent to the Gruyere area. Of these 42 are proposed to be impacted. The areas of each of the communities and the proposed percentage of impact from implementation of the project according to known distributions and current project design information are shown in Table 11 with a conceptual site layout overlain on vegetation communities provided in Figure 17.

Table 11: Vegetation Communities of the Gruyere Gold Project and Proposed Disturbance

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
Breakaway			
B-AS1	**Acacia Shrublands** Open scrub of *Acacia incurvaneura* over low scrub of *Acacia quadrimarginea* and low heath of *Prostanthera wilkieana* on breakaway.	148	0 0%
B-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus carnei* over low scrub of *Eremophila latrobei* subsp. *latrobei* and *Senna artemisioides* subsp. *x artemisioides* and dwarf scrub of *Atriplex vesicaria/Frankenia georgei* on breakaway.	21	0 0%
Closed Depression			
CD-AFW1	**Acacia Forests and Woodlands** Open low woodland of *Acacia caesaneura* over open dwarf scrub of *Eremophila maculata* subsp. *brevifolia* and low heath of *Frankenia interioris* var. *parviflora* in playa.	43	3 7%
CD-AFW2	**Acacia Forests and Woodlands** Low woodland of *Acacia aptaneura*/ *A. incurvaneura* over scrub of *A. tetragonophylla*/ *Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa.	39	0 0%
CD-CFS/MWS1	**Casuarina Forests and Woodlands/ Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus gypsophila*/ low woodland of *Casuarina pauper* over low scrub of *Melaleuca interioris* and open hummock grass of *Triodia basedowii* on playa edge.	411	0 0%
CD-CSSSF1	**Chenopod Shrublands, Samphire Shrublands and Forblands** Low heath of *Tecticornia undulata*/ *T. halocnemoides* on playa.	193	3 2%
CD-MWS1	**Mallee Woodlands and Shrublands** Very open tree mallee of *Eucalyptus gypsophila* over open low scrub of *Eremophila scoparia* and dwarf scrub of *Atriplex bunburyana* on playa edge.	39	0 0%

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
Clay-Loam Plain			
CLP-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Acacia caesaneura*/ *Acacia aptaneura* over heath of *Senna artemisioides* subsp. *x artemisioides*/ *Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus* on clay-loam plain.	801	110 14%
CLP-AFW2	**Acacia Forests and Woodlands** Thicket of *Acacia burkittii* over heath of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus*/ low grass of *Aristida contorta* on clay-loam plain.	480	26 5%
CLP-AFW3	**Acacia Forests and Woodlands** Low woodland of *Acacia caesaneura*/ *Acacia incurvaneura* over low scrub of *Eremophila forrestii* subsp. *forrestii*/ *Eremophila latrobei* subsp. *latrobei* and low grass of *Eragrostis eriopoda* on clay-loam plain.	469	7 1%
CLP-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia caesaneura*/*Acacia incurvaneura* over open low scrub of *Acacia ramulosa* var. *ramulosa*/*Maireana pyramidata* and dwarf of *Eremophila malacoides* on clay-loam plain.	194	4 2%
CLP-AS1	**Acacia Shrublands** Scrub of *Acacia burkittii* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus*/ low grass of *Aristida contorta* on clay-loam plain.	368	85 23%
CLP-MOW/SMS1	**Mallee Open Woodlands and Sparse Mallee Shrublands** Very open tree mallee of *Eucalyptus lucasii*/ low woodland of *Acacia incurvaneura*/ *Acacia caesaneura* over heath of *Eremophila latrobei* subsp. *glabra* and very open low grass of *Eragrostis eriopoda* on clay-loam plain.	288	12 4%
Drainage Depression			
DD-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia incurvaneura* over dwarf scrub of *Maireana pyramidata* and low heath of *Frankenia georgei* and *Sclerolaena densiflora* in drainage depression.	163	72 44%
DD-AOW2	**Acacia Open Woodlands** Open low woodland of *Acacia caesaneura* / *A. macraneura* / *A. ayersiana* over low scrub of *A. ramulosa* var. *ramulosa* / *Eremophila forrestii* subsp. *forrestii* / *Eremophila margarethae* / *Maireana triptera* and open low grass of *Eragrostis laniflora* in drainage depression.	74	1 1%

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
DD-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression.	358	7 2%
DD-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia aptaneura*/ *Acacia caesaneura* over open low scrub *of Eremophila latrobei* subsp*. latrobei* and dwarf scrub of *Eremophila gilesii* / *Eremophila malacoides* with occasional *Eragrostis eriopoda* in drainage depression.	127	0 0%
DD-AFW2	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Acacia quadrimarginea* over low scrub of *Senna artemisioides* subsp. *x artemisioides*/ *Senna artemisioides* subsp. *helmsii* and dwarf scrub of *Eremophila malacoides* in drainage depression.	244	0 0%
DD-MOW/SMS1	**Mallee Open Woodlands and Sparse Mallee Shrublands** Very open tree mallee of *Eucalyptus lucasii*/ over low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over low scrub of *Eremophila latrobei* subsp*. latrobei* and dwarf scrub of *Ptilotus obovatus* in drainage depression.	53	0 0%
Quartz/Rocky Plain			
QRP-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Acacia caesaneura*/ *Acacia aptaneura* over heath of *Senna artemisioides* subsp*. x artemisioides*/ *Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus*/ *Maireana triptera* on quartz/rocky plain.	245	60 24%
QRP-AFW2	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp*. latrobei* and low heath of *Eremophila exilifolia* on quartz/rocky plain.	310	33 11%
QRP-AFW3	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over heath of mixed shrubs and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain.	192	0 0%
QRP-AFW4	**Acacia Forests and Woodlands** Low woodland of *Acacia quadrimarginea*/ *Acacia caesaneura* over heath of mixed shrubs and dwarf scrub of *Ptilotus obovatus* with occasional *Triodia irritans*.	458	149 33%

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
QRP-AFW5	**Acacia Forests and Woodlands** Low woodland of *Acacia quadrimarginea*/ *Acacia caesaneura* over heath of mixed shrubs and sparse hummock grass of *Triodia basedowii* on quartz/rocky plain.	78	78 100%
QRP-AFW6	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Acacia quadrimarginea* over low scrub of *Acacia cuthbertsonii*/ heath of *Senna artemisioides* subsp. *x artemisioides* and dwarf scrub of *Ptilotus obovatus*/ low grass of *Aristida contorta* on quartz/rocky plain.	201	5 2%
QRP-AFW7	**Acacia Forests and Woodlands** Forest of *Acacia caesaneura/ A. incurvaneura* over low scrub of *Eremophila latrobei* subsp. *glabra/ Prostanthera campbellii* and very open low grass of *Eragrostis eriopoda*/ open hummock grass of *Triodia irritans* quartz/rocky plain .	222	19 9%
QRP-AFW8	**Acacia Forests and Woodlands** Open low woodland of *Acacia caesaneura* over low scrub of *A. grasbyi/ Senna artemisioides* subsp. *filifolia* and low heath of *Scaevola spinescens* on quartz/rocky plain .	11	1 9%
QRP-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia incurvaneura*/ *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *helmsii*/ *Senna artemisioides* subsp. *x artemisioides* and low heath of *Maireana glomerifolia*/ *Frankenia georgei* on quartz/rocky plain.	85	0 0%
QRP-CFW1	**Casuarina Forests and Woodlands** Low woodland of *Casuarina pauper* over heath of *Eremophila scoparia*/ *Senna artemisioides* subsp. x *artemisioides* and low heath of *Ptilotus obovatus*/ *Maireana triptera* on quartz/rocky plain.	24	0 0%
QRP-CFW2	**Casuarina Forests and Woodlands** Low woodland of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain.	524	14 3%
QRP-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus gypsophila* over low scrub of *Acacia burkittii* and open hummock grass of *Triodia irritans* on quartz/rocky plain.	249	6 2%

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
QRP-MWS2	**Mallee Woodlands and Shrublands** Low woodland of *Eucalyptus lucasii* over heath of *Acacia colletioides* / *Eremophila scoparia* and open low grass of *Eragrostis pergracilis* / hummock grass of *Triodia irritans* on quartz/ rocky plain.	56	2 4%
Rocky Hillslope			
RH-AFW1	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei*/*Scaevola spinescens* and sparse hummock grass of *Triodia irritans* on rocky hillslope.	250	0 0%
RH-AOW1	**Acacia Open Woodlands** Open low woodland of *Acacia incurvaneura*/ *Acacia quadrimarginea* over low scrub of *Mirbelia microphylla/Thryptomene nealensis* (P3) and open low grass of *Eriachne mucronata* on rocky hillslope.	4	0 0%
Sand Dune			
SD-EW/MWS1	**Eucalypt Woodlands/Mallee Woodlands and Shrublands** Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune.	1,480	69 5%
SD-MWS1	**Mallee Woodlands and Shrublands** Very open tree mallee of *Eucalyptus youngiana* over scrub of *Grevillea juncifolia* subsp. *juncifolia* and dwarf scrub of *Aluta maisonneuvei* subsp. *auriculata* / hummock grass of *Triodia basedowii* on sand dune.	930	11 1%
Sand-Loam Plain			
SLP-AFW1	**Acacia Forests and Woodlands** Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain.	850	11 1%
SLP-AFW2	**Acacia Forests and Woodlands** Forest of *Acacia caesaneura* over heath of *Cratystylis subspinescens* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain.	295	4 1%
SLP-RMNV1	**Regrowth, Modified Native Vegetation** Regrowth open tree mallee of *Eucalyptus? concinna* / *E.?mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain.	323	6 2%

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
Sandplain			
S-AFW1	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over dense hummock grass of *Triodia basedowii* in sandplain.	1,497	80 5%
S-AFW2	**Acacia Forests and Woodlands** Low forest of *Acacia incurvaneura*/ *Acacia caesaneura* over low scrub of mixed shrubs over dwarf scrub of *Eremophila gilesii* and sparse hummock grass of *Triodia irritans* in sandplain.	918	18 2%
S-AFW3	**Acacia Forests and Woodlands** Low woodland of *Acacia incurvaneura*/ *Hakea lorea* over heath of Melaleuca interioris and mid-dense hummock grass of *Triodia basedowii* in sandplain.	762	18 2%
S-AFW4	**Acacia Forests and Woodlands** Low woodland of *Acacia caesaneura*/ *Acacia incurvaneura* over dwarf scrub of *Eremophila forrestii* subsp. *forrestii* and mid-dense hummock grass of *Triodia irritans* in sandplain.	452	3 1%
S-AFW5	**Acacia Forests and Woodlands** Scrub of *Acacia grasbyi* over heath of *A. desertorum* and mid-dense hummock grass of *Triodia irritans* in sandplain.	131	2 6%
S-AS1	**Acacia Shrublands** Open low scrub of *Acacia abrupta* over dense hummock grass of *Triodia basedowii* in sandplain.	154	3 2%
S-EW1	**Eucalypt Woodlands** Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain.	1,813	221 12%
S-EW/MWS1	**Eucalypt Woodlands/Mallee Woodlands and Shrublands** Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain.	4,106	482 12%
S-EW/MWS2	**Eucalypt Woodlands/Mallee Woodlands and Shrublands** Low woodland of *Eucalyptus gongylocarpa* over open mallee tree of *Eucalyptus youngiana* and low heath of *Aluta maisonneuvei* subsp. *auriculata*/ mid-dense hummock grass of *Triodia basedowii* in sandplain.	263	24 9%

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
S-MWS1	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain.	2,903	152 5%
S-MWS2	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain.	265	25 9%
S-MWS3	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum*/ *Acacia grasbyi* and low heath of *Aluta maisonneuvei* subsp. *auriculata* over mid-dense hummock grass of *Triodia irritans* in sandplain.	3,971	8 0%
S-MWS4	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila latrobei* subsp. *glabra* and mid-dense hummock grass of *Triodia irritans* in sandplain.	862	15 2%
S-MWS5	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna*/ *Eucalyptus mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain.	746	39 5%
S-MWS6	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus hypolaena* over heath of *Senna artemisioides* subsp. *filifolia* and middense hummock grass of *Triodia basedowii* in sandplain.	143	0 0%
S-MWS7	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain.	148	121 82%
S-MWS8	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus youngiana* over heath of *Grevillea didymobotrya* subsp. *didymobotrya/ Acacia desertorum* and mid-dense hummock grass of *Triodia basedowii* in Sandplain.	161	1 1%
S-MWS10	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain.	151	4 3%

Vegetation Community	Vegetation Community Description	Mapped Area (ha) *	Proposed Clearing Area (ha) (% of Total Mapped Community)
S-MWS11	**Mallee Woodlands and Shrublands** Very open tree mallee of *Eucalyptus youngiana* over low heath of *Aluta maisonneuvei subsp. auriculata* and hummock grass of *Triodia basedowii* in sandplain.	31	1 3%
S-MWS12	**Mallee Woodlands and Shrublands** Very open tree mallee of *Eucalyptus leptopoda subsp. elevata*/ *E. youngiana*/ open scrub of *Grevillea pterosperma* over heath of *Aluta maisonneuvei subsp. auriculata* and mid-dense hummock grass of *Triodia basedowii* in sandplain.	230	15 7%
S-MWS9	**Mallee Woodlands and Shrublands** Open tree mallee of *Eucalyptus glomerosa*/*Eucalyptus youngiana* over low scrub of *Acacia ligulata* and dense hummock grass of *Triodia irritans* in sandplain.	110	1 1%
S-RMNV1	**Regrowth, modified native vegetation** Regrowth open tree mallee of *Eucalyptus leptopoda* subsp. *elevata* over heath of *Aluta maisonneuvei* subsp. *auriculata* and low heath of *Leptosema chambersii* / mid-dense hummock grass of *Triodia basedowii* in sandplain.	684	15 2%
S-RMNV2	**Regrowth, modified native vegetation** Regrowth open tree mallee of *Eucalyptus trivalva* over very open shrub mallee of *E. youngiana* and low heath of *Alyogyne pinoniana* / *Sida calyxhymenia* in sandplain.	249	6 2%
S-RMNV3	**Regrowth, modified native vegetation** Regrowth open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum* / *Grevillea didymobotrya* subsp. *didymobotrya* and mid-dense hummock grass of *Triodia basedowii* in sandplain.	402	13 3%

**Mapped area and proposed clearing areas have been rounded up.*

6.1.1 Conservation Significant Species

No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were identified within the project area.

Two Priority Flora taxa as listed by DPaW were identified within Mining Lease M38/1267 namely *Calytrix warburtonensis* (P2) and *Thryptomene nealensis* (P3). Both were located in the 'Low woodland of Mulga over mixed dwarf scrub vegetation community within a breakaway landform' (Botanica 2014). Neither of these species has been identified in areas of proposed disturbance and neither of these species are located within the Mine Site Development Envelope.

6.1.2 Threatened and Priority Ecological Communities

No Threatened Ecological Communities pursuant to Commonwealth and State legislation or Priority Ecological Communities as listed by DPaW have been recorded within the project area.

6.1.3 Groundwater Dependent Ecosystems

Two vegetation communities have been identified as potential Groundwater Dependant Ecosystems (GDEs) within the Yeo Palaeochannel area. These communities are:

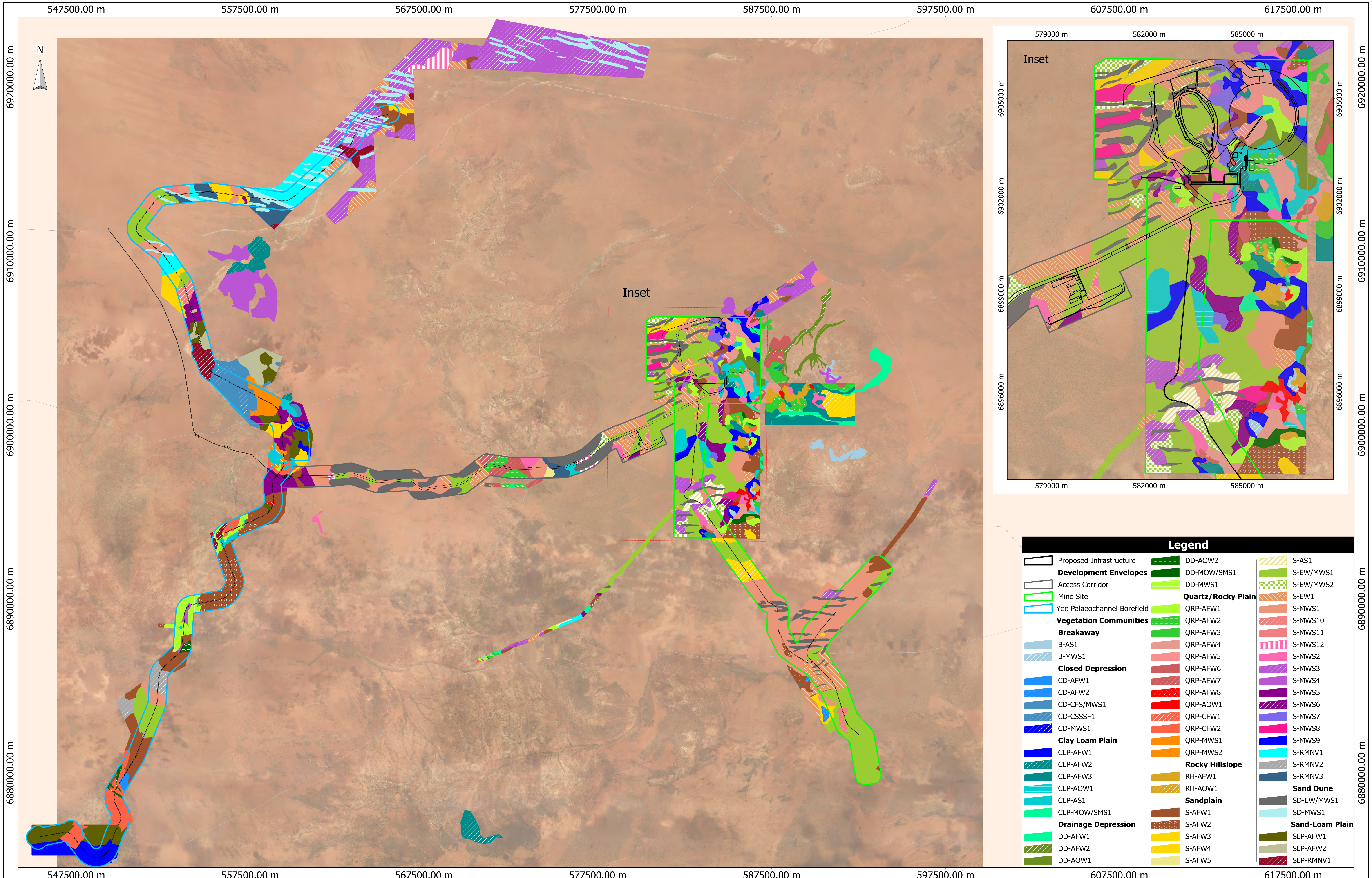
- Low woodland of *Acacia aptaneura* / *A. incurvaneura* over scrub of *A. tetragonophylla* / *Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa (CD-AFW2).
- Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1).

As per Table 11, vegetation community CD-AFW2 will not be impacted upon as no disturbance is proposed within this vegetation community. It is not expected that CD-AFW2 will face any indirect effects from the project.

Approximately 7 ha (2%) of the DD-MWS1 vegetation community will be disturbed. This represents an increase of approximately 2 ha when compared to the information supplied in the Section 38 EPA Referral submitted to the EPA on 31 March 2016. This is due to refinement of proposed infrastructure placement following further feasibility studies. Recent flora and vegetation surveys by Botanica have identified an additional 104 ha of this community, bringing the total known mapped area of DD-MWS1 to 358 ha. Therefore disturbance is still considered to be minimal.

6.1.4 Weeds

Two introduced taxon have been identified within the Gruyere survey areas, these included *Cenchrus ciliaris* (Buffel grass) and *Cenchrus echinatus* (Burr grass). Both species are naturalised pasture grasses established on the Yamarna pastoral lease. Neither taxon is listed as a Declared Plant under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (Botanica 2015b).



Scale: 1:200000
Original Size: A3
Air Photo Date:2015
Grid: Latitude / Longitude

0 10 km

Gold Road Resources Limited
Gruyere Gold Project
API

Figure 17

Vegetation Communities over Conceptual Site Layout

Martinick Bosch Sell Pty Ltd
4 Cook St
West Perth WA 6005
Ph: (08) 9226 3166
Fax: (08) 9226 3177
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au
MBS ENVIRONMENTAL

W:\Gold Road Resources\Gruyere\Approvals\API\Drawings\GGR_Flora and Fauna.map 4/10/2016 F18 Vegetation Communities Layout

6.2 TERRESTRIAL FAUNA AND HABITAT

A number of fauna surveys have been undertaken for the project including the proposed borefield areas as listed in Table 6. This includes two additional surveys undertaken since submission of the EPA Referral in March 2016. Results from these surveys are contained in Appendix 5. Eight broad fauna habitats and one sub-type (transition zone / ecotone) have been identified within the Gruyere area. No new habitat types were identified during the additional surveys.

The areas of each of the habitats and the proposed percentage of impact on each from implementation of the project given current project design are shown in Table 12. The conceptual site layout over habitat type is shown in Figure 18.

Table 12 Habitats of the Gruyere Gold Project Area

Habitat	Vegetation Description	Geology, Soil, Landform Description	Total Mapped Area (ha)	Proposed Disturbance Within Survey Area (ha, %)
Sand Ridges	Eucalypt Woodlands/ Mallee. Woodlands and Shrublands. Lower story often *Triodia* dominated.	Red sands.	2,410	80 3%
Sand Plains*	*Acacia* Forests and Woodlands; *Acacia* Shrublands; Eucalypt Woodlands; Eucalypt Woodlands/ Mallee Woodlands and Shrublands; Mallee Woodlands and Shrublands; Regrowth (modified native vegetation). Lower story *Triodia* dominated.	Red sands.	21,040	1257 6%
Clay Loam Plains*	*Acacia* Forests and Woodlands; *Acacia* Shrublands; Mallee Open Woodlands and Sparse Mallee Shrublands.	Clay loam red soil plains in parts bisected by minor drainage.	2,597	242 9%
Quartz Rocky Plains	*Acacia* Forests and Woodlands; *Acacia* open Woodlands; *Casuarina* Forests and Woodlands.	Quartz dominated plains and rises. Skeletal red soils.	2,649	364 14%
Rocky Hill Slopes	*Acacia* Forests and Woodlands.	Rocky skeletal red soils on hill slopes.	253	8 0%
Breakaways	*Acacia* Shrublands.	Permian breakaway with gravel soils.	168	0 0%
Closed Depression	*Acacia* Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands, Chenopod Shrublands, Samphire Shrublands and Forblands.	Light brown clays, bare patches due to water accumulation.	722	11 2%
Drainage Depression	*Acacia* Open Woodlands; Mallee Open Woodlands and Sparse Mallee Shrublands. Understorey typically dominated by Chenopods.	Light brown clays, bare patches due to water accumulation.	1,015	79 8%
Sand-Loam Plains	*Acacia* Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands, Regrowth, modified native vegetation.	Red sands.	1,467	20 1%

** NB: Site 3 (Ecotone) is a combination of Sand Plain and Clay Loam Plain habitat. It exists in the overlap zone where these two habitats meet, and therefore cannot be mapped or its extent measured.*
**Mapped area and proposed clearing areas have been rounded up.*

6.2.1 Species of Conservation Significance

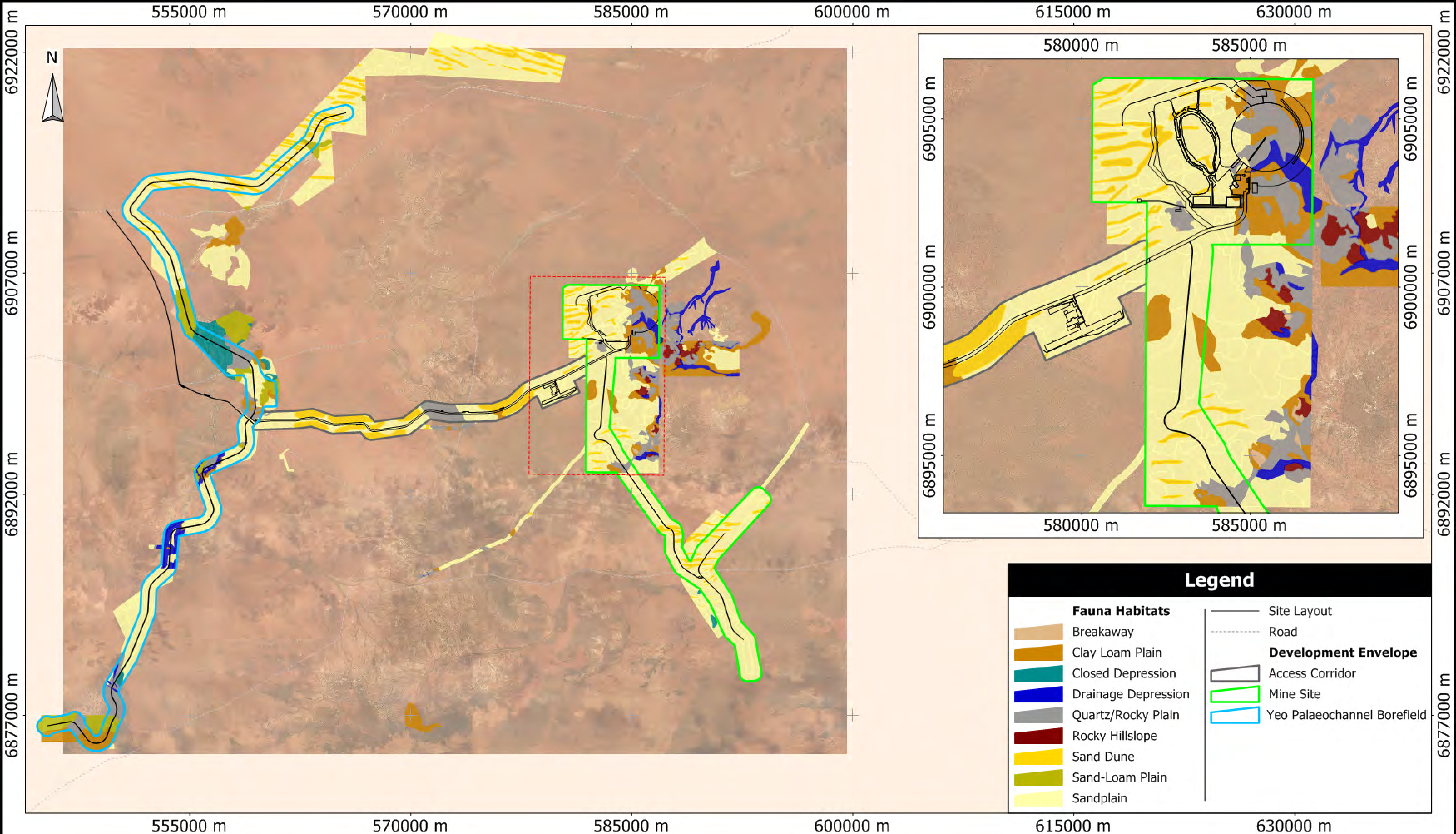
Database searches by Rapallo (2015), Harewood (2016) and Botanica (2016a and b) identified 12 species of conservation significance that have potential to occur within the project. Of these two species were observed during baseline fauna surveys. These were:

- Rainbow Bee-eater (*Merops ornatus).* This species is listed under the *WC Act* as Schedule 3 – Migratory birds protected under an international agreement. It is protected under Japan-Australia Migratory Bird Agreement (JAMBA). Under the *EPBC Act* the species is listed as Migratory. It was observed within the Mine Site and Borefield development envelopes and has also been recorded near to the existing Yamarna exploration camp located 20 km south west of the project area. The Rainbow Bee-eater is a very common and widespread seasonal visitor to the southern half of Western Australia. The species is likely to use the project area and surrounds for foraging and there is potential for the species to breed in some sections of the project area where ground conditions are suitable (Harewood 2016). Given the widespread nature of the species, it is considered unlikely that development of the project will adversely impact upon the conservation status of the Rainbow Bee-eater.
- Southern Marsupial Mole (*Notoryctes typhlops).* The Southern Marsupial Mole is listed as S1 under the *Wildlife Conservation Act 1950 (WC Act)* and is a DPaW Priority 4 species. In December 2015, this species was removed from the Threatened Species List under the *EPBC Act* as they no longer met any of the criterion that would make them eligible for listing (DoE 2016). At the extreme northern end of the Yeo Palaeochannel, Harewood (2015; 2016) reported that distinctive backfilled burrows were found in the walls of a temporary holding dam. The dam had been constructed on a sand dune in the extreme northern section of the proposed Yeo Palaeochannel borefield, north of the Great Central Road. This finding confirms the presence of the Southern Marsupial Mole in this particular area. Harewood (2016) found that this area of dunes appeared to be separate from those in other areas *e.g.* project area where no evidence of the species had been found despite targeted searches (*i.e.* trenches and examination of large cutting in dunes). The Yeo Palaeochannel borefield design has considered potential disturbance of this P4 species. The disturbance area is expected to be minimal considering infrastructure will consist of a pipeline and track. Habitat will be avoided through pipeline alignment and placement of the pipeline on the surface of dunes (with shallow covering) as opposed to a directional cut through the dune.

6.2.2 Introduced Species

Six species of introduced mammal have been recorded within the project area and its associated borefields. These species included the House mouse (*Mus musculus*), Dromedary Camel (*Camelus dromedaries*), Cattle (*Bos taurus*), Feral cat (*Felis catus*), Wild dog (*Canis* sp.) and the European Rabbit (*Oryctolagus cuniculus*).

Figure 18: Fauna Habitats over Conceptual Site Layout



Scale: 1:400000 Grid: MGA94(51) GIS Source: GGR_Flora and Fauna.map Fauna Habitats with Site Layout_InLayout

6.3 HERITAGE

A heritage survey was completed within the Yamarna exploration area in 2004, an ethnographic cultural mapping survey across the greater project region was completed in September 2015 and archaeological surveys were undertaken in 1994 and 2016.

Surveys were undertaken by anthropologists and Senior men representing the Aboriginal community as cultural custodians of the land. The information from these surveys is subject to a confidentiality agreement, and not available for public release. Exclusion zones have been established around heritage sites and by Gold Road under the Yamarna Pastoral Lease Heritage Agreement and the Yamarna Project Agreement. These exclusion zones will not be disturbed by the construction, operation or closure of the Project. Gold Road has developed a Cultural Heritage Management Plan (CHMP) which will be implemented as required

Commitments made with regards to the impact and management of heritage with regards to the project are presented in Table 13 in Section 7.4.

6.4 REHABILITATION AND CLOSURE

There have been no new closure and rehabilitation studies completed since Referral of the project to the EPA on 31 March 2016. A Mine Closure Plan for the project will be submitted with the Mining Proposal to the DMP and will include impact and management measures as per Table 13 in Section 7.4.

7. ENVIRONMENTAL MANAGEMENT FRAMEWORK

Section 7 outlines the project's environmental management framework (EMF). The EMF is an overarching strategy that will be used to translate the commitments and management measures contained in environmental approval documentation into the planning, engineering, construction and day to day operations of the project. The EMF consists of an Environmental Policy under which an Environmental Management System (EMS) and a comprehensive series of Environmental Management Plans (EMPs) operate.

7.1 ENVIRONMENTAL POLICY

Gold Road's Environmental Policy outlines its intentions and commitment to environmental performance. A copy is provided in Appendix 7. The policy's goal is to ensure that environmental harm resulting from Gold Road's activities are minimised and do not compromise future land uses. The policy is a statement of Gold Road's intentions and principles in relation to overall environmental performance, which provides a framework for action and the setting of environmental objectives, targets and improvements.

7.2 ENVIRONMENTAL MANAGEMENT SYSTEM

Gold Road is developing an environmental management system (EMS) to facilitate the management of environmental responsibilities for all phases of the project (construction, operation and closure) and to enable continuous improvement of the company's environmental performance. Over the life of the project, the EMS will enable Gold Road to systematically assess and review its environmental impacts, in addition to implementing programs for the management of environmental impacts and obligations.

The Gold Road EMS will be based on *AS/NZ ISO 14001:2004 Environmental Management System Standards*, which are internationally accepted and include a model for continuous improvement.

Environmental management plans and procedures will be developed in order to implement the EMS at an operational level and will include objectives for management, consideration of legal and other obligations, monitoring requirements and targets to measure performance.

7.3 ENVIRONMENTAL REFERRAL COMMITMENTS

Environmental commitments made within the Referral submitted to the EPA on 31 March 2016 with regards to Preliminary Environmental Factors of flora and vegetation, heritage and rehabilitation and closure (discussed in Section 6) will form part of the EMS and are presented in Table 13.

7.4 ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS

Aspect specific Environmental Management Plans will form the cornerstone of the project's EMS as they will document actions and responsibilities for protection of the environmental values of the project area.

The EMP's will address the design, construction, commissioning and operation phases of the project. They will identify key environmental issues across the project and provide strategies and plans for managing them effectively. They will also define the legal requirements for the project, identify regulatory permits and licences required for various activities and document monitoring program required to validate impact assessment predictions.

Environmental Management Plans will be developed and documented through a systematic and consultative process to address environmental factors and risks. They will be dynamic documents, that will be regularly reviewed and amended to ensure they incorporate information collected from monitoring programs, audits and stakeholder engagement so that they remain effective and will ensure Gold Road meets the stated environmental objectives for various environmental factors.

Table 13: Environmental Management Commitments from Gruyere Gold Project EPA Referral

Environmental Factor	EPA Objectives	Potential Impacts of Gruyere Gold Project	Mitigation and Management Actions
Flora and Vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.	**Mine Site:** • Localised loss of vegetation from clearing. • Loss of biological diversity and reduced regional representation of flora and vegetation communities. • Fragmentation of land. • Spread of existing weed species and introduction of new weed species due to increased vehicle movement in the local area. • Vegetation damage due to increased fire risk. • Death of vegetation due to saline water and tailings spills/leaks. • Alteration to vegetation communities resulting from changed drainage patterns. • Reduction in vegetation condition due to dust emissions. **Access Corridor/ Yeo Palaeochannel Borefield:** • Localised loss of vegetation from clearing. • Spread of existing weed species and introduction of new weed species due to increased vehicle movement in the local area. • Vegetation damage due to increased fire risk. • Death of vegetation due to saline water leaks. • Alteration to vegetation communities resulting from changed drainage patterns. • Reduction in vegetation condition due to dust emissions.	• Local provenance seed collection will be undertaken with assistance from the Traditional Owners both prior to vegetation clearing and throughout the project life. • Clearing activities will be managed to ensure clearing is strictly limited to that necessary for the operations. • Disturbance will be minimised through careful design of site layout. Disturbed areas will be rehabilitated as they become available. • Vehicle and equipment hygiene procedures will be implemented to minimise entry of weed and soil borne diseases. • Fire breaks will be installed in consultation with Department of Fire and Emergency Services (DFES) to protect key infrastructure where required and mosaic burns will be conducted to assist with minimising spread of fire and reducing the severity of fire when it does occur. • Firefighting equipment will be located on site and personnel trained in fire response. • Lightning protection equipment will be installed as part of project design where necessary. • Project and borefields design will consider location of drainage lines and flood levels with the aim of minimising disturbance of these areas. • Pipes transferring saline water and tailings will be located within bunds. • Dust control measures will be implemented. • Speed limits will be implemented to minimise dust emissions. • Dust suppression agents will be used as needed to minimise dust emissions from roads and other disturbed areas. • A Mine Closure Plan will be developed and implemented. Closure criteria will consider EPA objectives for this factor.

Environmental Factor	EPA Objectives	Potential Impacts of Gruyere Gold Project	Mitigation and Management Actions
Heritage	To ensure that historical and cultural associations are not adversely affected.	**Mine Site:** • Disruption of access to sites of cultural significance. • Direct disturbance of archaeological sites. **Access Corridor:** There will be no impacts to heritage within the access corridor. **Yeo Palaeochannel Borefield:** • Disruption of access to sites of cultural significance. • Direct disturbance of archaeological sites.	• Project and borefields design will consider the results of the archaeological and ethnographic surveys. • Project and borefields inductions will include information on heritage aspects of the Project area. • Traditional Owners will continue to have uninterrupted access along existing pastoral and public roads.
Rehabilitation and Closure	To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.	**Mine Site:** • Wind and water erosion of disturbed areas. • Off-site discharge of potential pollutants from un-rehabilitated land. • Ineffective establishment of vegetation and habitat. • Disruption to or poor re-establishment of local drainage paths. • Safety risks associated with infrastructure and the mine workings. **Access Corridor/Yeo Palaeochannel Borefield:** • Wind and water erosion of disturbed areas. • Ineffective establishment of vegetation and habitat. • Disruption to or poor re-establishment of local drainage paths. • Safety risks associated with borefield infrastructure.	• A Mine Closure Plan will be developed and implemented. • Monitoring will be implemented once areas are rehabilitated to ensure progression towards completion criteria. • Annual payments will be made to the Mining Rehabilitation Fund.

8. PRINCIPALS OF THE ENVIRONMENTAL PROTECTION ACT

The EPA has identified a set of principles for environmental management. Gold Road has considered these throughout the development process of the project, including this API and will continuing to give them consideration well into the project. Gold Road's environmental design standards will be incorporated and implemented in the engineering specifications of the project. Details of how these principals have been considered in project design are provided in Table 14.

Table 14: Gruyere Gold Project – Principles of Environmental Management

Principle	Application
Precautionary Principle Where there are threats of serious irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: • Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and • An assessment of the risk-weighted consequences of various options.	Gold Road has made use of the results of baseline environmental investigations to identify potential impacts and assess the environmental risk of the project's implementation on these aspects. Environmental risks have been considered when finalising options for key project design choices. This has been considered in detail during design of the process water borefield in the Yeo palaeochannel where a number of options were evaluated. The selected design has considered risk to stygofauna populations and a conservative engineering approach selected to avoid impacts in an area identified to have high species richness and uniqueness. Gold Road commits to develop and implement measures to avoid serious or irreversible damage to the environment.
Intergenerational Equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	Gold Road commits to managing those environmental factors within its control such that future adverse impacts are minimised and that, wherever possible, the quality of the environment is maintained or enhanced. Long-term land management proposals are being discussed between Gold Road and the Native Title Claimant Group who are charged as the custodians of their Country to preserve and enhance environmental and cultural values of the region so that the land can be protected for future generations. Additionally Gold Road has developed a Preliminary Integrated Groundwater and Stygofauna Habitat Management Plan in order to protect stygofauna for future generations. This plan is attached as Appendix 3 A Mine Closure Plan will be prepared for the project in consultation with regulatory and Traditional Owner stakeholders to ensure that post mining land use is consistent with agreed stakeholder objectives and so that rehabilitation can be progressively implemented.

Principle	Application
Conservation of Biological Diversity and Ecological Integrity Conservation of biological diversity and ecological integration should be a fundamental consideration	The project and borefields design, including site layout, environmental protection measures, and engineering specifications have taken into account conservation of biological diversity, in particular that of stygofauna found within the Yeo Palaeochannel. There will be no direct impacts on conservation significant flora and fauna species, and risks to other fauna and flora will be minimised to as low as is reasonably practicable. Biological studies undertaken as part of collation of baseline information for the project and borefields has greatly assisted the scientific community in understanding the biological diversity of this previously poorly studied area and gained knowledge of the historical impacts of pastoral activity (at the project site) in comparison to the greater GVD region.
Improved Valuation, Pricing and Incentive Mechanisms • Environmental factors should be included in the valuation of assets and services. • The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. • The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste. • Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which benefit and/or minimise costs to develop their own solutions and responses to environmental problems.	Costs and environmental impact associated with power generation and energy use options were considered as part of the Scoping Study and then refined as part of the PFS. Diesel compared to natural gas or LNG/CNG was evaluated considering environmental life cycle analysis, environmental footprints, market drivers, taxation and economic advantages. Costs associated with waste generation and disposal has been considered as part of the design process. In particular, the decision to go with an IWL solution substantially reduces environmental impact and emissions. Specialist waste engineering models have also been completed to design minimal haulage and tailings pipeline distances thereby minimising fuel use and power requirements. Costs associated with closure of the project have been considered as part of the PFS and FS and will be further refined as part of the detailed engineering designs.

Principle	Application
Waste Minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment. Wastes should be managed in accordance with the following order of preference: • Avoidance. • Re-use. • Recycling. • Recovery. • Treatment. • Containment. • Disposal.	Waste minimisation principles have been considered in project design. This includes: • Design of the TSF and waste rock dump landforms into a single landform (IWL) in order to minimise the number of landforms at the site. • Re-use of topsoil and cleared vegetation in rehabilitation of areas during operations and post-mining. • Recycling and re-treatment of waste water from the IWL to reuse within the processing plant. • Designing the project to be 'zero discharge' with a balanced water supply without generating or the need to dispose of excess waste water off-site. • Containment of tailings in an engineered IWL which will be safe, stable and non-polluting in the long term. • Disposal of putrescible wastes in a purpose built onsite landfill. • Minimising packaging wastes associated with reagents by importing in bulk and requiring return of packaging to suppliers.

9. CONCLUSION

9.1 PROPONENTS CONCLUSION

The primary basis for determining the likely significance and acceptability of a proposal is whether it is likely to meet the EPA's objectives for that preliminary environmental factor. The EPA's objective for subterranean fauna is:

"To maintain representation, diversity, viability and ecological function at the species, population and assemblage level"

Based on environmental studies and modelling undertaken to date for the project it can be concluded that:

- Three potentially restricted stygofauna species are found within the impact area of the Yeo borefield. It is however considered highly probable by experts in the field that these species will be located outside the drawdown impact area should further DNA analysis and/or sampling be undertaken. This is already evident when taking into consideration that further work carried out since the submission of the Referral on 31 March 2016 has reduced the number of potentially restricted stygofauna species from 30 to three. Of these three species:
  - *Enchytraeidae sp. B07* and *Parabathynellidae gen. nov 1 sp. B07* are found within bore 16GYWB0019 which is predicted to have more than 70% of its calcrete habitat remaining saturated at project completion thus providing sufficient habitat for the survival of these two species.
  - *Enchytraeidae sp. B10* is found within a fractured rock aquifer system (bore 16GYWB0016) and thus will be able to move through the hydraulic connections in the aquifer as its habitat changes thus providing sufficient habitat for the survival of this species.
  - Parabathynellidae gen. nov. 1 sp. B07 is also found within bore 16GYWB0025 in the southern part of the Yeo borefield. The finding of this species within two bores separated by 30 km suggests that there is interconnectivity between the habitat the bores intersect, and should further sampling be undertaken, the likelihood is high that further specimens will be found.
- Abstraction is conservatively predicted to result in about 69% of calcrete habitat remaining within the Yeo Palaeochannel area considered for the two borefields. Additional habitat that will not be impacted by the project remains outside of this area.
- Implementation of an adaptive borefield management program together with implementation of the Preliminary Integrated Groundwater and Stygofauna Habitat Management Plan will allow Gold Road to actively manage project impacts upon the northern and southern Yeo borefield and thus minimise the loss of subterranean fauna habitat and consequently stygofauna species.

Based on the information contained within this API, which is supported by the studies undertaken to date, Gold Road believes that it can maintain representation, diversity, viability and ecological function at the species, population and assemblage level with regards to subterranean fauna found within the Yeo Palaeochannel and as such believes the project will not be at variance with the EPA's objective.

9.2 APPLICATION OF THE SIGNIFICANCE FRAMEWORK

Figure 19 illustrates the likely significance of the preliminary environmental factor (Subterranean Fauna) considering the inherent and residual risk after management and mitigation measures have been applied in the form of a condition. It is envisaged that this condition will be based on the information contained in Appendix 3 of this document.

It should be noted that Figure 19 is conceptual and represents Gold Road's view of the level of uncertainty. The figure is not intended to be precise in evaluating the significance of impacts.

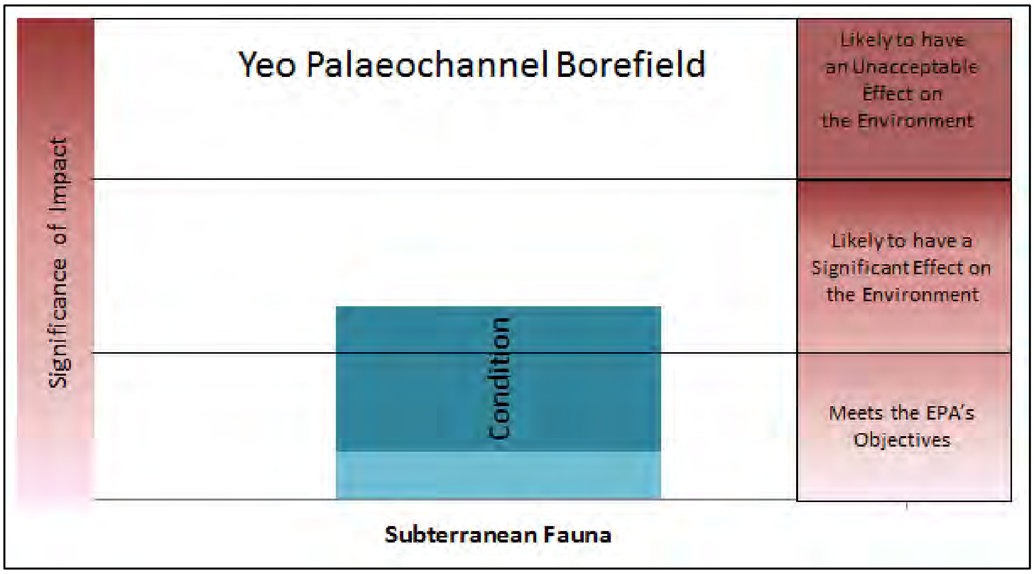


Figure 19: Gold Road's Conceptual Application of the EPA's Significance Framework

10. REFERENCES

Botanica Consulting (Botanica). 2014. *Level 1 Flora and Vegetation Survey of the Gruyere Project Tenements E38/1932, E38/2178, E38/2325, E38/2362 & E38/2446.* Unpublished report prepared for Gold Road Resources Limited.

Botanica Consulting (Botanica). 2015a. *Level 2 Spring Flora & Vegetation Survey of the Gruyere Project Tenement M38/1267*. Unpublished report prepared for Gold Road Resources Limited.

Botanica Consulting (Botanica). 2015b. *Level 2 Autumn Flora & Vegetation Survey of the Gruyere Project Tenement M38/1267*. Unpublished report prepared for Gold Road Resources Limited.

Botanica Consulting (Botanica). 2016a. *Level 1 Flora Survey and Fauna Assessment Gruyere Camp and Airstrip*. Unpublished report prepared for Gold Road Resources Limited.

Botanica Consulting (Botanica). 2016b. *Level 1 Flora and Fauna Survey Gruyere Borefields.* Unpublished report prepared for Gold Road Resources Limited.

Bennelongia Pty Ltd (Bennelongia). 2016. *Gruyere Gold Project: Borefields Stygofauna Assessment*. Unpublished report prepared for Gold Road Resources Limited.

Department of Environment (DoE). 2016. *Two Mammal Species Removed from the List of Threatened Species under the EPBC Act.* http://www.environment.gov.au/news/2015/12/03/two-mammal-species-removed-list-threatened-species-under-epbc-act (accessed January 25, 2016).

Environmental Protection Authority (EPA). 2012. *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012*.

Environmental Protection Authority (EPA). 2012a. *Defining the Key Characteristics of a Proposal Environmental Protection Act 1986 May 2012 (EAG 1)*.

Environmental Protection Authority (EPA). 2015. *EAG 14: Environmental Assessment Guideline for Preparation of an API – Category A, Environmental Review Document.*

Environmental Protection Authority (EPA). 2015a. *EAG 17: Environmental Assessment Guideline for Preparation of Management Plans under Part IV of the Environmental Protection Act 1986.*

Environmental Protection Authority (EPA). 2015b. *EAG 8: Environmental Assessment Guideline for Environmental Factors and Objectives under Part IV of the Environmental Protection Act 1986.*

Harewood, G. 2015. *Southern Marsupial Mole (Notoryctes typhlops) – Northern Borefield Area.* An unpublished correspondence prepared for Gold Road Resources Limited.

Harewood, G. 2016. *Fauna Assessment Level 1 Gruyere Borefield Project*. Unpublished report prepared for Gold Road Resources Limited.

MBS Environmental (MBS). 2011. *Windarra Nickel Project: Subterranean Fauna Assessment: First Round Stygofauna Sampling*. Unpublished report prepared for Poseidon Nickel.

MBS Environmental (MBS). 2013. *Gidgee Gold Project: Subterranean Fauna Assessment*. Unpublished report prepared for Panoramic Gold Pty Ltd.

MBS Environmental (MBS). 2015. *Gruyere Project Level 1 Subterranean Fauna Survey*. Unpublished report prepared for Gold Road Resources Limited.

Pennington Scott. 2016. *Hydrogeological Summary. Gruyere Gold Project*. Unpublished report prepared for Gold Road Resources Limited.

Pennington Scott. 2016a. *Hydrogeological Modelling Synopsis for API. Gruyere Gold Project*. Unpublished report prepared for Gold Road Resources Limited.

Rapallo Group (Rapallo). 2015. *Level 2 Vertebrate Fauna Survey of the Gruyere Project Area Rev E.* Unpublished report prepared for Gold Road Resources Limited.

Rockwater Pty Ltd (Rockwater). 2006. *Regional Stygofauna Sampling Programme Redmond – King River Area and Proposed Southdown Mine*. Unpublished report prepared for Grange Resources.

Subterranean Ecology Pty Ltd. 2010. *Solomon Project: Kings Deposits Subterranean Fauna Survey and Assessment.* Unpublished report prepared for Fortescue Metals Group.

TORO Energy Limited. 2015. *Extension to the Wiluna Uranium Project Assessment NO: 2002 (CMS14025.* Public Environmental Review.

Stumpp C, Hose GC. 2013. *The Impact of Water Table Drawdown and Drying on Subterranean Aquatic Fauna in In-Vitro Experiments*. PL0S ONE 8(11): e78502. Doi: 1371/journal.pone0078502.

APPENDICES

APPENDIX 1: STAKEHOLDER CONSULTATION REGISTER

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
29-Aug-14	14:00	Department of Mines and Petroleum	Various	Graham Cobby (DMP) Ian Mitchell (DMP) Ivor R / Mike Freeman / Tony Bullen	Ian Murray (Gold Road) Gordon Murray (Gold Road) Ziggy (Gold Road) Kristy Sell (MBS)	Gruyere	Meeting with DMP to discuss potential for lead agency status. Project overview, discussions re: heritage/NT issues, progress with Scoping Study, project plan timing, progress with baseline studies.	Formal Meeting	Gruyere Project Lead Agency Status Meeting	Lead agency Approvals
13-Nov-14	13:25	Department of Mines and Petroleum	Strategic Projects	Graham Cobby (DMP)	Nicole Garbin (MBS) Kristy Sell (MBS) Gordon Murray (Gold Road)	Gruyere	Email from Graham Cobby advising Gordon Murray that the Gruyere Project has been assessed by DMP and designated a Level 2 Lead Agency Project Proposal.	Email	Gruyere Project Granted Level 2 Lead Agency Status	Lead agency Approvals
13-Mar-15	9:00	Department of Mines and Petroleum	Strategic Projects	Graham Cobby (DMP)	Nicole Garbin (MBS) Kristy Sell (MBS) Gordon Murray (Gold Road)	Gruyere	Meeting with Graham Cobby to provide a project update briefing and discussion around level 2 lead agency status.	Formal Meeting	Approvals Meeting with DMP 2015 03 13 ppt	Lead agency Approvals
20-Mar-15	15:21	Department of Mines and Petroleum	Strategic Projects	Graham Cobby (DMP)	Gordon Murray (Gold Road)	Gruyere	Email to Graham Cobby to provide the approvals meeting presentation as an attachment.	Email	Approvals Meeting DMP Edited V3 2015 03 20	Lead agency Approvals
27-Mar-15	16:37	Department of Mines and Petroleum	Operations, Environment	Lawson Brandis (DMP)	Kristy Sell (MBS)	Central Bore	Email to Lawson Brandis regarding a query on gravel extraction from E38/2325 for maintenance of the airstrip and roads at Central Bore E38/2326.	Email	Gravel Extraction Query	Gravel extraction Approvals
30-Mar-15	8:40	Montezuma Mining Company Ltd	Exploration	Justin Brown	Gordon Murray (Gold Road)	Gruyere	Email from Gordon Murray to Justin Brown with attached 'Letter of Authority' addressed to Justin Brown (Managing Director of Montezuma Mining Company Ltd) requesting permission to conduct L2 autumn flora survey over Montezuma's tenement E38/2999.	Email Letter	20150327MontezumaLvl2FloraSurveyAccess	Approvals Flora survey
30-Mar-15	10:31	Department of Mines and Petroleum	Operations, Environment	Lawson Brandis (DMP)	Kristy Sell (MBS)	Gruyere	Email from Lawson Brandis providing advice on the query for gravel extraction and how it can be developed under a PoW.	Email	Gravel extraction Query	Gravel extraction Approvals
30-Mar-15	13:29	Montezuma Mining Company Ltd	Exploration	Brad Drabsch	Gordon Murray (Gold Road)	Gruyere	Email between Gordon Murray and Bradley Drabsch with permission from Brad Drabsch (Exploration Manager) to conduct L2 autumn flora survey over Montezuma's tenement E38/1299.	Email	20150327MontezumaLvl2FloraSurveyAccess	Approvals Flora survey
30-Mar-15	15:20	Montezuma Mining Company Ltd	Exploration	Brad Drabsch	Gordon Murray (Gold Road)	Gruyere	Email between Gordon Murray and Bradley Drabsch confirming that agreement to provide Montezuma with raw flora and vegetation data where it covers E38/2999 only. The final report will remain with Gold Road.	Email	20150327MontezumaLvl2FloraSurveyAccess	Approvals Flora survey
30-Mar-15	16:19	Montezuma Mining Company Ltd	Exploration	Brad Drabsch	Gordon Murray (Gold Road)	Gruyere	Email between Gordon Murray and Bradley Drabsch confirming the agreement to provide Gordon with the signed letter to conduct the flora survey over Montezuma's tenement.	Email	Access For Level 2 Flora Survey Over Gruyere Area By Gold Road	Approvals Flora survey
20-Apr-15	9:15	Department of Parks and Wildlife	Nature Protection Branch	Danny Stefoni (DPaW)	Nicole Garbin (MBS) Talia Warda (MBS)	Gruyere	Email from Danny Stefoni providing a Licence to take fauna for scientific purposes for the subterranean fauna survey.	Email	Licence Copy	Subterranean Survey
23-Apr-15	10:10	Traditional Owners	Yilka People	HM (Harvey Murray senior) / HJ (Harvey Murray junior) / Rowan Murray / Sebastien Murray / Hayley Westlake / Kassey Murray	Kate George (Rapallo)	Gruyere	Email from Kate George to the Traditional Owners regarding conversations had during level 2 spring fauna survey 2014 and queries regarding names of Traditional owners and whether any of the habitats or fauna of the area are of particular cultural significance.	Email	Information request for Gold Road Fauna Survey Report.	Fauna survey
5-May-15	15:44	Western Australian Museum (WAM)	Research Associate	Erich S. Volschenk (WAM)	Nicole Garbin (MBS) Kristy Sell (MBS) Gordon Murray (Gold Road)	Central Bore	Email between Nicole Garbin and Erich Volschenk requesting a copy of the scorpian report for Yamarna.	Email	Scorpian Report for Yamarna	Fauna survey

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
5-May-15	16:52	Western Australian Museum (WAM)	Research Associate	Erich S. Volschenk (WAM)	Nicole Garbin (MBS) Kristy Sell (MBS) Gordon Murray (Gold Road)	Central Bore	Email between Erich Volschenk and Nicole Garbin providing the scorpian report as an attachment and stating it was provided to KLA on 23/03/12.	Email	Scorpian Report for Yamarna	Fauna survey
19-May-15	14:44	Department of Mines and Petroleum	Mineral Exploration	Tonya Carter (DMP)	Meg Bagby (Gold Road)	Central Bore	Email from Tonya Carter to Meg Bagby with queries regarding the PoW for gravel extraction.	Email	REG ID 54439-Programme of Work - Further Information Required	Approvals Gravel Extraction
20-May-15	All day	Traditional Owners	Yilka People	Yilka Community Meeting	Ian Murray (Gold Road) Sharon Goddard (Gold Road) Gordon Murray (Gold Road) Shaun Richardson (Gold Road) Rhys Davies (DLA Piper) Rebecca Shanahan (Ashurst)	Gruyere	General discussion on the development of the Gruyere project, benefits to the company and community.	Community Gathering	N/A	Community Negotiations
22-Jun-15	6:10	Traditional Owners	Yilka People	HM (Harvey Murray senior) / HJ (Harvey Murray junior) / Rowan Murray / Sebastien Murray / Hayley Westlake / Kassey Murray	Kate George (Rapallo)	Gruyere	Email from Kate George to the Traditional Owners following up on conversations had during level 2 spring fauna survey 2014.	Email	Information request for Gold Road Fauna Survey Report.	Fauna survey
23-Jun-15	All day	Traditional Owners	Yilka People	Yilka people (numerous from Cosmo Newberry) Giacomo Boranga Sean Calderwell Mladen Mverlj (CDNTS)	Glenn Firth (Gold Road) Sharon Goddard (Gold Road) Gordon Murray (Gold Road) Exploration personnel Rhys Davies (DLA Piper) Rebecca Shanahan (Ashurst)	Gruyere	Yilka claim members attended a preliminary site visit to generally view the proposed pit areas and mine camp and have cultural heritage discussions.	Community Gathering	N/A	Community Negotiations
24-Jun-15	All day	Senior men	*Wati*	Yilka people (numerous from Cosmo Newberry) and *Wati*	None	Gruyere	CONFIDENTIAL: Following a Wati meeting, Yilka, confirmed that the *Wati* did not consider there to be any threshold cultural heritage issues to Yilka continuing negotiations in relation to the proposed Gruyere pit location. This is on the basis that the pit will not extend more than 200 metres north of the large, northern most sand dune (i.e. the sand dune past drill line 51012.5 as shown on the plan distributed during the site visit).	Community Gathering	N/A	Community Negotiations
24-Jun-15	13:00	Department of Mines and Petroleum	Strategic Projects	Ian Mitchell (DMP)	Glenn Firth (Gold Road)	Gruyere	Introduction meeting between DMP and GOR Approvals Manager and to provide a project update briefing and discussion around level 2 lead agency status.	Formal Meeting	N/A	Approvals Lead agency
26-Jun-15	13:00	Western Australian Museum (WAM)	Research Associate	Erich S. Volschenk (WAM)	Nicole Garbin (MBS) Kristy Sell (MBS) Kate George (Rapallo) Glenn Firth (Gold Road) Marieke Weeheim (Rapallo)	Gruyere	Meeting with Rapallo, MBS, Glenn Firth and WAM regarding SREs found during level 2 spring fauna survey in 2014 and SRE proposal for future work.	Formal Meeting	SRE Proposal Meeting with Glenn Firth	Fauna survey SREs
29-Jun-15	11:04	Department of Parks and Wildlife	Environmental Management Branch	Sandra Thomas (DPaW)	Kristy Sell (MBS)	Gruyere	Phone call from Kristy Sell to Sandra Thomas regarding arranging a meeting to discuss SREs and future SRE surveys.	Phone Call	SRE Meeting	Fauna survey SREs

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
30-Jun-15	11:22	Traditional Owners	Yilka People	HM (Harvey Murray senior) / HJ (Harvey Murray junior) / Rowan Murray / Sebastien Murray / Hayley Westlake / Kassey Murray	Kate George (Rapallo)	Gruyere	Email from Harvey Murray to Kate George with information regarding queries on L2 fauna survey, last names and what fauna are significant to the Yilka people.	Email	Information request for Gold Road Fauna Survey Report.	Fauna survey Commuity Negotiations
02-Jul-15	10:04	Department of Mines and Petroleum	Mineral Exploration	Tonya Carter (DMP)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Meg Bagby (Gold Road)	Gruyere	Email from DMP to Meg Bagby regarding approval for the PoW for gravel extraction.	Email	PoW Approval REG ID 54439 - PoW - Approval Letter	Approvals Gravel Extraction
02-Jul-15	13:32	Department of Parks and Wildlife & Department of Mines and Petroleum	Environmental Management Branch	Sandra Thomas (DPaW) Ian Mitchell (DMP)	Kristy Sell (MBS) Glenn Firth (Gold Road) Nicole Garbin (MBS)	Gruyere	Email from Kristy Sell to Sandra Thomas (cc'ed Ian Mitchell) outlining the current project status and a request to have a meeting regarding SREs found, future SRE surveys and the opportunity to discuss surveys to date.	Email	Gold Road Gruyere Project	Approvals Fauna survey
07-Jul-15	9:54	Department of Parks and Wildlife	Environmental Management Branch	Sandra Thomas (DPaW)	Kristy Sell (MBS)	Gruyere	Email from Sandra Thomas to Kristy Sell responding to the request to have a meeting and to discuss SREs and surveys.	Email	Gold Road Gruyere Project	Approvals Fauna survey
14-Jul-15	16:51	Traditional Owners	Yilka People	HM (Harvey Murray senior) / HJ (Harvey Murray junior) / Rowan Murray / Sebastien Murray / Hayley Westlake / Kassey Murray	Kate George (Rapallo)	Gruyere	Email from Kate George to MBS with a memo attached regarding types of fauna that are culturally significant to the Yilka people and their last names.	Email Memo	Cultural Significance Memo.pdf	Fauna survey Commuity Negotiations
21-Jul-15	16:00	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Sally Bowman (OEPA)	Glenn Firth (Gold Road)	Gruyere	Provide OEPA with an overview of the proposal to enable the OEPA to provide useful advice at the meeting. Include location, type of proposal, scale and duration of the proposal, potential key environmental factors, studies conducted and discussions with other agencies.	Email	Gold Road Gruyere Project	Approvals OEPA Referral
Mid-late Jul-15	All day	Traditional Owners	Yilka People			All	Cultural mapping fieldwork (male and female).	Fieldwork	N/A	Cultural Survey
6-Aug-15 / 7-Aug-15	2 days	Traditional Owners	Yilka People	Harvey Murray / Harvey Murray Junior / Gavin Murray Junior / Kassey Murray / Barron Bonney / Shaneane Weldon / Robyn Smythe	Ian Murray (Gold Road) Sharon Goddard (Gold Road) Glenn Firth (Gold Road)	All	Second negotiation meeting.	Meeting	N/A	Community Negotiations
13-Aug-15	17:00	Office of the Environmental Protection Authority, Department of Mines and Petroleum	Mining and Industrial Assessments Branch (North)	Sally Bowman (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road)	Gruyere	Pre-referral information on the Gruyere Project	Email	N/A	Approvals OEPA Referral

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
14-Aug-15	All day	Representative members of Yilka and Central Desert Native Title Services	Yilka People / CDNTS	Harvey Murray / Gavin Murray Jnr / Barron Bonney / Kassey Murray / Harvey Murray Junior / Shaneane Weldon / Robin Smythe / Melissa Watts / Giacomo Boranga / Malcolm O'Dell / Marian Hennessy	Ian Murray (Gold Road) Gordon Murray (Gold Road) Sharon Goddard (Gold Road) Shaun Richardson (Gold Road) Glenn Firth (Gold Road)	Cosmo-Newberry	Gruyere Project Briefing meeting. Gold Road provided an update on the development of the Gruyere Project including discussion on the PFS which covered the proposed footprint and indicative infrastructure. There was a general discussion on required consents and what specific initiatives and benefits may be of interest to the Yilka people from mining at Gruyere.	Meeting	N/A	Community Negotiations
27-Aug-15 / 28-Aug-15	All day	Traditional Owners	Yilka People	Yilka People community meeting	None	Gruyere	Yilka review and discussion on various expert reports regarding economics, environment and water for native title negotiations on the Gruyere Project. Meeting was attended by Yilka environmental and hydrological experts	Community Gathering	N/A	Community Negotiations
31-Aug-15	15:00	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA) Helen Lafuente (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sharon Goddard (Gold Road)	Gruyere	Pre-referral meeting held with the OEPA to provide a project briefing presentation and discussion regarding Part IV approvals.	Meeting	150813 GF EPA Pre-referral Meeting (Mine).pptx OEPA meeting outcomes	Approvals
01-Sep-15	10:30		Cultural Mapping	Malcolm O'Dell / Giacomo Boranga / Mladen Mverjl / Sean Calderwell	Sharon Goddard (Gold Road) Glenn Firth (Gold Road) Rebecca Shanahan	Gruyere	Meeting to discuss arrangement and agree outcomes from the Gruyere Cultural Mapping desktop and fieldwork surveys	Meeting	N/A	Cultural Survey
01-Sep-15	13:50	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Glenn Firth (Gold Road)	Gruyere	Email from Glenn Firth to Peter Tapsell, thanking the OEPA for their time and feedback and invited the OEPA for a day trip to Gruyere.	Email	Site Visit	Approvals Site Visit
02-Sep-15	12:26	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Glenn Firth (Gold Road)	Gruyere	Email from Peter Tapsell to Glenn Firth stating that the pre-referral meeting was very useful and clarified matters. Peter declined the offer of a site visit and stated that if the EPA decides to formally assess the proposal then may take up the offer of a site visit.	Email	Re: Site Visit	Approvals Site Visit
02-Sep-15	14:18	Department of Environment Regulation	Licensing	Danielle Eyre (DER)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sharon Goddard (Gold Road)	Gruyere	Email from Nicole Garbin to Danielle Eyre to introduce the Gruyere project and request a briefing meeting. This was a result of the OEPA meeting held on 31/08/15 where OEPA suggested that Gold Road make contact with DER at this stage of the project as OEPA and DER liaise closely on Referral documents.	Email	Gold Road Gruyere Project - DER briefing meeting	Approvals Works Approval
03-Sep-15			Native Title Negotiations	Yilka		Gruyere	Received Yilka/CNAC Proposal for the Gruyere Native Title Agreement.	Email	N/A	Approvals
03-Sep-15	15:28	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Glenn Firth (Gold Road)	Gruyere	Email from Glenn Firth to Peter Tapsell, suggesting that Gold Road submit the draft Referral form and supporting document to give OEPA time to look at it before a second meeting is arranged with the OEPA.	Email	Re: Site Visit	Approvals Site Visit
03-Sep-15	15:36	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Glenn Firth (Gold Road)	Gruyere	Email from Peter Tapsell to Glenn Firth confirming that submission of the draft Referral form and supporting document to the OEPA before a second meeting is appropriate.	Email	Re: Site Visit	Approvals Site Visit
08-Sep-15	10:16	Department of Environment Regulation	Licensing	Danielle Eyre (DER)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere	Phone call to Danielle Eyre to discuss email from 02/09/15 regarding organising a briefing meeting. Voice message left and followup email sent.	Phone call Email	RE: Gold Road Gruyere Project - DER briefing meeting	Approvals Works Approval

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
09-Sep-15			Native Title Negotiations	Yilka			Provided Yilka/CNAC with Gold Road's response to their Proposal for the Gruyere Native Title Agreement	Email	N/A	Approvals
11-Sep-15	13:15	Wildflower Society WA		Brian Moyle (Wildflower Society of WA)	Glenn Firth (Gold Road)	Gruyere	Email introducing WSWA to the project and an offer to provide more information if the project is of interest to them. They will be available in October.	Email	N/A	Approvals
11-Sep-15	13:20	Conservation Council WA (Wilderness Society at same address)		Nic Dunlop	Glenn Firth (Gold Road)	Gruyere	Email introducing CCWA to the project and an offer to provide more information if the project is of interest to them.	Email	N/A	Approvals
11-Sep-15	13:25	Great Victoria Desert Biodiversity Trust		Kathryn Sinclair (GVD)	Glenn Firth (Gold Road)	Gruyere	Email introducing GVDBT to the project and an offer to provide more information if the project is of interest to them.	Email	N/A	Approvals
15-Sep-15	10:21	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Nathan Tetlaw to Amy Evangelista thanking Amy for going through the new process and informing Amy he will get the company registered. Nathan submitted a paper version of the 26D application and the Letter of Authority from Gold Road.	Email	26D Licence Application for Gold Roads Yamarna Project	Approvals Water
15-Sep-15	11:00	Great Victoria Desert Biodiversity Trust		Kathryn Sinclair (GVD)	Glenn Firth (Gold Road)	Gruyere	Meeting to discuss in more detail the function of GVDBT, how it contributes to biodiversity conservation, and how the Gruyere project may become involved in the trust if Ministerial conditions dictate.	Email	N/A	Approvals GVD
16-Sep-15	8:37	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Amy Evangelista to Nathan Tetlaw asking Nathan to clarify where the proposed bores are located.	Email	RE: 26D Licence Application for Gold Roads Yamarna Project	Approvals Water
16-Sep-15	9:35	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Nathan Tetlaw to Amy Evangelista, providing proposed bore information.	Email	RE: 26D Licence Application for Gold Roads Yamarna Project	Approvals Water
21-Sep-15 / 22-Sep-15	2 days	Traditional Owners	Yilka People	Harvey Murray / Harvey Murray Junior / Gavin Murray Junior / Kassey Murray / Barron Bonney / Shaneane Weldon / Robyn Smythe.	Martin Pyle Sharon Goddard (Gold Road) Glenn Firth (Gold Road)	All	First formal native title negotiation meeting for the Gruyere Project. Prior to the meeting the parties had exchanged proposals for the Gruyere Project. The proposals covered all areas of interest including, Agreement Consents, Employment and Contracting, Communication and Consultation, Management Measures and Compensation and Financial Benefits.	Meeting		Community Negotiations
1-Oct-15	9:00	Central Desert Native Title Services	Yilka People	Giacomo Boranga / Malcolm O'Dell	Justin Osborne (Gold Road) Glenn Firth (Gold Road) Sharon Goddard (Gold Road)	All	Outcomes of the cultural mapping exercise by TO's and identification of *tjukurrpa* 'windows' that GOR can design infrastructure corridors within.	Meeting		Cultural heritage
07-Oct-15	10:23	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere	Email to Peter Tapsell to enquire about the submission of the EPA referral document and supporting form as a 'draft' (as requested by the EPA during the meeting of 31 August) and the timeframe for assessment.	Email	Gold Road Gruyere Project Referral	Approvals OEPA Referral
08-Oct-15	9:38	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere	Email from Peter Tapsell to say that he would like to see a draft of the EPA referral document first and then the 28 days assessment period would start from the formal submission to the EPA of the final document.	Email	Gold Road Gruyere Project Referral	Approvals OEPA Referral
9-Oct-15			Native Title Negotiations	Yilka / CNAC	Gold Road	Gruyere	Gold Road provided and Updated Proposal on matters the subject of the native title negotiations for Yilka/CNAC to consider.	Email	N/A	Community Negotiations
13-Oct-15	15:01	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Nathan Tetlaw to Amy Evangelista, asking about how the 26D licence application is tracking.	Email	RE: 26D Licence Application for Gold Roads Yamarna Project	Approvals Water

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
14-Oct-15	9:18	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Amy Evangelista to Nathan Tetlaw, advising that an officer has picked up the 26D licence application as of 13/10/15 and that Amy has let them know that Nathan plans on commencing drilling on 1/11/15.	Email	RE: 26D Licence Application for Gold Roads Yamarna Project	Approvals Water
15-Oct-15 / 16-Oct-15	2 days	Traditional Owners	Yilka People	Harvey Murray / Harvey Murray Junior / Gavin Murray Junior / Kassey Murray / Barron Bonney / Shaneane Weldon / Robyn Smythe.	Ian Murray (Gold Road) Justin Osborne (Gold Road) Sharon Goddard (Gold Road) Glenn Firth (Gold Road) Rebecca Shanahan / Tony Shaw / Geoff Gishubl / Phil Mirabella	Gruyere	Fourth negotiation meeting. Formal native title negotiation meeting. Meeting to discuss the further proposals by the Parties on matters pertaining to: Consents, Employment and Contracting; Management Measures; Communication and Consultation; Compensation and Financial Benefits. The Parties could not reach agreement on all matters and both Parties were agreed to provide further details on elements of their respective proposals	Meeting		Community Negotiations
22-Oct-15	15:23	Department of Water	Licensing Compliance	Amy Evangelista (DoW) Ellam Reception	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Nathan Tetlaw to Amy Evangelista, submitting an annual environmental monitoring report for the Yamarna Project for GWLs 176189 and 177087.	Email	Gold Road - Yamarna Project Annual Monitoring Report	Approvals Water
23-Oct-15	1 day	Traditional Owners	Yilka People	Yilka/CNAC	Ian Murray (Gold Road) Sharon Goddard (Gold Road) Glenn Firth (Gold Road) Wayne Foote	Tropicana	A tour of the Tropicana Gold Mine was undertaken with Yilka to provide a working example of an operating mine, noting differences in size and scale compared to Gruyere proposal.	Site Visit	N/A	Cultural Heritage Approvals
26-Oct-15	15:22	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere	Email from Kristy Sell to Peter Tapsell advising that the EPA referral is ready for submission as a draft and asking for an indicative timeframe in which the EPA will be able to review prior to formal submission (Two phone messages were left for Peter Tapsell on 26/10/15 at 15:15 and on 27/10/15 at 12:00).	Email Phone Call	Gold Road Gruyere Project Referral	Approvals OEPA Referral
27-Oct-15	13:54	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Nathan Tetlaw to Amy Evangelista asking if there is any news regarding the 26D licence application.	Email	RE: 26D Licence Application for Gold Roads Yamarna Project	Approvals Water
28-Oct-15	10:25	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere	Email from Peter Tapsell to Kristy Sell advising that the EPA will be able to review the draft referral within a week.	Email	Gold Road Gruyere Project Referral	Approvals OEPA Referral
28-Oct-15	17:12	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS) Glenn Firth (Gold Road) Sim Lau (Gold Road) Ian Mitchell (DMP)	Gruyere	Email from Nicole Garbin to Peter Tapsell, Helen Lafuente and Ian Mitchell, submitting a draft version of the EPA Referral Supporting Document and Form for EPA review (figures, appendices, fully compiled report available on dropbox link).	Email	Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral
28-Oct-15	13:40	Department of Water	Licensing	Andrew Naskos (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Andrew Naskos to Nathan Tetlaw, providing a copy of the 26D licence application and stating that the hard copy is in the mail.	Email	RE: 26D Licence Application for Gold Roads Yamarna Project	Approvals Water
28-Oct-15	17:49	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS) Glenn Firth (Gold Road) Sim Lau (Gold Road) Ian Mitchell (DMP)	Gruyere	Email from Nicole Garbin to Peter Tapsell , Helen Lafuente, Ian Mitchell, advising that the referral is for the Gruyere Project and potable borefield water supply and that that process water borefield will be subject to a separate referral submission upon completion of investigations.	Email	Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral
29-Oct-15	9:43	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS) Glenn Firth (Gold Road) Sim Lau (Gold Road)	Gruyere	Email from Peter Tapsell to Nicole Garbin, advising that Peter will provide feedback regarding the EPA referral by Wednesday 4th November 2015.	Email	Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
03-Nov-15	8:55	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Ben Miles (OEPA)	Nicole Garbin (MBS)	Gruyere	Email from Ben Miles to Nicole Garbin, requesting a link to be sent in order to access the EPA referral documents.	Email	RE: Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral
03-Nov-15	9:00	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Ben Miles (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS) Glenn Firth (Gold Road)	Gruyere	Email from Nicole Garbin to Ben Miles with link to access EPA referral documents.	Email	RE: Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral
04-Nov-15	12:21	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere	Email from Peter Tapsell with four review comments regarding the EPA referral.	Email	RE: Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral
04-Nov-15	12:44	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere	Email from Nicole Garbin to Peter Tapsell thanking Peter and stating the matters and review comments will be addressed.	Email	RE: Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral
04-Nov-15	15:00	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere	Phone call from Kristy Sell to Peter Tapsell re: EPA's feedback on their draft review of the EPA Referral.	Phone Call	RE: Gold Road Resources EPA Referral Submission - Draft	Approvals OEPA Referral
04-Nov-15	15:32	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere	Email from Peter Tapsell to Kristy Sell advising that a meeting has been arranged with Anthony Sutton for 6 November 2015 at 2pm at the OEPA offices.	Email	Meeting re Gruyere Gold Mine	Approvals OEPA Referral
04-Nov-15	16:24	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere	Email from Kristy Sell to Peter Tapsell confirming attending at the meeting to discuss EPA's feedback on the draft EPA referral.	Email	RE: Meeting re Gruyere Gold Mine	Approvals OEPA Referral
04-Nov-15		Traditional Owners	Native Title Negotiations	Yilka/CNAC	Sharon Goddard (Gold Road)		Gold Road provided an Updated Proposal on matters the subject of the native title negotiations for Yilka/CNAC to consider.	Email	N/A	Cultural Heritage Approvals
05-Nov-15	15:47	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA)	Nicole Garbin (MBS) Kristy Sell (MBS) Glenn Firth	Gruyere	Email from Nicole Garbin to Peter Tapsell confirming names of who will attend the meeting on 6 November 2015, this being Kristy Sell, Glenn Firth, Sim Lau, Don Scott and Nicole Garbin.	Email	RE: Meeting re Gruyere Gold Mine	Approvals OEPA Referral
06-Nov-15	14:00	Office of the Environmental Protection Authority	Assessment and Compliance Division	Peter Tapsell (OEPA) Anthony Sutton (OEPA)	Nicole Garbin (MBS) Kristy Sell (MBS) Glenn Firth (Gold Road) Sim Lau (Gold Road)	Gruyere	Meeting at OEPA offices to discuss the EPA feedback on the draft version of the EPA referral.	Meeting	EPA Referral Draft Version October 2015	Approvals OEPA Referral
16-Nov-15	16:00	Central Desert Native Title Services	Yilka People	Giacomo Boranga Malcolm O'Dell	Sharon Goddard (Gold Road) Ian Murray (Gold Road) Glenn Firth (Gold Road) Phil Mirebella (Gold Road)	Gruyere	Outcomes of the cultural mapping exercise by TO's and issues around the northern dune sensitive area.	Meeting	N/A	Cultural Heritage

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
19-Nov-15 / 20-Nov-15	2 days	Traditional Owners	Yilka People	Harvey Murray Harvey Murray Junior Gavin Murray Junior Kassey Murray Barron Bonney Shaneane Weldon Robyn Smythe	Ian Murray (Gold Road) Sharon Goddard (Gold Road) Glenn Firth (Gold Road) Rebecca Shanahan Geoff Gishubl Phil Mirabella Wayne Foote	Gruyere	Fifth formal native title negotiation meeting. Meeting to discuss the further proposals by the Parties on matters pertaining to: Consents, Employment and Contracting; Management Measures; Communication and Consultation; Compensation and Financial Benefits. The Parties could not reach agreement on all matters and both Parties were agreed to provide further details on elements of their respective proposals.	Meeting	N/A	Cultural Heritage Approvals
25-Nov-15	14:11	Department of Water	Licensing	Amy Evangelista (DoW)	Glenn Firth (Gold Road) Rob Braaten (Pennington Scott)	Gruyere	Meeting request from Amy Evangelista to Rob Braaten and Glenn Firth regarding meeting up to handover the H3 report to the DoW in Victoria Park, discuss licencing and provision of a small presentation in regards to the project.	Email	FW: Meeting to discuss Gold Road Resources	Approvals Water
02-Dec-15	13:03	Department of Water	Licensing	Amy Evangelista (DoW) Chris O'Boy (DoW)	Don Scott (Pennington Scott)	Gruyere	Email from Don Scott to Amy Evangelista (Cc Chris O'Boy) from DoW, thanking DoW for meeting. Don Scott submitted two 5C amendment applications to DoW for L38/244, L38/248 and provided an FTP link to the updated version of the H3 report (hard copy also provided).	Email	Gold Road Resources 5C amendment application	Approvals Water
02-Dec-15	13:20	Department of Water	Licensing	Amy Evangelista (DoW) Chris O'Boy (DoW)	Don Scott (Pennington Scott)	Gruyere	Email from Amy Evangelista to Don Scott (Cc Chris O'Boy) , thanking Don for the revised H3 report. Amy Evangelista advised that she had forwarded the applications to Ellam Reception for processing.	Email	RE: Gold Road Resources 5C amendment application	Approvals Water
04-Dec-15	13:50	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Nathan Tetlaw to Amy Evangelista, submitting an application for an additional 26D licence at Yamarna, which covered drilling slightly east of the current drilling and included a list of targets in the area. Nathan also included a letter of authority and a typical bore construction picture.	Email	TRIM: 26D Licence Application for Gold Road Resources Yamarna Project	Approvals Water
04-Dec-15	8:12	Department of Water	Licensing	Amy Evangelista (DoW)	Nathan Tetlaw (Pennington Scott)	Gruyere	Email from Amy Evangelista to Nathan Tetlaw confirming receipt of the 26D licence application and stating she has passed the application onto reception for processing.	Email	TRIM: 26D Licence Application for Gold Road Resources Yamarna Project	Approvals Water
12-Feb-16	11:56	Department of Environment Regulation	Licensing	Clarrie Green (DER)	Nicole Garbin (MBS)	Gruyere Project	Email from Nicole Garbin to Clarrie Green querying who to contact within DER to provide a briefing presentation about the Gruyere Project.	Email	Gruyere Gold Project	Approvals Works Approval
12-Feb-16	13:54	Department of Environment Regulation	Licensing	Clarrie Green (DER) Tim Gentle (DER)	Nicole Garbin (MBS)	Gruyere Project	Email from Clarrie Green to Nicole Garbin advising that Tim Gentle is the person to contact to discuss the Gruyere Project and that Tim will assign the Project to a DER officer and then a scoping meeting will be arranged after that.	Email	RE: Gruyere Gold Project	Approvals Works Approval
16-Feb-16	22:29	Office of the Environmental Protection Authority	Assessment and Compliance Division	Sally Bowman (OEPA)	Glenn Firth (MBS) Nicole Garbin (MBS) Kristy Sell (MBS)	Gruyere Project	Email from Kristy Sell to Sally Bowman regarding how Gold Road have continued baseline stygofauna studies for the borefields and Bennelongia are in the final stages of compiling results from sampling undertaken in late 2015 and early 2016. Kristy asked for a meeting with Sally and whoever in the OEPA has stygofauna technical expertise to discuss the referral and make sure it presents the information required for the OEPA to make a decision on the assessment level.	Email	Request for Gruyere Project Meeting	Approvals OEPA Referral Subterranean Fauna
17-Feb-16	12:03	Office of the Environmental Protection Authority	Assessment and Compliance Division Terrestrial Ecosystems Branch	Sally Bowman (OEPA) Chris Stanley (OEPA) Maree Heath (OEPA)	Glenn Firth (MBS) Kristy Sell (MBS)	Gruyere Project	Email from Sally Bowman to Kristy Sell regarding Gold Road's request for a meeting on stygofauna. Sally advised that Chris Stanley and their Terrestrial Ecosystems branch will liaise directly with Kristy regarding setting up a meeting. In order to help the OEPA provide useful advice, an evaluation on how the proponent has applied the relevant considerations of policy and guidance relating to stygofauna and the propenent's view on whether there has been consistency with that policy, needs to be provided to OEPA.	Email	FW: Request for Gruyere Project Meeting	Approvals OEPA Referral Subterranean Fauna

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
17-Feb-16	22:21	Office of the Environmental Protection Authority	Assessment and Compliance Division Terrestrial Ecosystems Branch	Sally Bowman (OEPA) Chris Stanley (OEPA) Maree Heath (OEPA)	Glenn Firth (MBS) Kristy Sell (MBS) Stuart Halse (Bennelongia)	Gruyere Project	Email from Kristy Sell to Sally Bowman regarding a meeting to discuss stygofauna. Kristy advised that Stuart Halse will put the information together regarding considerations of policy and how Bennelongia are mindful of EPA guidance statement requirements. Kristy advised that the main reason Gold Road is looking to meet with the OEPA is to get some guidance on what the EPA consider acceptable levels of drawdown for stygofauna habitat as it is a topical subject for some of the uranium projects undergoing assessment.	Email	RE: Request for Gruyere Project Meeting	Approvals OEPA Referral Subterranean Fauna
19-Feb-16	15:42	Department of Environment Regulation	Licensing	Clarrie Green (DER) Tim Gentle (DER)	Nicole Garbin (MBS) Kristy Sell (MBS) Glenn Firth (Gold Road)	Gruyere Project	Email from Nicole Garbin to Tim Gentle requesting to arrange a scoping meeting regarding the Gruyere Project to discuss works approvals and licencing.	Email	FW: Gruyere Gold Project	Approvals Works Approval
22-Feb-16	9:26	Office of the Environmental Protection Authority	Assessment and Compliance Division Terrestrial Ecosystems Branch	Sally Bowman (OEPA) Chris Stanley (OEPA) Maree Heath (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Stuart Halse (Bennelongia)	Gruyere Project	Email from Chris Stanley to Kristy Sell and Sally Bowman stating that Chris has spoken to the Terrestrial Ecosystems Branch and advised they have a number of competing priorities and are not free to meet till next week at the earliest. It was advised to provide the information up front to have a quick review and from that they can provide early guidance on potential impacts to stygofauna. This may also negate the need for a meeting.	Email	RE: Request for Gruyere Project Meeting	Approvals OEPA Referral Subterranean Fauna
02-Mar-16	19:17	Office of the Environmental Protection Authority	Assessment and Compliance	Sally Bowman (OEPA) Chris Stanley (OEPA) Maree Heath (OEPA) Registrar (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road) Nicole Garbin (MBS)	Gruyere Project	Email from Kristy Sell to Sally Bowman, Chris Stanley, Maree Heath and the registrar, submitting the EPA Referral form. Kristy advised that the referral will comprise 2 documents i.e. the form and supporting document and that given document sizes, the submission will be sent in parts in addition to shapefiles and a hard copy will be sent in the mail.	Email	Gruyere Project EPA Referral	Approvals OEPA Referral
02-Mar-16	21:48	Office of the Environmental Protection Authority	Assessment and Compliance	Sally Bowman (OEPA) Chris Stanley (OEPA) Maree Heath (OEPA) Registrar (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road) Nicole Garbin (MBS)	Gruyere Project	Email from Kristy Sell to Sally Bowman, Chris Stanley, Maree Heath and the registrar, submitting the EPA Referral supporting document Part 1 and Part 2. Kristy advised that the appendices will be sent separately.	Email	Gruyere Project EPA Referral Part 2	Approvals OEPA Referral
03-Mar-16	12:09	Office of the Environmental Protection Authority	Assessment and Compliance	Sally Bowman (OEPA) Chris Stanley (OEPA) Maree Heath (OEPA) Registrar (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road) Nicole Garbin (MBS)	Gruyere Project	Email from Nicole Garbin to Sally Bowman, Chris Stanley, Maree Heath and the registrar advising that Part 3 (the appendices) have been put onto dropbox due to their large size.	Email	RE: Gruyere Project EPA Referral Part 2	Approvals OEPA Referral
03-Mar-16	15:59	Office of the Environmental Protection Authority	Assessment and Compliance	Sally Bowman (OEPA) Chris Stanley (OEPA) Registrar (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	Email from Nicole Garbin to Sally Bowman, Chris Stanley and the registrar advising that the complete EPA referral submission i.e. Parts 1 to 3 as well as shapefiles and referral form have been put onto dropbox due to their large size and advising that a hard copy has been sent in the mail, express registered post. Nicole asked the EPA to provide receipt of the submission.	Email	Gruyere Project EPA Referral Submission	Approvals OEPA Referral
03-Mar-16	16:07	Office of the Environmental Protection Authority	Assessment and Compliance	Sally Bowman (OEPA) Chris Stanley (OEPA) Registrar (OEPA)	Nicole Garbin (MBS)	Gruyere Project	Email from Chris Stanley to Nicole Garbin to advise that the EPA has received the email submission of the EPA referral and that the referral will be processed through the EPA registrar email address.	Email	RE: Gruyere Project EPA Referral Submission	Approvals OEPA Referral
03-Mar-16	16:13	Office of the Environmental Protection Authority	Assessment and Compliance	Chris Stanley (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	Email from Nicole Garbin to Chris Stanley, thanking Chris for the receipt of EPA referral submission and advising Chris to contact Kristy Sell, Glenn Firth or Nicole Garbin if there are any queries.	Email	RE: Gruyere Project EPA Referral Submission	Approvals OEPA Referral
14-Mar-16	N/A	Department of Water	Swan Avon Region	Paul Gherghetta (DoW)	Don Scott (Pennington Scott)	Gruyere Project	Letter from DoW to Don Scott, stating that H3 hydrgeological studies indicate the required amount of water can be abstracted with acceptable impacts (re: applications dated 3 Dec 2015 to amend GWL177087(1) and 176189(1)), however the assessment of impacts on the environment is unable to be completed until further work completed and EPA approval received.	Letter	Additional Information Required for a Licence	Approvals Water

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
24-Mar-16	14:02	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	Email from Maree Heath to Glenn Firth with a request for further information regarding the EPA Referral submission.	Email	FW: The Gruyere Project	Approvals OEPA Referral
31-Mar-16	17:00	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA) Peter Tapsell (OEPA) Registrar (OEPA) Chris Stanley (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road) Nicole Garbin (MBS)	Gruyere Project	Email from Kristy Sell to Peter Tapsell (cc Registrar) with a formal response letter submission to the additional information that was requested by the OEPA on 24 March.	Email	Provision of Additional Information for the Gruyere Gold Project S38 Referral	Approvals OEPA Referral
31-Mar-16	18:59	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA) Peter Tapsell (OEPA) Registrar (OEPA) Chris Stanley (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road) Nicole Garbin (MBS)	Gruyere Project	Email from Nicole Garbin to Peter Tapsell (cc Registrar) with formal submission of the revised EPA Referral supporting document and GIS files.	Email	RE: Provision of Additional Information for the Gruyere Gold Project S38 Referral	Approvals OEPA Referral
01-Apr-16	10:46	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA) Peter Tapsell (OEPA) Registrar (OEPA) Chris Stanley (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road) Nicole Garbin (MBS)	Gruyere Project	Email from Maree Heath to Nicole Garbin confirming receipt of submission of the revised EPA referral supporting document and additional information letter and that a hard copy will be dropped off into the EPA reception office on 01/4/16.	Email	RE: Provision of Additional Information for the Gruyere Gold Project S38 Referral	Approvals OEPA Referral
01-Apr-16	11:58	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA) Peter Tapsell (OEPA) Registrar (OEPA) Chris Stanley (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road) Nicole Garbin (MBS)	Gruyere Project	Email from Nicole Garbin to Maree Heath thanking Maree for receipt of submission of the revised EPA referral supporting document and additional information letter and advising that a hard copy and A0 size stygofauna map will be dropped off at EPA reception on 01/4/16 (NB: document was dropped off at OEPA reception at 13:15).	Email	RE: Provision of Additional Information for the Gruyere Gold Project S38 Referral	Approvals OEPA Referral
05-Apr-16	13:30	Office of the Environmental Protection Authority	Assessment and Compliance	Chris Stanley (OEPA)	Kristy Sell (MBS)	Gruyere Project	Phone call from Kristy Sell to Chris Stanley to discuss how things are progressing with the EPA referral additional information submission. Chris advised that Maree Heath and Peter Tapsell were out of the office and that Chris is not involved in the Gruyere Project approvals anymore.	Phone Call	RE: EPA Call	Approvals OEPA Referral
06-Apr-16	16:00	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	Phone call from Kristy Sell to Maree Heath to discuss the EPA Referral additional information, the re-start of the 28 day assessment period from the time the information was re-submitted and that parts of the referral will be submitted to technical specialists and there is a potential for a stop the clock scenario while they deliver this advice.	Phone Call	RE: EPA Level of Assessment	Approvals OEPA Referral
06-Apr-16	16:52	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Kristy Sell (MBS) Sim Lau (Gold Road) Glenn Firth (Gold Road) Nicole Garbin (MBS) Don Scott (Pennington Scott)	Gruyere Project	Email from Kristy Sell to Maree Heath, providing a copy of the DoW correspondence relating to review of the H3 report and stating that Pennington Scott are working on providing evidence of the acceptance of environmental impacts of the proposed abstraction prior to any licence being issued and that Pennington Scott are working with DoW which is closely linked to the EPA processes.	Email	Gruyere Gold Project - DoW Advice	Approvals OEPA Referral Water
08-Apr-16	14:54	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA) Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere Project	Email from Maree Heath to Kristy Sell, advising that the EPA are looking at advertising the Gruyere Project for public comment on the EPA website and that some of the appendices contain disclaimers regarding the copying and distribution of these documents and that the EPA request permission to publicise these documents.	Email	Gruyere Gold Project	Approvals OEPA Referral
08-Apr-16	15:05	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA) Peter Tapsell (OEPA)	Kristy Sell (MBS) Glenn Firth (MBS) Nicole Garbin (MBS)	Gruyere Project	Email from Kristy Sell to Maree Heath, advising that Kristy has spoken to Glenn Firth and can confirm that there are no problems with the EPA publishing the EPA Referral on the EPA's website and gave permission to the EPA to publicise the documents.	Email	RE: Gruyere Gold Project	Approvals OEPA Referral
11-Apr-16	11:06	Department of Water	Swan Avon Region	Andrew Naskos (DoW)	Don Scott (Pennington Scott)	Gruyere Project	Email from Don Scott to Andrew Naskos to request a meeting to provide the DoW with a technical update on the additional investigations subsequent to the H3 report that has already been assessed.	Email	Request for technical presentation on Gruyere Gold Project to DoW	Approvals OEPA Referral Water

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
11-Apr-16	11:55	Department of Water	Swan Avon Region	Andrew Naskos (DoW)	Don Scott (Pennington Scott)	Gruyere Project	Email from Andrew Naskos to Don Scott thanking Don for sending the details through and suggesting a meeting time of 20 April 2016 at 10:30am to provide a presentation to the DoW.	Email	RE: Request for technical presentation on Gruyere Gold Project to DoW	Approvals OEPA Referral Water
12-Apr-16	9:49	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	Email from Maree Heath to Kristy Sell (Cc Nicole Garbin) to advise that the Gruyere Project has now been listed on the EPA website for public comment and the public comment period will end on 18 April 2016.	Email	Gruyere Gold Project	Approvals OEPA Referral
18-Apr-16	16:00	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	Email from Nicole Garbin to Maree Heath asking if there had been any public comments on the EPA referral advertisment period i.e. who were they and how many submissions were received.	Email	RE: Gruyere Gold Project	Approvals OEPA Referral
18-Apr-16	All day	Traditional Owners CDNTS	Yilka People	Robin Smythe Dudley Wongawol Lyle Wongawol Dempsey Chambers Terrence Westlake Sr Terrence Westlake Jr Mladen Marvel Malcolm O'Dell	Glenn Firth (Gold Road) Josh Foote (Gold Road)	Gruyere Project Northern Borefield Extension	Cultural heritage survey within the Aboriginal Reserve (proposed northern extension to the Yeo borefield). Visited the locations of the 8 proposed production bores.	Survey	CDNTS cultural heritage report on northern borefield extension area	Cultural Heritage Survey Senior Men Sensitive Areas
19-Apr-16	11:45	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	Email from Nicole Garbin to Peter Tapsell asking if he could answer the query above regarding public submissions whilst Maree was out of the office.	Email	RE: Gruyere Gold Project	Approvals OEPA Referral
19-Apr-16	13:31	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	Email from Peter Tapsell to Nicole Garbin, advising that there were no public comments received on the Gruyere Project and the EPA are now waiting for a response from the Department of Water before they can make a final decision on the referral.	Email	RE: Gruyere Gold Project	Approvals OEPA Referral
19-Apr-16	All day	Traditional Owners CDNTS	Yilka People	Robin Smythe Dudley Wongawol Lyle Wongawol Terrence Westlake Sr Mladen Marvel	Glenn Firth (Gold Road) Josh Foote (Gold Road)	Gruyere Project Northern Borefield Extension	Cultural heritage survey within the Aboriginal Reserve (proposed northern extension to the Yeo borefield). Visited the locations of the 11 proposed stygofauna monitoring bores.	Survey	CDNTS cultural heritage report on northern borefield extension area	Cultural Heritage Survey Senior men Sensitive areas
20-Apr-16	10:30	Department of Water	Swan Avon Region	Andrew Naskos (DoW)	Don Scott (Pennington Scott) Sim Lau (Gold Road) Kristy Sell (MBS)	Gruyere Project	A meeting to provide a technical updateto the DoW on the additional investigations subsequent to the H3 report that has already been assessed.	Meeting	Technical Presentation	Approvals OEPA Referral Water
20-Apr-16	All day	Traditional Owners CDNTS	Yilka People	Harvey Murray Sr Ronald Bonney Sebastian Murray Hayley Westlake Terrence Westlake Jr Gwenetta Westlake Marika Westlake Chelsea Westlake Mladen Marvel	Glenn Firth (Botanica)	Gruyere Project Yeo and Anne Beadell Borefield Areas	Cultural heritage survey within the Aboriginal Reserve (proposed locations of the 11 additional stygofauna monitoring bores) .	Survey	CDNTS cultural heritage report on locations of the 11 stygofauna monitoring bores	Cultural Heritage Survey Sensitive Areas
21-Apr-16	All day	Traditional Owners	Yilka People	Harvey Murray Sr Ronald Bonney Sebastian Murray Gavin Murray Junior	Glenn Firth (Gold Road) Jim Williams (Botanica) Aiden Williams (Botanica)	Gruyere Project Northern Borefield Extension	Fauna and flora surveys within the Aboriginal Reserve (proposed northern extension to the Yeo borefield).	Survey	CDNTS cultural heritage report on the proposed alignment of the pipeline connecting the additional 8 production bores	Cultural Heritage Survey Sensitive Areas
22-Apr-16	10:00	Department of Environment Regulation	Licensing Compliance	Tim Gentle (DER)	Nicole Garbin (MBS) James Cumming (MBS) Kristy Sell (MBS)	Gruyere Project	A meeting with Tim Gentle to understand the works approvals and licencing process and briefly introduce the project.	Meeting	Gruyere Project	Approvals OEPA Referral Water

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
27-Apr-16	13:05	Shire of Laverton	Technical Services	Russell Williams Steve Deckett	Glenn Firth (Gold Road)	Gruyere Project Airstrip Roads	Relocation of the public road around the existing pastoral lease airstrip and any extensions made to the airstrip.	Email	Gruyere Project	Airstrip Road Relocation
27-Apr-16	13:39	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	A phone call from Maree Heath to Kristy Sell explaining that the DoW have requested an extension until 9th May 2016 and that the OEPA period starts from the 9th May, meaning that an EPA decision on the referral of the project is due by 7 June 2016 (if not earlier).	Phone Call	Gruyere Project	Approvals OEPA Referral Water
10-May-16	10:00	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	Maree Heath advised Kristy Sell that the OEPA did receive the DoW response late last week ahead of the 9 May 2016 extension date and that Maree was meeting with project officers this afternoon. Maree also mentioned that there is potentially a meeting with the EPA chairman and Anthony Sutton tomorrow and that the OEPA were waiting on information from their internal zoologist regarding stygofauna.	Chance Meeting	EPA Referral Update	Approvals OEPA Referral Water
13-May-16	16:18	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere Project	A phone call from Peter Tapsell to Kristy Sell, advising the DoW response did not provide the certainty the EPA was looking for in terms of interaction between the two aquifers and how this relates to managing stygofauna risks. Discussion was held around the level of assessment and an OEPA meeting to discuss further was planned to be held on 25 May 2016.	Email	RE: EPA Referral Update	Approvals OEPA Referral
18-May-16	12:07	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere Project	Email from Kristy Sell to Peter Tapsell, confirming that Gold Road are keen to meet at 11am on Wednesday 25 May and that material on the ongoing hydrogeological and stygofauna collection program as well as the borefield management approach are being prepared.	Email	Gold Rd Meeting	Approvals OEPA Referral
20-May-16	15:03	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Kristy Sell (MBS) Sim Lau (Gold Road) Glenn Firth (Gold Road) Nicole Garbin (MBS) Don Scott (Pennington Scott) Stuart Halse (Bennelongia)	Gruyere Project	An email from Kristy Sell to Peter Tapsell, providing a letter (ahead of the meeting planned for Wednesday 25 May) with additional information on the ongoing hydrogeological and stygofauna studies and planned adaptive management approach to bore field operations.	Email Letter	Additional Information on Gold Road Gruyere Project	Approvals OEPA Referral
20-May-16	16:40	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere Project	A phone call from Peter Tapsell to Kristy Sell (and follow up email from Kristy Sell to the Gold Road team), discussing the additional information letter, water quality of the aquifers, pump testing, contingency options, drawdown and the meeting with the EPA scheduled for Wednesday 25 May.	Phone Call Email	RE: Additional Information on Gold Road Gruyere Project	Approvals OEPA Referral
20-May-16	16:46	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere Project	A phone call from Peter Tapsell to Kristy Sell (and follow up email from Kristy Sell to the Gold Road team), stating there is an opening at 2pm on Friday 27 May 2016, for Gold Road to have a meeting with Tom Hatton (Chair of the EPA).	Phone Call Email	Potential Change to EPA meeting date	Approvals OEPA Referral
27-May-16	11:30	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA) Tom Hatton (OEPA) Species and Communities Branch (OEPA)	Kristy Sell (MBS) Sim Lau (Gold Road) Glenn Firth (Gold Road) Ian Murray (Gold Road) Don Scott (Pennington Scott) Stuart Halse (Bennelongia)	Gruyere Project	A meeting held at the OEPA offices to discuss the level of assessment and hydrogeological/stygofauna aspects of the referral.	Meeting	OEPA Meeting	Approvals OEPA Referral

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
27-May-16	16:06	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA) Anthony Sutton (OEPA)	Kristy Sell (MBS)	Gruyere Project	An email from Peter Tapsell to Kristy Sell thanking Kristy and Gold Road representatives for attending the meeting. Peter stated that Gold Road will provide the OEPA with further information that will clarify the adaptive management approach that Gold Road will take to ensure that stygofauna habitat will be maintained, the actions that will be taken and the further work to be done.	Email	Todays Meeting with the EPA Chairman	Approvals OEPA Referral
30-May-16	16:42	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	An email from Maree Heath to Kristy Sell with attachment, stating that one public comment regarding fauna surveys was received by the OEPA in response to the EPA Referral.	Email	FW: Gruyere Gold	Approvals OEPA Referral
01-Jun-16	14:26	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS) Sim Lau (Gold Road) Glenn Firth (Gold Road) Ian Murray (Gold Road) Don Scott (Pennington Scott) Stuart Halse (Bennelongia)	Gruyere Project	An email with attachment (160601 IM EPA Gruyere EPA Ref Letter) sent to the EPA regarding a response to Peter's email of 27 May 2016. This email was followed up with a phone call from Peter to Kristy advising that assessment will likely be an API, however an official letter will be provided after it has been checked by EPA lawyers.	Email Phone Call	Gruyere Gold Project Additional Information	Approvals OEPA Referral
09-Jun-16	9:00	Office of the Environmental Protection Authority	Assessment and Compliance Infrastructure Branch	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere Project	A phone call from Peter Tapsell to Kristy Sell explaining that the drafting of the EPA referral notice of assessment is almost complete and that this will go to the lawyers soon and then it needs to go to the EPA for final approval and issue. Peter estimated that Gold Rd will get the notification around Monday 20 June 2016.	Phone Call	RE: Gas Pipeline Referral Update	Approvals OEPA Referral
13-Jun-16	15:09	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	An email from Maree Heath to Kristy Sell with attached figure of heritages sites, advising that heritage sites have been idenitifed within the mining lease.	Email	Gruyere Gold - Heritage	Approvals OEPA Referral
13-Jun-16	15:53	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	An email from Kristy Sell to Maree Heath to advise that MBS did an updated database search for DAA and Tengraph for the recently granted mining lease M38/1267 and that this returned no results for heritage sites within the mining lease.	Email	FW: Gold Road Heritage	Approvals OEPA Referral
13-Jun-16	15:59	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	An email from Kristy Sell to Maree Heath to advise that the EPA have got their coordinates/projection wrong because there is obvious mining infrastructure in their figure and that Kristy will get a heritage search done of the development envelopes.	Email	RE: Gruyere Gold - Heritage	Approvals OEPA Referral
14-Jun-16	16:50	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA)	Kristy Sell (MBS)	Gruyere Project	Kristy received a phone call from Peter Tapsell to say that the EPA went back to the GIS group and realised they had the wrong projection for the EPA's heritage sites figure and that the Gruyere layout had been accidentally overlaid on top of the Mt Magnet area.	Phone Call	RE: Aboriginal Heritage Search	Approvals OEPA Referral
15-Jun-16	12:16	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS) Sim Lau (Gold Road) Glenn Firth (Gold Road)	Gruyere Project	A phone call from Maree Heath to Nicole Garbin to confirm that a level of assessment letter is due on 20 June 2016 and the decision will be advertised as well. Kathryn advised there will be 4 key environmental factors but the EPA will only want information on one of those factors.	Phone Call	Phone call from Maree at EPA re: LOA	Approvals OEPA Referral
21-Jun-16	12:41	Department of Mines and Petroleum	Operations, Environment	Ian Mitchell (DMP)	Glenn Firth (Gold Road) Nicole Garbin (MBS)	Gruyere Project	An email from Glenn Firth to Ian Mitchell advising of the API-A level of assessment for the Gruyere Project. Glenn asked if Ian could advise about the comments that were sent back to the EPA from the DMP. Glenn asked Ian if DMP would consider assessing an MP/MCP in parallel with the tenement granting process.	Email	Update and Advice	Approvals OEPA Referral

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
21-Jun-16	14:30	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath to ask when an API scoping guideline will be issued to Gold Road now that the level of assessment has been received.	Email	API Scoping Guideline	Approvals OEPA Referral
21-Jun-16	14:37	Department of Mines and Petroleum	Operations, Environment	Ian Mitchell (DMP) Richard Trent (DMP)	Glenn Firth (Gold Road) Nicole Garbin (MBS)	Gruyere Project	An email from Ian Mitchell to Glenn Firth advising that he does not know what comments were sent back to the EPA and is not at liberty to say and that DMP are loath to assess an approval document whilst the tenement granting process is still happening.	Email	RE: Update and advice	Approvals OEPA Referral
21-Jun-16	15:13	Office of the Environmental Protection Authority	Assessment and Compliance	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email and phone call from Maree Heath to Nicole Garbin to inform that with the API (A) level of assessment (LOA) there is the option of an environmental scoping guideline being prepared and in the case of Gruyere Gold Project, the LOA did not include this as a process step. Maree informed that a scoping guideline will not be provided, however, as an outcome of the meeting on 27 May 2016, the EPA are waiting for further information regarding stygofauna.	Email Phone Call	API Scoping Guideline	Approvals OEPA Referral
26-Jun-16	13:14	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA) Maree Heath (OEPA)	Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	Email from Kristy Sell to Peter Tapsell to explain that Gold Road would like to meet and discuss an application for minor and preliminary works to allow activity to occur whilst the API process is ongoing and that Gold Road are close to having an application together. Kristy queried whether all preliminary factors need to be addressed in the API document and if the EPA are open to looking at a draft of the API document and management plan when available.	Email	Gruyere Project Queries	Approvals OEPA Referral Early Works
26-Jun-16	12:58	Department of Environment Regulation	Licensing Compliance	Tim Gentle (DER)	Kristy Sell (MBS)	Gruyere Project	An email from Kristy Sell to Tim Gentle, stating that Gold Road will be ready to put two WA/Licence applications in to DER around late July and that the EPA has assigned an API level of assessment. Kristy requested to meet with the DER and the assigned Project Officer for these applications.	Email	Meeting about Gruyere Works Approval/Licence Applications	Approvals Works Approval Early Works
29-Jun-16	15:52	Office of the Environmental Protection Authority	Assessment and Compliance	Peter Tapsell (OEPA)	Kristy Sell (MBS)	Gruyere Project	A phone call to Peter Tapsell and follow up email to Gold Road from Kristy Sell, stating that the EPA are available at 2pm on 5 July 2016 to discuss the early works. Kristy stated that the EPA only want stygofauna information in the API and nothing on the other preliminary factors and that the EPA referral document was comprehensive enough to allow assessment of those factors. The EPA are able to look at an advanced draft towards the end of July when we have the habitat info included to make sure we are on the right track.	Email Phone Call	EPA Meeting Tuesday 5 July 2pm	Approvals OEPA Referral Early Works
06-Jul-16	9:42	Department of Environment Regulation	Licensing Compliance	Tim Gentle (DER)	Kristy Sell (MBS)	Gruyere Project	An email from Kristy Sell to Tim Gentle, stating that Gold Road would like to come and discuss the Works Approval and Licence applications with DER and for the minor and major works and that a meeting is booked for 22 July 2016.	Email Phone Call	Gruyere Gold Meeting	Approvals Works Approval Early Works
07-Jul-16	14:55	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email and phone call from Maree Heath to Nicole Garbin to ask for more information regarding the water usage for the project and how there are inconsitencies between the original referral document and additional information received. Maree requested a water demand graph for the EPA decision report. Nicole Garbin replied at 15:02 and stated the information will be provided.	Email Phone Call	Gruyere Gold Project	Approvals OEPA Referral
07-Jul-16	16:10	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin to ask for the details of the proposed camp in relation to the development envelope areas that were stated in the referral document.	Email	Gruyere Gold Project	Approvals OEPA Referral

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
07-Jul-16	18:06	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath stating that the airstrip falls partially outside of the mine site and access corridor envelopes and asked Maree how this can be addressed and managed.	Email	Gruyere Gold Project	Approvals OEPA Referral
08-Jul-16	9:07	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin proposing to meet on Friday 15/07/16 to discuss the EPA Referral development envelope change and advising that a section 43a application to the Chairman is necessary.	Email	Gruyere Gold Project	Approvals OEPA Referral
08-Jul-16	12:29	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath to advise that Gold Rd and MBS are available to meet with the EPA on Friday 15/07/16. Nicole asked for more information about the Section 43A and if it is a lengthy process.	Email	Gruyere Gold Project	Approvals OEPA Referral
08-Jul-16	13:18	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin to advise of a meeting time of 2pm on 15 July 2016. Maree explained the S43A process and how it involves writing to the Chairman of the EPA and the Chairman will then consider the request. Nicole thanked Maree for the information and confirmed the meeting time.	Email	Gruyere Gold Project	Approvals OEPA Referral
14-Jul-16	18:12	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath replying to Maree's query regarding water balance, source and water availability information.	Email	RE: Gruyere Gold Project	Approvals OEPA Referral
15-Jul-16	14:00	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road)	Gruyere Project	Meeting with the EPA to discuss EPA referral, development envelopes, S43a letter, flora and fauna, EPA consent minor works letter and water balance.	Meeting	Gruyere Gold Project	Approvals OEPA Referral
19-Jul-16	9:15	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath replying for a second time to Maree's query regarding Gruyere water usage and water availability information as discussed in the meeting on 15/07/16.	Email	RE: Gruyere Gold Project	Approvals OEPA Referral
19-Jul-16	14:03	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath with GIS files of all flora and fauna surveys to date.	Email	Gruyere Gold Project - Flora & Fauna GIS Files	Approvals OEPA Referral
19-Jul-16	15:05	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin thanking Nicole for the flora/fauna data and stating that more GIS files will be required if Gold Road decide to submit a section 43a request and condense the development envelopes.	Email	RE: Gruyere Gold Project - Flora & Fauna GIS Files	Approvals OEPA Referral
20-Jul-16	10:37	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin thanking Nicole for attending the meeting on Friday 15/07/16 and for the additional water balance information. Maree queried the volume of water to be taken from the Anne Beadell borefield exceeds the previously defined resource of 0.2GL/a and asked if this was correct and also asked about stygofauna sampling.	Email	FW: Gruyere Gold Project	Approvals OEPA Referral
20-Jul-16	18:19	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Nicole Garbin to Maree Heath and Peter Tapsell, submitting the Consent Letter to the EPA for minor or preliminary works whilst the Gruyere Gold Project is under formal assessment.	Email	Gruyere Gold Project - Minor or Preliminary Works Consent Letter Submission	Approvals Minor Works

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
21-Jul-16	8:08	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin confirming receipt of submission of the Consent Letter for minor or preliminary works.	Email	RE: Gruyere Gold Project - Minor or Preliminary Works Consent Letter Submission	Approvals Minor Works
21-Jul-16	14:31	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Maree Heath to Nicole Garbin stating that the EPA have just been through a legal and governance review and are requesting that the Minor Works Letter is re-submitted by the proponent and addressed to Dr Tom Hatton, Chairman EPA.	Email	RE: Gruyere Gold Project - Minor or Preliminary Works Consent Letter Submission	Approvals Minor Works
21-Jul-16	15:41	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Nicole Garbin to Maree Heath stating that the Minor Works Letter will be re-addressed and will be re-submitted by Gold Road.	Email	RE: Gruyere Gold Project - Minor or Preliminary Works Consent Letter Submission	Approvals Minor Works
21/07/2016	17:56	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Glenn Firth to EPA registrar, Maree Heath and Peter Tapsell submitting the Consent Letter to the EPA for minor or preliminary works for a second time (on a Gold Road template and addressed to Tom Hatton - Chairman of the EPA).	Email	Attn: Tom Hatton, Chairman EPA	Approvals Minor Works
22-Jul-16	13:54	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath responding the Maree's water balance query for the third time and advising of a Pennington Scott water balance error.	Email	RE: Gruyere Gold Project	Approvals OEPA Referral
25-Jul-16	10:28	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin requesting GIS files and checklist for the minor works application and providing a link to the EPA bulletin #16.	Email Phone Call	FW: Attn: Tom Hatton, Chairman EPA	Approvals Minor Works
25-Jul-16	13:30	Department of Environment Regulation	Licensing Compliance	Tim Gentle (DER)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Kristy Sell to Tim Gentle, thanking Tim for the meeting on 22/07/16 and addressing the 2 applications that Gold Road will be making and asking if the second application is able to be processed in parallel with the Part IV approvals.	Email	RE: Gruyere Gold Meeting	Approvals Minor Works Licensing Works Approval
25-Jul-16	18:07	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath with GIS files, a checklist and stakeholder consultation regarding the application for minor or preliminary works.	Email	RE: Attn: Tom Hatton, Chairman EPA	Approvals Minor Works
26-Jul-16	14:53	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Maree Heath to Glenn Firth, asking Glenn to confirm the disturbance hectares for the minor works application.	Email	RE: Attn: Tom Hatton, Chairman EPA	Approvals Minor Works
27-Jul-16	8:42	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Glenn Firth to Maree Heath to confirm that the disturbance hectares in the table that Maree provided are the same as the hectares that were provided to the EPA in the minor works consent letter and GIS files and that the figures are accurate.	Email	RE: Attn: Tom Hatton, Chairman EPA	Approvals Minor Works
29-Jul-16	13:17	Department of Mines and Petroleum	Operations, Environment	Ian Mitchell (DMP)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Glenn Firth to Ian Mitchell updating Ian on the approvals strategy and informing Ian regarding the preliminary or minor works mining proposal application. Glenn asked who the assessing officer will be for the Gold Road approvals submissions.	Email	Update	Approvals Minor Works Mining Proposal

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
29-Jul-16	14:24	Department of Mines and Petroleum	Operations, Environment	Ian Mitchell (DMP)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Ian Mitchell to Glenn Firth thanking Glenn for the update. Ian explained that officers can't be issued at this stage and that he will make officers aware of the impending approvals and recommeded a catch up meeting once the application is submitted.	Email	RE: Update	Approvals Minor Works Mining Proposal
15-Aug-16	11:16	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Maree Heath to Kristy Sell explaining the EPA are considering the Minor or Preliminary Works application from Gruyere and stated that the applied for works do not fall within the development envelope under assessment as per the spatial data files.	Email	Gruyere Gold Minor or Preliminary Works	Approvals Minor Works
15-Aug-16	18:09	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath, stating that the minor or preliminary works falls within the 'access corridor' envelope and summarising the remainder of the approval documentation.	Email	RE: Gruyere Gold Minor or Preliminary Works	Approvals Minor Works S43a Letter
16-Aug-16	9:14	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin asking Nicole to give her a call regarding the Minor or Preliminary Works application. Nicole followed up with a phone conversation.	Email Phone Call	RE: Gruyere Gold Minor or Preliminary Works	Approvals Minor Works
16-Aug-16	12:15	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin, explaining that Maree has spoken to her GIS team and that they do not have any data that includes a buffer around the Access Road. Maree asked Nicole to follow this up with Nicole's GIS people and let her know the outcome.	Email	RE: Figure for Discussion	Approvals Minor Works
16-Aug-16	12:44	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath explaining that Figure 1 of the minor works application has been revised so that it shows the development envelopes and that the minor works falls within the 'access corridor' development envelope and that these envelopes are the same as those that were submitted with the S38 referral. Nicole provided 2 lots of GIS files and suggested that the EPA GIS team overlay the Stage 1 works GIS files over the development envelope GIS files.	Email	RE: Figure for Discussion	Approvals Minor Works
19-Aug-16	12:31	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath asking if the information supplied on the 16/08/16 made sense and if Maree needs any further information for the minor works application. Nicole advised that Gold Rd will be submitted a S43a letter for the change in development envelopes.	Email	RE: Figure for Discussion	Approvals Minor Works S43a Letter
19-Aug-16	15:25	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin stating that the application for the minor or preliminary works has been passed on from Maree to the relevant people prior to the Chairman's consideration and thanked for the help in regards to the development envelope issue. Maree understood that Gold Road will submit a S43a and update to key characteristics table soon.	Email	RE: Figure for Discussion	Approvals Minor Works S43a Letter
19-Aug-16	15:51	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath thanking Maree and confirming that Gold Road will be submitting a S43a Letter and an update to the key characteristics table early next week.	Email	RE: Figure for Discussion	Approvals Minor Works S43a Letter
22-Aug-16	15:23	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA) Registrar (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Nicole Garbin to Maree Heath submitting a letter for 'Amendment to EPA Referral, S43a Development Envelope Change'. GIS files were also provided.	Email	Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals Minor Works S43a Letter

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
22-Aug-16	15:36	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Maree Heath to Nicole Garbin stating that the S43a letter needs to be re-submitted on a Gold Road letterhead. Nicole replied and asked if it should be submitted to Tom Hatton and Maree advised it should be submitted to the Registrar.	Email	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals Minor Works S43a Letter
22-Aug-16	16:27	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA) Tom Hatton (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Glenn Firth to the EPA registrar and Tom Hatton, re-submitting the letter for 'Amendment to EPA Referral, S43a Development Envelope Change' on a Gold Road letterhead.	Email	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals Minor Works S43a Letter
24-Aug-16	10:17	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road)	Gruyere Project	An email from Maree Heath to Nicole Garbin, referring to the S43a amendment letter and stating that the changes to the development envelope have not been supported by the appropriate surveys and that the EPA are unable to assess the significance of the environmental impacts from the change request.	Email	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals Minor Works S43a Letter
24-Aug-16	15:04	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Ian Murray (Gold Road) Kristy Sell (MBS)	Gruyere Project	An email from Maree Heath to Ian Murray and Kristy Sell, advising that the minor or preliminary works consent letter has been approved. Maree provided a letter from Tom Hatton dated 24 August 2016.	Email	FW: Gruyere Gold - proposed minor or preliminary works application	Approvals Minor Works
24-Aug-16	15:20	Department of Mines and Petroleum Department of Environment Regulation	Environmental Management Branch	Graham Cobby (DMP) Ian Mitchell (DMP) Tim Gentle (DER)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Kristy Sell to Tim Gentle, Graham Cobby and Ian Mitchell advising that the EPA has authorised the subsequent application to be submitted to DMP and DER for minor or preliminary works and that the applications will be lodged shortly.	Email	FW: Gruyere Gold - proposed minor or preliminary works application	Approvals Minor Works
24-Aug-16	15:32	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS) Glenn Firth (Gold Road) Kristy Sell (MBS) Sim Lau (Gold Road)	Gruyere Project	An email from Nicole Garbin to Maree Heath, stating the that overall size of the development envelopes has been reduced and therefore the potential environmental impact has been reduced and that all surveys to date support the revised changes to the development envelopes. Nicole provided a dropbox link of all relevant surveys and GIS files.	Email	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals Minor Works S43a Letter
25-Aug-16	11:15	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath, asking if MBS are available to meet on Monday 29/08/16 at 3pm for an hr to discuss survey data over the revised development envelopes and the proposed changes.	Email	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals S43a Letter
26-Aug-16	10:24	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Nicole Garbin (MBS) Jonathon Barker (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath, advising that MBS will attend the meeting on Monday 29/08/16 at 3pm to discuss the revised development envelopes and surveys and will bring figures for the meeting.	Email	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals S43a Letter
26-Aug-16	13:23	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin,confirming the meeting for 29/08/16 and stating that the EPA need to see what environmental impacts to the proposed changes to the development envelope area are and what investigations have been done.	Email	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals S43a Letter
29-Aug-16	15:00	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	A meeting between MBS and the EPA to discuss the revised development envelope changes.	Meeting	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals S43a Letter

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
29-Aug-16	15:32	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA) Claire Hawke (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin, requesting that GIS data for flora and fauna survey work be sent to Claire Hawke for the revised development envelopes.	Email	GIS data Gruyere 43a request	Approvals S43a Letter
29-Aug-16	16:55	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA) Claire Hawke (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Claire Hawke providing GIS files and a figure for flora and fauna surveys over the whole of the Gruyere Gold Project.	Email	RE: GIS data Gruyere 43a request	Approvals S43a Letter
30-Aug-16	9:27	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA) Claire Hawke (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Claire Hawke to Nicole Garbin stating that the GIS data has been received and that Claire will work on the files.	Email	RE: GIS data Gruyere 43a request	Approvals S43a Letter
30-Aug-16	17:15	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath and Peter Tapsell, with a summary of outcomes from the meeting held on 29/08/16 and asking if the EPA could reiterate the question they had regarding GDEs.	Email	Gold Road Gruyere Meeting Outcomes 29/08/16	Approvals S43a Letter
31-Aug-16	11:20	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin, stating that the development envelopes need to follow EAG1 and asking about GDEs and land disturbance.	Email	FW: Gold Road Gruyere Meeting Outcomes 29/08/17	Approvals S43a Letter
16-Sep-16	11:23	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Nicole Garbin (MBS)	Gruyere Project	An email from Maree to Nicole Garbin, stating that the EPA will need final information regarding the defined development envelope including the S43a application and the referred proposal survey work no later than close of business 23 September 2016.	Email	Gruyere Gold	Approvals S43a Letter
16-Sep-16	11:56	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath, stating that the delay is due to waiting on new survey data and that Gold Road will be able to submit the revised S43a application by 23 September 2016. Nicole asked how quickly the application could be assessed considering the API needs to be submitted before end of September 2016.	Email	RE: Gruyere Gold	Approvals S43a Letter
16-Sep-16	12:00	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin stating that the EPA would like the additional stygofauna information by 23 September 2016.	Email	RE: Gruyere Gold	Approvals S43a Letter
16-Sep-16	12:03	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Glenn Firth (Gold Road) Nicole Garbin (MBS)	Gruyere Project	An email from Glenn Firth to Maree Heath to state that the in fill flora and fauna surveys of the modified development envelope were completed and mapped and that GIS data will be submitted with the revised S43 letter.	Email	RE: Gruyere Gold	Approvals S43a Letter
16-Sep-16	14:35	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin stating that the assessment process depends on the information provided and the significance of the impacts and that Maree cannot comment on the timeframe until the final information is received.	Email	RE: Gruyere Gold	Approvals S43a Letter
20-Sep-16	10:03	Department of Environment Regulation	Licensing Compliance	Tim Gentle (DER)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Tim Gentle, asking for an application identification number (AIN) in order to lodge the Minor Works Approval.	Email	RE: Gruyere Gold - proposed minor or preliminary works application	Approvals Works Approval Minor Works

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
21-Sep-16	14:26	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Glenn Firth to Maree Heath with the final stygofauna report attached and asking about arranging a meeting to discuss stygofauna. Glenn notified Maree that the S43 will be finalised soon.	Email	Final Stygo Report	Approvals S43a Letter API
22-Sep-16	10:18	Department of Environment Regulation	Licensing Compliance	Loretta Shillinglaw (DER)	Glenn Firth (Gold Road) Nicole Garbin (MBS)	Gruyere Project	An email from Loretta Shillinglaw (DER Admin Officer) to Nicole Garbin to confirm that the application for the Minor Works - Works Approval was received.	Email	RE: Gold Road Gruyere Works Approval WWTP Submission - Part 1	Approvals Works Approval Minor Works
22-Sep-16	10:36	Department of Environment Regulation	Licensing Compliance	Loretta Shillinglaw (DER)	Glenn Firth (Gold Road) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Loretta Shillinglaw, thanking Loretta for confirmation of receival of the Minor Works - Works Approval.	Email	RE: Gold Road Gruyere Works Approval WWTP Submission - Part 1	Approvals Works Approval Minor Works
22-Sep-16	17:06	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Glenn Firth to Maree Heath submitting the final revised S43a letter to the EPA. Attachments included a letter, development envelope GIS files and flora and veg survey GIS files for the entire development envelope.	Email	Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals S43a Letter
22-Sep-16	17:42	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath, submitting a (first) revised key characteristics table to the EPA.	Email	Gruyere Gold - Update to Key Characteristics Table	Approvals S43a Letter EPA Referral
23-Sep-16	14:50	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath, submitting information regarding potential GDEs and answering the EPA's query regarding further disturbance.	Email	Gruyere Gold GDEs Query	Approvals S43a Letter EPA Referral
23-Sep-16	16:04	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Glenn Firth, advising that the EPA are unable to finalise the S43 application as the development envelope proposed does not comply with EAG 1.	Email Phone Call	RE: Gold Road Gruyere Gold Project S43a Amendment Letter	Approvals S43a Letter EPA Referral
23-Sep-16	16:30	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Kristy Sell to Maree Heath asking if a reduction of 2,000ha for the mine site development envelope will be suitable for the EPA to assess and for Gold Road to resubmit the S43a letter.	Email Phone Call	FW: Development Envelope Change	Approvals S43a Letter EPA Referral
27-Sep-16	8:42	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Kristy Sell advising that the revised mine site development envelope is suitable for assessment purposes.	Email Phone Call	RE: Development Envelope Change	Approvals S43a Letter EPA Referral
27-Sep-16	14:42	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA) Tom Hatton (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Glenn Firth to Tom Hatton and the EPA Registrar, submitting the final revised S43a letter to the EPA with development envelope and vegetation community GIS files attached.	Email	Revised S43a Submission	Approvals S43a Letter EPA Referral
27-Sep-16	15:01	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath with a (second) revised key characteristics table. Email received from Maree at 15:03, thanking Nicole for the updated table.	Email	RE: Gruyere Gold - Update to Key Characteristics Table	Approvals S43a Letter EPA Referral
28-Sep-16	10:29	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS) Don Scott (Pennington Scott) Rob Bratten (Pennington Scott)	Gruyere Project	An email from Kristy Sell to Maree Heath, with stygofauna habitat and impact assessment information including two figures of calcrete habitat.	Email	Stygofauna Habitat and Impact Assessment Information	Approvals Stygofauna API

Date	Time	Govt Department/ Stakeholder	Section	Stakeholder Name(s)	Gold Road Member Name(s)	Project Area	Discussion/Outcomes	Consultation Type	Document Reference	Key Words
28-Sep-16	10:51	Department of Environment Regulation	Licensing Compliance	Tim Gentle (DER) Ian Mitchel (DMP)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Kristy Sell to Tim Gentle, stating that Gold Road are close to finalising the submission for the major Works Approval and verified that the document will be submitted via the info@der.wa.gov.au address.	Email	Gold Rd Works Approval Submission	Approvals Works Approval
28-Sep-16	11:10	Department of Mines and Petroleum	Safety Resources Branch	Ian Mitchell (DMP) Graham Cobby (DMP)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Kristy Sell to Ian Mitchell and Graham Cobby, stating that tenure for L38/254 and L38/255 has been granted and providing an update as to where approvals are up to and the plan for submission.	Email	Gold Road Gruyere Applications Update	Approvals Mining Proposal Minor Works
28-Sep-16	14:42	Department of Mines and Petroleum	Safety Resources Branch	Clay Witchen (DMP) Christina Folley (DMP)	Nicole Garbin (MBS) David O'Brien (MBS) Glenn Firth (Gold Road)	Gruyere Project	An email from David O'Brien to Clay Witchen and Christina Folley, confirming that the PMP for the Minor or Preliminary Works has been submitted.	Email	PMP-243-217609 Gold Road Gruyere Project Stage 1 Preliminary Works	Approvals PMP Safety Minor Works
28-Sep-16	15:18	Department of Mines and Petroleum	Safety Resources Branch	Ian Mitchell (DMP) Graham Cobby (DMP)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Nicole Garbin to Ian Mitchell and Graham Cobby, stating that the Project Management Plan and Mining Proposal for Stage 1 was submitted through SRS and EARS respectively.	Email	RE: Gold Road Gruyere Applications Update	Approvals Mining Proposal Minor Works
29-Sep-16	11:00	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA) Claire Hawke (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS) Jonathon Barker (MBS) Rob Bratten (Pennington Scott)	Gruyere Project	Meeting with EPA to discuss stygofauna, API document, 2m drawdown, S43a amendment and addendum.	Meeting	N/A	Approvals S43a Letter EPA Referral API Stygofauna
29-Sep-16	12:19	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS) Jonathon Barker (MBS)	Gruyere Project	An email from Nicole Garbin to Maree Heath, submitting a (third) revised key characteristics table.	Email	RE: Gruyere Gold - Update to Key Characteristics Table	Approvals S43a Letter EPA Referral
29-Sep-16	17:45	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Glenn Firth to Maree Heath and Peter Tapsell, submitting the S43a addendum letter.	Email	Gruyere S43a Addendum Letter	Approvals S43a Letter EPA Referral
30-Sep-16	8:20	Office of the Environmental Protection Authority	Mining and Industrial Assessments Branch (North)	Maree Heath (OEPA) Peter Tapsell (OEPA)	Glenn Firth (Gold Road) Kristy Sell (MBS) Nicole Garbin (MBS)	Gruyere Project	An email from Maree Heath to Nicole Garbin, thanking Nicole for the new key characteristics table.	Email	RE: Gruyere Gold - Update to Key Characteristics Table	Approvals S43a Letter EPA Referral

APPENDIX 2: GRUYERE GOLD PROJECT: BOREFIELDS STYGOFAUNA ASSESSMENT (BENNELONGIA 2016)

Bennelongia Environmental Consultants

Gruyere Gold Project: Borefields Stygofauna Assessment

Prepared for:

Gold Road Resources Ltd

September 2016

Final Report

Short-Range Endemics I Subterranean Fauna

Waterbirds I Wetlands

Gruyere Gold Project: Borefields Stygofauna Assessment

Bennelongia Pty Ltd
5 Bishop Street
Jolimont WA 6014

P: (08) 9285 8722
F: (08) 9285 8811
E: info@bennelongia.com.au

ABN: 55 124 110 167

Report Number: 279

Report Version	Prepared by	Reviewed by	Submitted to Client	
			Method	Date
Draft	Stuart Halse		email	18 August 2016
Draft 2	Stuart Halse Mike Scanlon		Dropbox	19 August 2016
Final	Stuart Halse Michael Curran		Dropbox	7 September2016

K:\Prjects\GRR_05\Report\BEC_Gruyere Borefield Stygofauna Assessment2_final24viii16

EXECUTIVE SUMMARY

Introduction

The Gruyere Gold Project is a greenfields gold deposit in the Yamarna greenstone belt of the Yilgarn Region of Western Australia. The Project is owned by Gold Road Resources Limited, which aims to develop an open pit mining operation to extract and process gold.

The Gruyere Project will require one or more sources of groundwater to supply water for mine operations, ore processing and accommodation village supplies. This report documents the stygofauna species present in groundwater within the Yeo Palaeochannel in the vicinity the Gruyere Project, including the proposed Yeo and Anne Beadell Borefields that will supply the Project with groundwater.

Stygofauna are aquatic animals that live in groundwater. They occur in an array of different groundwater habitats including calcrete and alluvium. The calcrete bodies in the palaeovalleys of the Yilgarn have been identified as areas rich in stygofauna species, with the ranges of many species being restricted to single calcretes

Yeo Palaeochannel

The Yeo Palaeochannel represents an ancient river system, flowing east for about 60 km to Lake Yeo and then ultimately discharging into the Eucla Basin. The palaeochannel varies from 2 to 12 km in width, with calcrete and halite deposits occurring at intervals along its length.

Extensive calcrete deposits with saturated depths of 4 to 14 m occur within Quaternary detritals in the vicinity of the Gruyere Gold Project. The calcrete is cavernous in places with high permeability and groundwater storage. Groundwater salinity in the palaeochannel in the vicinity of the two proposed sections of the Yeo Borefield west of the Project is approximately 14,000-50,000 mg L^{-1}. Groundwater in the Anne Beadell Borefield south of the Project is about 1,500-6,000 mg L^{-1}.

Stygofauna Sampling

Ten rounds of stygofauna sampling were conducted in palaeochannel areas between 2012 and 2016, with a total of 239 samples collected overall from 115 bores. Methods and approach followed those recommended in the Environmental Protection Authority's Environmental Assessment Guideline 12 and Guidance Statement 54A.

A total of 4,263 stygofauna specimens were collected, representing at least 61 species and 12 higher taxonomic groups occurring in the palaeochannel. These included worms in the groups Nematoda (1 species), Aphanoneura (1 species), Oligochaeta (11 species) and Turbellaria (1 species), as well as rotifers (2 species), crustaceans belonging to the 'orders' Copepoda (33 species), Ostracoda (1 species), Syncarida (5 species), Amphipoda (3 species), and diving beetles in the insect family Dytiscidae (3 species). Three additional syncarid species were collected only in bores outside the palaeochannel.

Sequences of the CO1 gene of 100 specimens were used to refine or confirm species identifications based on morphology. Most species were relatively widespread in the Yeo Palaeovalley around the Gruyere Gold Project but three of the species collected are currently known only from within the Yeo Borefield. These species are:

- Enchytraeidae sp. B07 – known from a single animal in the northern section of the Yeo Borefield as a result of genetic analysis. Altogether, 159 specimens of enchytraeid sp. were collected in surveys and species were widely distributed in the Yeo Palaeochannel. Not all specimens could be sequenced (some were slide-mounted, some were considered unsuitable for DNA extraction and some of the specimens analysed did not yield DNA). It is considered highly likely that Enchytraeidae sp. B07 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.

- Enchytraeidae sp. B10 – known from a single animal ion the northern section of the Yeo Borefield through genetic analysis. For the reasons outlined above for Enchytraeidae sp. B07, it is considered highly likely that Enchytraeidae sp. B10 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.
- Parabathynellidae gen. nov. sp. B07 – known from two animals, one in the southern section and one in the northern section of the Yeo Borefield. The area between the two records is prospective stygofauna habitat and the species is almost certain to occur in this intervening area of highly prospective stygofauna habitat between the two sections of the Yeo Borefield.

In general, stygofauna species in the Yeo Palaeochannel appear to have relatively widespread occurrences for subterranean species in Yilgarn calcretes, with Chiltoniidae sp. B02 having a linear range of >100 km. This suggests that the subterranean habitat within the Yeo Palaeochannel is homogeneous and that, if the ranges of all species were fully documented, most species may occupy moderately large areas.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The Yamarna greenstone belt is a newly discovered gold region covering approximately 5,000 km^2 on the eastern side of the Yilgarn Craton of Western Australia. The Gruyere Gold Project is a greenfields gold deposit in the Yamarna greenstone belt (Figure 1) that is owned by Gold Road Resources Limited (Gold Road). Gold Road aims to develop an open pit mining operation to extract and process gold from the Gruyere Deposit, which is located within the Yamarna Pastoral Lease. This lease is wholly owned and managed by Gold Road.

The Gruyere Gold Project will require one or more sources of groundwater to supply water for mine operations, ore processing and accommodation village supplies. This report builds on earlier reports by Bennelongia (2013a,b, 2016) to document the stygofauna species occurring in groundwater of the Yeo Palaeochannel in the vicinity the Gruyere Gold Project, including the two proposed sections of borefield to the west of the Project that are referred to as the Yeo Borefield and a proposed smaller borefield to the south of the Project that is referred to as the Anne Beadell Borefield. Stygofauna are aquatic animals that live in groundwater.

2. STYGOFAUNA

Stygofauna occur in an array of different groundwater habitats including porous, karstic and fractured rock aquifers, springs and hyporheos of streams (Eberhard *et al.* 2005). Stygofauna inhabit interstitial spaces, fissures and voids in aquifers (Gibert and Deharveng 2002) and, in general terms, the likelihood of them occurring in an aquifer is directly related to its transmissivity.

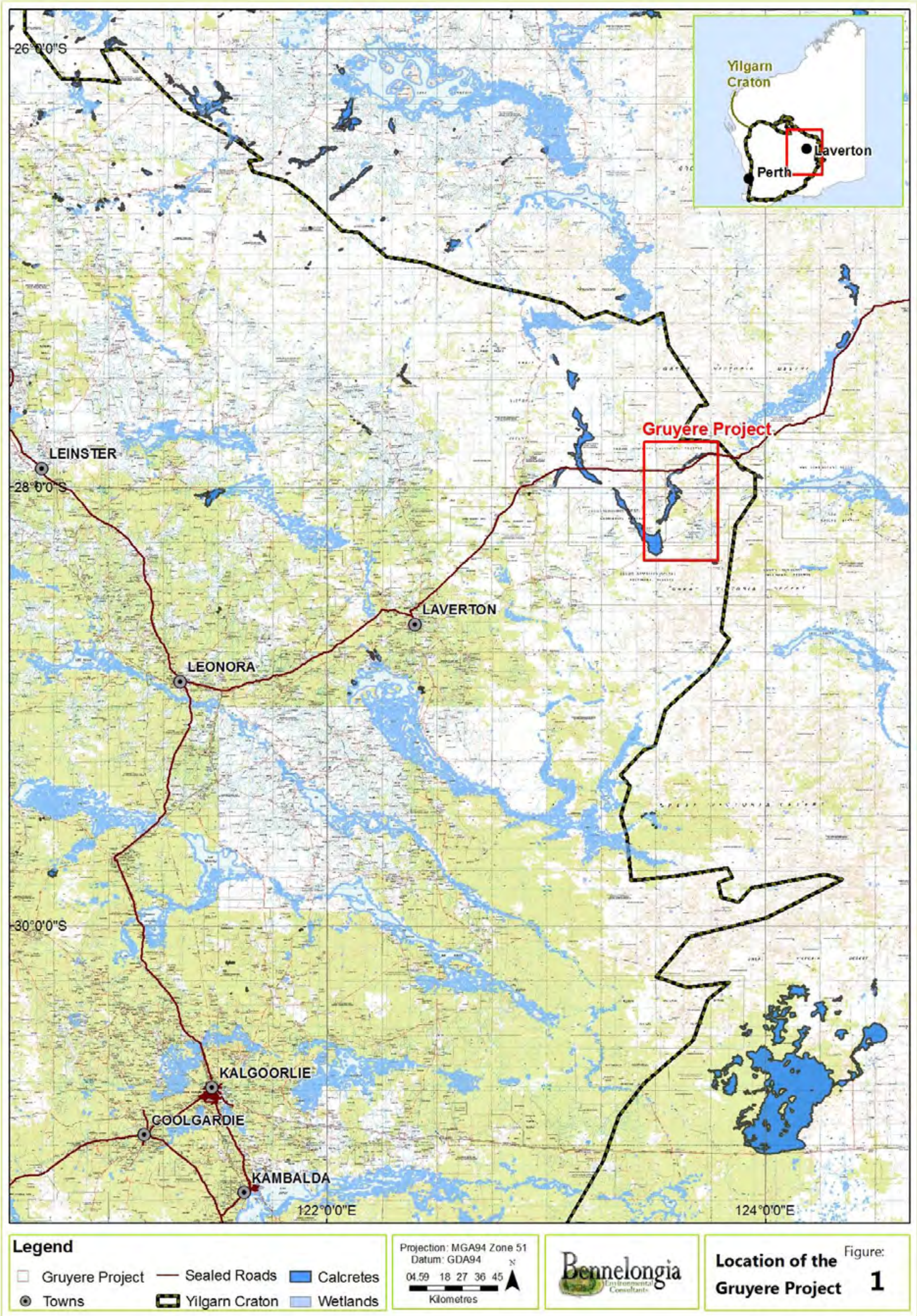
The physiochemical tolerances of stygofauna have not been well defined, although some information is available on salinity tolerances and more can be inferred from salinity tolerance information for surface wetland species. Stygofauna have mostly been recorded in fresh to brackish groundwater but may possibly occur in salinities up to 50,000 mg/L TDS (Watts and Humphreys 2006; Reeves *et al.* 2007).

Calcrete and alluvium are typically considered to be productive habitats for stygofauna because the fissures and voids in groundwater aquifers provide highly suitable habitat for small aquatic invertebrates. The calcrete bodies in the palaeovalleys of the Yilgarn have been identified as areas rich in stygofauna species, with many species being restricted to single calcretes (Guzik *et al.* 2008, Karanovic and Cooper 2011, Karanovic *et al.* 2014). The belief that most stygofauna species are restricted to individual calcretes is often termed the 'calcrete island' hypothesis (Cooper *et al.* 2002). It is suggested that calcretes have endemic faunas because the fine alluvial and clay deposits that occur around the calcrete bodies have limited voids or spaces through which the animals can move, therefore providing a barrier to dispersal for subterranean species. In many cases, high salinities may also provide barriers to movement of stygofauna between different calcretes. Many of the stygofauna communities restricted to individual calcretes have been listed as either Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) (DPaW 2015). In both cases, the communities are seen as having high conservation value during any environmental impact assessment process. The mapped calcretes of the Yeo Palaeochannel in the vicinity of the Gruyere Project are not listed as TECs or PECs.

3. YEO PALAEOCHANNEL HYDROLOGY

3.1. Aquifer characteristics

The Yeo Palaeochannel represents an ancient river system, flowing east for about 60 km to Lake Yeo (Figures 1 and 2) and then ultimately discharging into the Eucla Basin. The palaeochannel varies from 2 to 12 km in width, with calcrete and halite deposits occurring at intervals along its length.



The Yeo Palaeochannel extends to a depth of 130 to 150 m and typically consists of a basal sand and gravel unit up to 40 m thick, overlain by interbedded clayey sequences of colluvium and alluvium with minor sand lenses (Commander *et al.* 1992 in Pennington Scott 2012). Although the surface expression of the palaeochannel is 2 to 12 km across, the buried channels are less than 1.5 km wide. Outside the central trunk, the surface colluvium and alluvium rapidly thins out to have a depth of less than 20 m (Johnson *et al.* 1999; ANL 2000 in Pennington Scott 2012). The extensive calcrete deposits can be up to 1.5 km wide and over 5 km in length, with depths of 4 to 14 m. The calcrete is cavernous in places with high permeability and groundwater storage, although most of the calcrete occurs as a matrix that binds the dominant sand substrate (Pennington Scott 2012, 2016).

The most significant aquifers in the Yeo Palaeochannel lie within the Quaternary detritals and within the thicker Werillup Formation. Areas of calcrete occur within the Quaternary detritals aquifer, which contains brackish to saline water. The Werillup Formation aquifer lies within sand, gravel and clay and contains saline to hypersaline water. The Perkolilli Shale, which consists of clay and silt, forms an aquitard between the Quaternary detritals aquifer and Werillup Formation aquifer, which would be expected to be a barrier to stygofauna movement (Figure 3; Appendix 1).

In broad terms, the depth from the surface to the water table is approximately 8 m in much of the Yeo Palaeochannel. On average, the Quaternary detritals aquifer is about 4 m thick although its thickness ranges from 0 to 12 m (Figure 4). The Perkolilli Shale aquitard is about 20 m thick and the deeper Werillup Formation is on average about 90 m thick and underlain by saprolite formed by weathering of the Archean Basin rock. The proposed borefields will extract groundwater from this deeper Werrilup Formation. Reduction of pressure in this aquifer will lead to lowering of water levels over time in the overlying Quaternary detritals.

3.2. Groundwater salinity

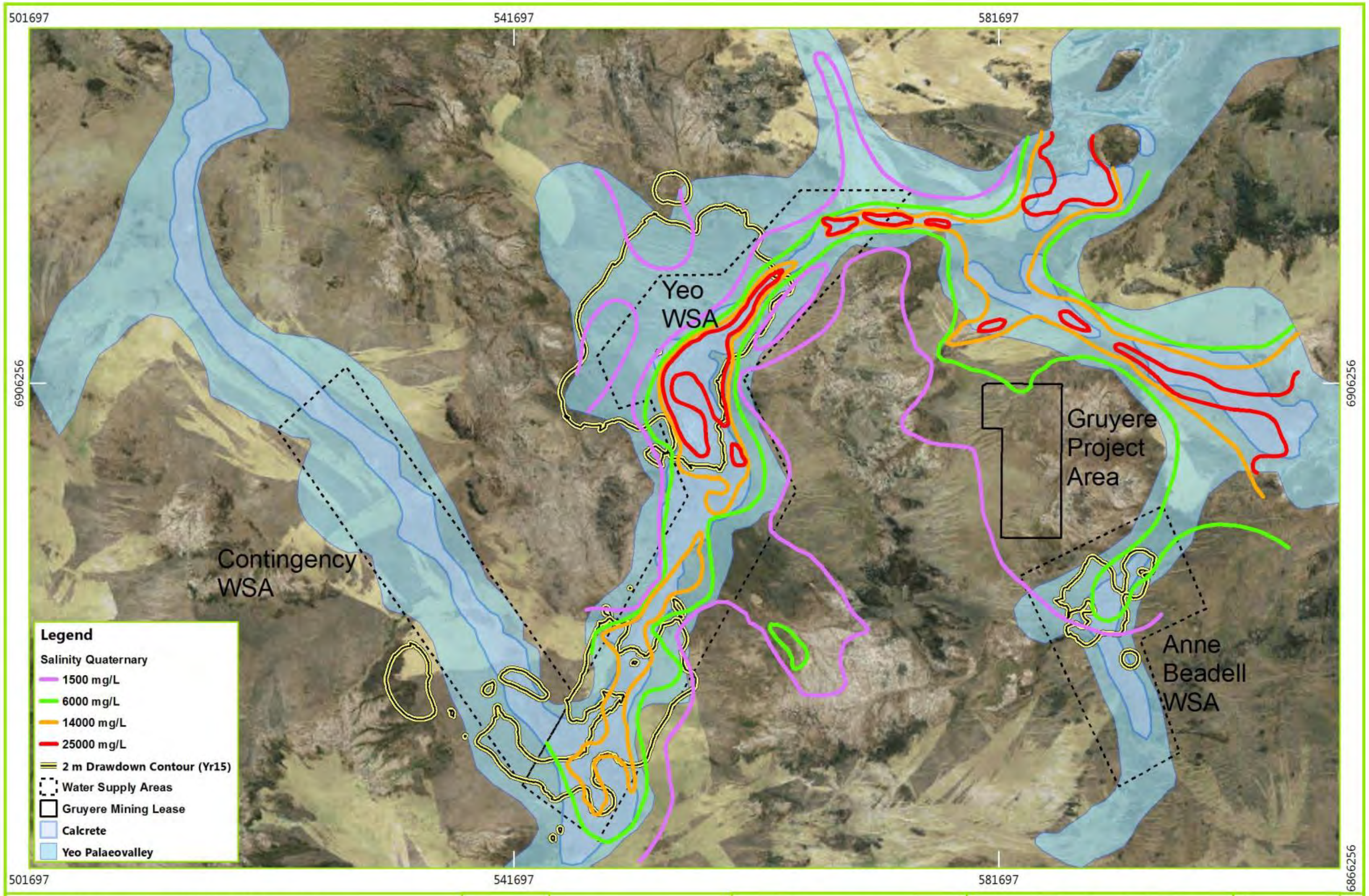
Groundwater salinities in the Yeo Palaeochannel increase as groundwater flows from catchment headwaters towards Lake Yeo (Figure 2). Groundwater salinity in the surficial aquifer is approximately 1,500 - 6,000 mg L^{-1} in the southern tributary of the Yeo Palaeochannel where the Anne Beadell borefield is located and carbonate content is relatively high. Groundwater salinity at depth in the main trunk of the Yeo Palaeochannel, west of the Gruyere Gold Project, where the Yeo Borefield are located is approximately 14,000-50,000 mg L^{-1}.

There is often a vertical gradient of salinity in the Yeo Palaeochannel, with the top metre of groundwater having a salinity that is approximately half that found at depth. Groundwater in the valley flanks outside the palaeochannel is fresh.

3.3. Prospective stygofauna habitat

The surficial Quaternary detritals aquifer in the Yeo Palaeovalley, which lies principally within colluvium, alluvium and saturated calcrete, is up to 14 m thick and is likely to comprise the main habitat for stygofauna in the Yeo Palaeochannel. The Werillup Formation aquifer lies under an aquitard formed by the Perkolilli Shale that reduces opportunities for colonisation by stygofauna and also reduces inflow of nutrients and carbon. Thus, while stygofauna species may be present below the aquitard in the Werillup Formation, they would be expected to be present in low numbers and to be relatively insensitive to changes in the upper aquifer.

In general, stygofauna are unlikely to occur at salinities >50,000 mg L^{-1} although there are records of stygofaunal amphipods and copepods at salinities >100,000 mg L^{-1} near Wiluna (Outback Ecology 2012). Below 50,000 mg L^{-1}, provided physical habitat is suitable, the number of stygofauna species present is expected to be inversely proportional to salinity, with individual species mostly occurring across a limited range of salinities (i.e. in fresh groundwater or hyposaline groundwater or saline groundwater) (see Pinder *et al.* 2005 for surface water examples).



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.

Salinity levels in the Quaternary Detritals aquifer

Figure: 2

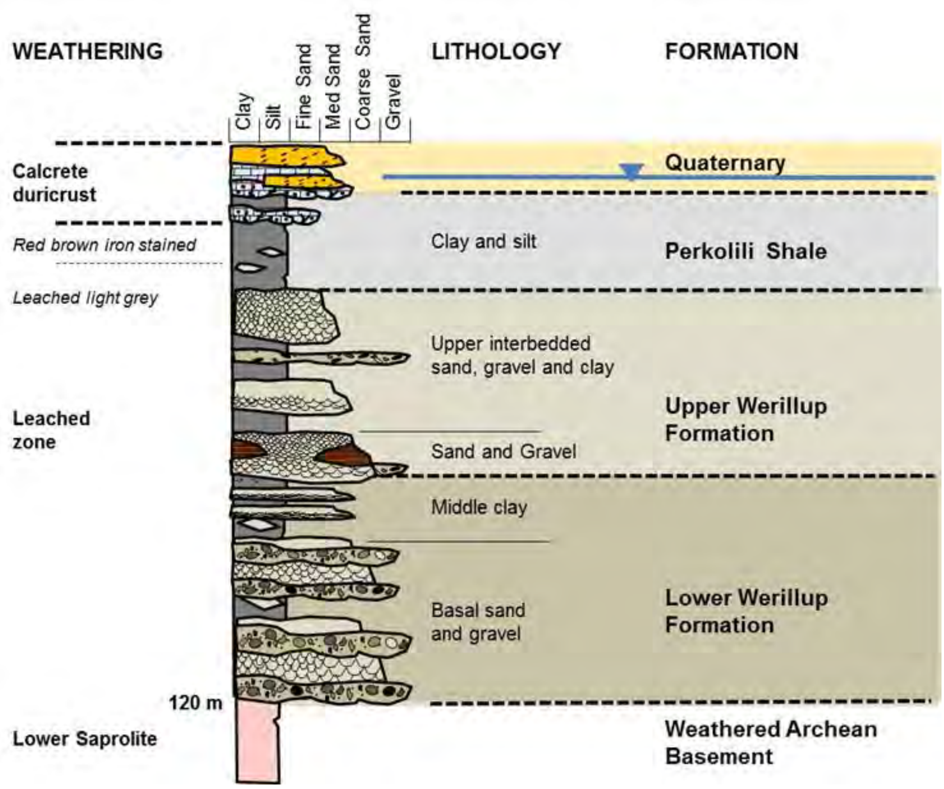


Figure 4. Profile through the Yeo Palaeochannel (from Pennington Scott 2016).

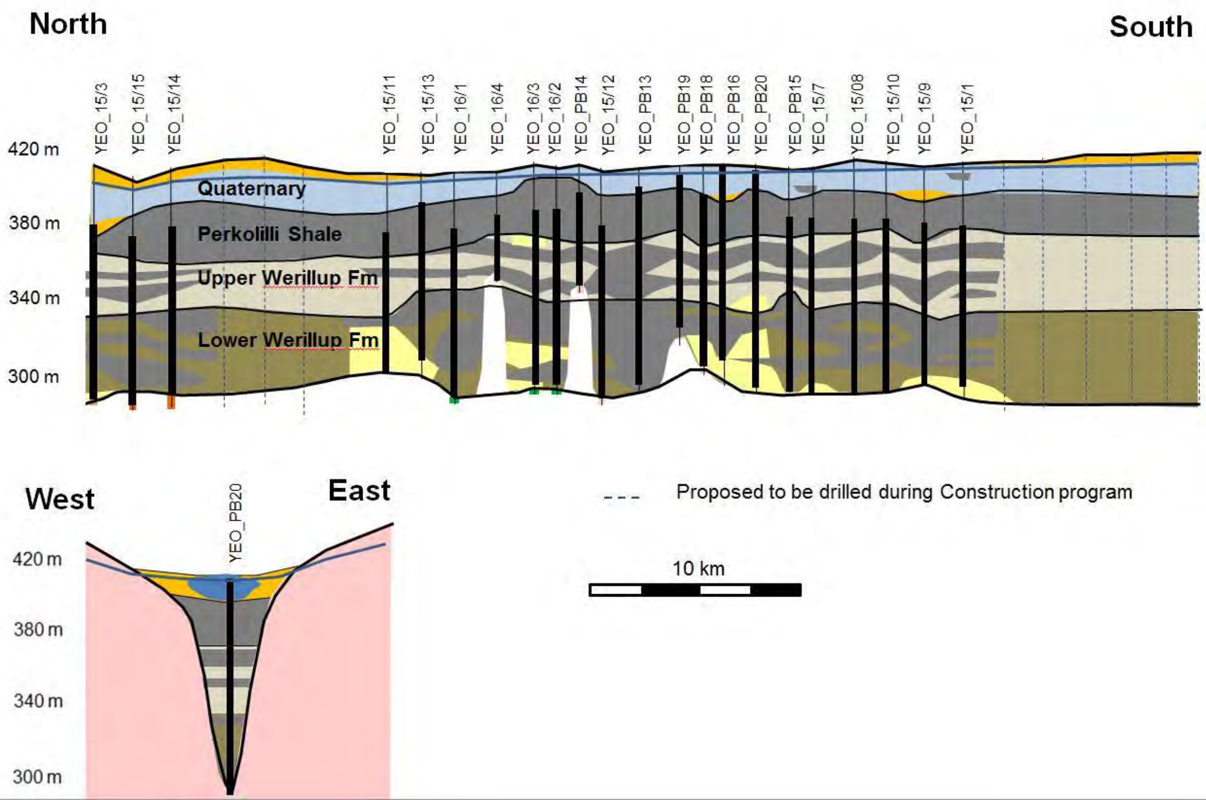


Figure 5. Longitudinal and cross section of the Yeo Palaeochannel.
(From Pennington Scott 2016).

While salinity in the surficial aquifer is shown in Figure 2 as a parameter with broad gradients, in reality salinity is heterogeneous at a fine scale and shows variation as a result of local surface topography, vegetation and soil type (Runyan and d'Odorico 2010). A consequence of this is that the preferred salinity levels of a species may sometimes occur in only a small proportion of the palaeochannel and the species will have a patchy distribution that is not easily predicted without fine-scale salinity mapping.

4. STYGOFAUNA SURVEYS

4.1. Sampling Methods

The sampling methods used followed those outlined by Eberhard *et al.* (2005) and recommended in Environmental Assessment Guideline 12 and Guidance Statement 54A (EPA 2007, 2013). At each bore, six net hauls were collected using a weighted plankton net. Three hauls were made using a 50 µm mesh net and three with a 150 µm mesh net. After the net was lowered to the bottom of the bore it was jerked up and down briefly to agitate benthic stygofauna into the water column. The net was then slowly retrieved. Contents of the net were transferred to a 125 ml polycarbonate vial after each haul and preserved in 100% ethanol. Nets were washed between bores to minimise contamination among sites.

4.2. Sampling effort and locations

Ten rounds of sampling were conducted in palaeochannel areas between 2012 and 2016, with a total of 239 samples collected overall from 115 bores (Table 1, Figure 5). Of these, 227 samples were collected from the proposed Yeo Borefield and surrounding areas while 12 samples were collected within, or in close proximity to, the proposed Anne Beadell Borefield. Given the extensive nature of palaeovalley areas around the Gruyere Gold Project, we have reported all samples outside the areas of >2 m drawdown associated with these borefields as 'reference' samples.

Details for all sampled bores are given in Appendix 2.

4.3. Species identification

Samples were returned to the Bennelongia laboratory in Perth for sorting and identification.

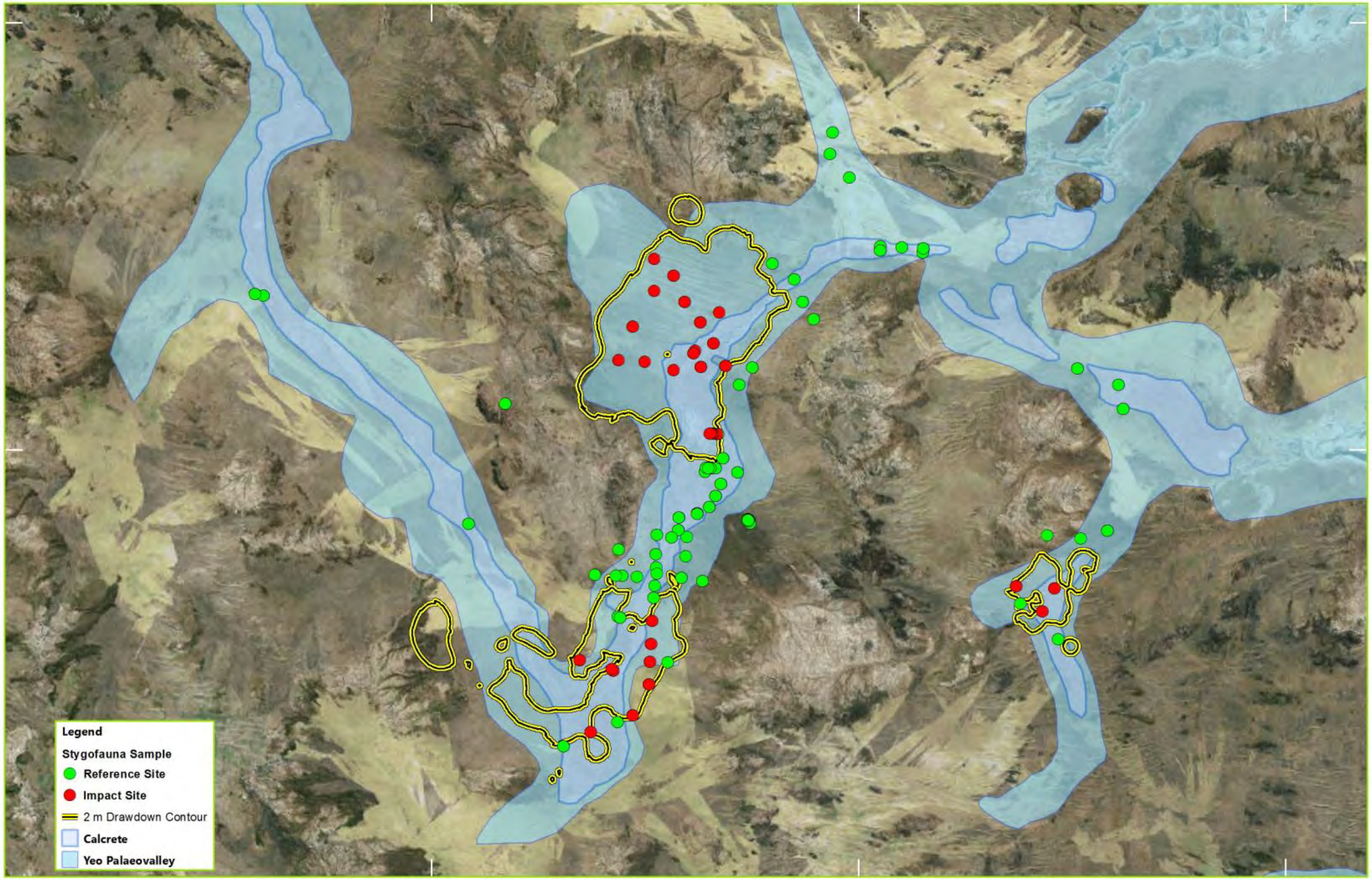
After elutriation and sieving to remove as much detritus as possible, samples were sorted under dissecting microscopes. All stygofauna specimens present were identified morphologically to species level or, in a few cases, to morphological entity representing several species. Morphological identifications were made using published keys or the characters in those keys were used to distinguish undescribed species.

DNA analyses were carried out on 125 animals using the CO1 barcoding gene to confirm or refine morphological identifications. A dissecting microscope was used when the individual animals to be used in analyses were selected from samples that had previously been subject to morphological examination. Either legs or whole animals (depending on their size) were transferred directly into ATL buffer and proteinase K after confirming species identification. DNA was extracted using a Qiagen DNeasy Blood & Tissue kit. PCR amplifications of 487 - 883 base pair fragments of the CO1 gene were attempted with four primers (LCO1490:HCO2198, LCO1490:HCOoutout, C1-J-1718:HCO2198, C1-J-1718:HCOoutout; Folmer *et al.* 1994). Sequencing was undertaken by AGRF (Australian Genome Research Facility). Sequences were obtained for 102 animals.

4.4. Compiling species lists

In many cases, animals could not be identified morphologically to species level because they were damaged, juvenile or the wrong sex for morphological determination. While many of the animals were potentially identifiable using DNA analysis (although a significant number of copepods failed to yield DNA), for reasons of cost only a small proportion of the animals collected were analysed for CO1.

The higher level (i.e. above species level) identifications were included in calculations of the number of species present only if the specimens could not belong to a species already recorded. Other records



Source: Infrastructure supplied by Client (August 2016) Imagery: World Imagery (ESRI 2016)	N	0 7 14 km Scale 1:580250	Bennelongia Environmental Consultants	**Stygofauna Sampling Locations**	Figure: **5**
		MGA94 (Zone 51)	Author: M. Scanlon		
		Date:07 September 2016 Rev: A	Source Destination		

Table 1. Sample effort for stygofauna at the Project.

	Borefield Impact		Reference	Total
	Yeo	Anne Beadell		
Jun-12	-	-	8	8
Dec-12	8	-	27	35
Feb-13	-	-	37	37
Oct-15	2	1	8	11
Dec-15	1	1	5	7
Jan-16	2	-	16	18
Apr-16	3	1	9	13
May-16	11	1	12	24
Jun-16	9	-	15	24
Jul-16	20	-	42	62
Total	**56**	**4**	**179**	**239**

of higher level identifications are provided in a separate table from the species list. One of the implications of the higher level identifications is that the frequency of occurrence (and ranges) of some species are likely to have been underestimated.

4.5. Personnel

Fieldwork was undertaken by Jim Cocking, Dean Main, Jeremy Quartermaine, Sean Bennet, Mike Scanlon and Michael Curran. Samples were sorted by Jane McRae, Michael Scanlon, Jim Cocking, Grant Pearson, Dean Main and Jeremy Quartermaine. All identifications were undertaken by Jane McRae except for Aphanoneura, Oligochaeta and Nematoda which were identified by Mike Scanlon, and ostracods which were identified by Stuart Halse. DNA analyses were run by Michael Curran.

5. SURVEY RESULTS

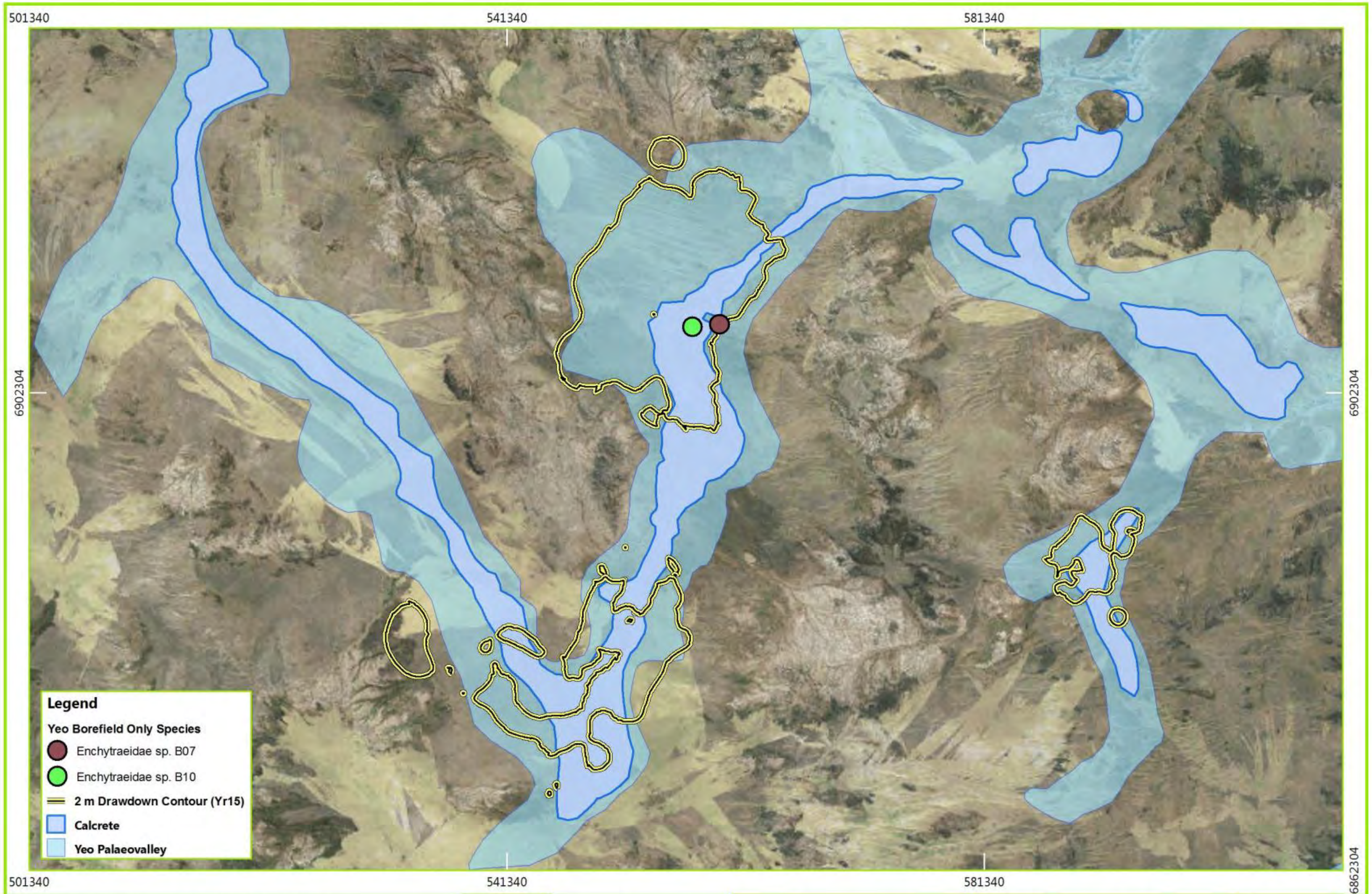
5.1. Species collected

A total of 4,263 stygofauna specimens were collected, representing at least 61 species and 12 higher taxonomic groups occurring in the palaeochannel (Tables 2 and 3). These included worms in the groups Nematoda (1 species), Aphanoneura (1 species), Oligochaeta (11 species) and Turbellaria (1 species), as well as rotifers (2 species), crustaceans belonging to the 'orders' Copepoda (33 species), Ostracoda (1 species), Syncarida (5 species), Amphipoda (3 species), and diving beetles in the insect family Dytiscidae (3 species). Three additional syncarid species were collected only in bores outside the palaeochannel (*Kimberleybathynella* sp. B07, *Atopobathynella* sp. B21, Parabathynellidae gen. nov. 1 sp. B06) and are omitted from the total list of species in Table 2.

Copepods were both the most diverse and the most abundant group, representing 53% of all species and 77% of all specimens collected (3,289 specimens in total). Amphipods also represented a significant proportion of total abundance (18%) with 763 specimens collected. The abundance of individual species was not always clear because, in some cases, DNA analyses altered the results of morphological determinations which resulted in a fairly large number of specimens identified only to higher order level. However, among the copepods *Nitocrella* sp. B06 was an abundant species and the amphipod *Stygochiltonia* sp. B03 is also likely to be abundant although DNA confirmation is required when identifying this species.

5.2. Distribution patterns

Four of the 61 species collected from the Yeo Palaeochannel belong to groups that are not assessed in environmental impact assessments in Western Australia because of poor taxonomic frameworks and



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.

N

0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A
Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Stygofauna species known from the Yeo Borefields

Figure: **6**

difficulties in identification (nematodes, turbellarians, rotifers), although one of the rotifers was able to be identified as a cosmopolitan species.

Six other species have known ranges extending well beyond the Yamarna area, with three species known widely in the Yilgarn (copepods *Dussartcyclops uniarticulatus*, *Fierscyclops fiersi* and ostracod *Sarscypridopsis* sp. BOS615), two in north-western Australia (copepods *Dussartcyclops* nr *uniarticulatus*, *Halicyclops kieferi* and a calanoid copepod with an unknown distribution (Table 2). It is considered likely that Calanoida sp. is a species of *Calamoecia* with a predominantly surface occurrence and a moderately large, inland range but all animals collected were female and not readily identifiable. Calanoids occasionally occur in the Perth water supply but usually only as fragments. All calanoids in the Yamarna samples were in good condition and Bennelongia has filters on all taps, so it is unlikely contamination from the water supply is the source of the calanoids.

The remaining 51 species are known only from the Yamarna area, with 48 of these species having been recorded both within and outside, or only outside, the proposed borefields (Table 2). Just three species are known only from the proposed Yeo Borefield (Figure 6). No species is known only from the Anne Beadell borefield.

Two of three 'restricted' species are enchtraeid worms (Enchytraeidae sp. B07 and Enchytraeidae sp. B10), known only from the northern section of proposed Yeo Borefield (Figure 6). The third 'restricted' species is the syncarid Parabathynellidae gen. nov. 1 sp. B07, which was collected as a single specimen from both the southern and the northern sections of the Yeo Borefield. The species is almost certain to occur in the palaeochannel between the two proposed borefields.

5.3. Comments on selected species

Enchytraeidae

Enchytraeids were speciose in the Yeo palaeochannel, with genetic lineages recorded on the basis of differences in CO1 sequences. This is a group for which there has traditionally been little attempt to undertake morphological identification, although in fact the results of a morphological assessment undertaken while preparing specimens for sequencing were in full agreement with the genetic results.

The genetic differences observed between species were 11 –23% or more. This is interpreted to mean the lineages represent different species. Hebert *et al*. (2003) reported the mean CO1 sequence divergence for 128 species pairs of annelids was 15.7% but divergences of 10 – 11% are frequently regarded as indicative of the existence of cryptic oligochaete species (Novo *et al*. (2009). It is possible, however, that the 10 – 11% threshold is too low for some subterranean oligochaetes, which have limited dispersal capacity and are therefore likely to exhibit a high degree of genetic structuring.

Among the 33 enchytraeids that yielded sequences, only Enchytraeidae sp. B10 was abundant, being represented by 13 sequenced specimens in three bores. Three species occurred in moderate abundance (Enchytraeidae sp. B09, Enchytraeidae sp. B12, Enchytraeidae sp. B13). In contrast, Enchytraeidae sp. B07 and Enchytraeidae sp. B10 were both in the low abundance part of the species abundance curve in Figure 7, which shows a log-normal pattern typical of most animal communities (Fisher et al. 1943). More extensive sampling would be required to obtain the multiple records of these species that are required to adequately document their ranges, even when habitat information is used to assist in range predictions. Thus, while Enchytraeidae sp. B07 and Enchytraeidae sp. B10 are each known only from single holes within the northern section of the proposed Yeo Borefield (Figure 8), in both cases the restricted known distributions are probably artefacts of the species having low abundance.

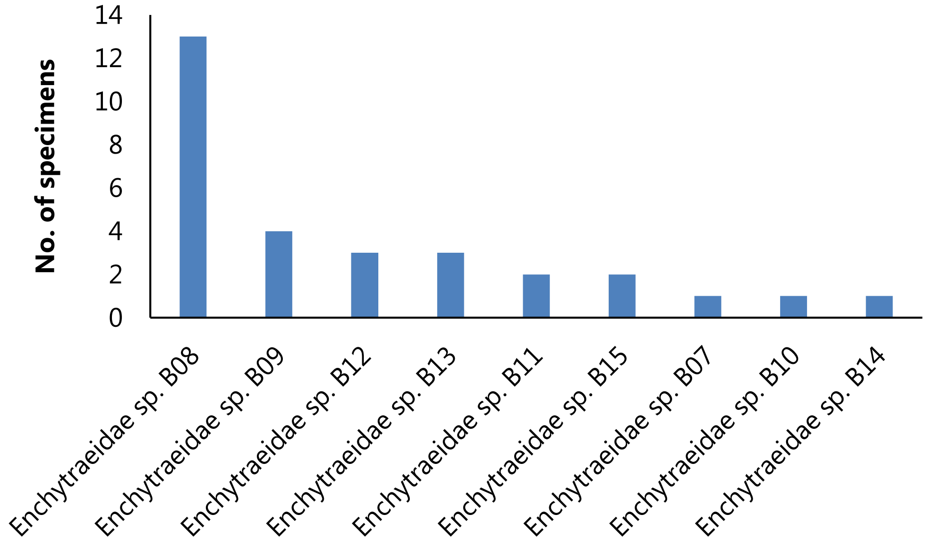


Figure 7. Relative abundance of the nine enchytraeid species in the Yeo Palaeochannel.

Other Worms

Phreodrilid worms are relatively uncommon in groundwater and it is likely a single species was collected in the Yeo palaeochannel as Phreodrilidae with similar ventral chaetae and Phreodrilidae sp. This phreodrilid species has a known linear range in the paleochannel of 12 km, occupying the full length of area between the southern and northern sections of the Yeo Borefield (Figure 9).

One species of tubificid worm is present in the palaeochannel. DNA analysis confirmed that the specimens of Tubificidae sp. B02 in the southern section of the proposed Yeo Borefield and in the palaeochannel to the north of that are the same species with CO1 sequence divergence of only 0.24%. Other morphologically identified specimens of Tubificidae sp. B02 give the species a known linear range of 20 km (Figure 9).

Amphipoda

DNA analysis suggested three species of amphipod occur in the palaeochannel. The species appear to have high intraspecific morphological variability, making morphological determinations difficult, although morphology and DNA indicates they do not belong to any known genera of Amphipoda. The most widespread species is Chiltoniidae sp. B02, which has a linear range of 104 km along the palaeochannel, including both sections of the proposed Yeo Borefield (Figure 10). It showed CO1 sequence divergence of up to 8.6% (4.7% average) from twelve animals. In contrast, Chiltoniidae sp. B03 was found in the eastern part of the palaeochannel, away from the Yeo and Anne Beadell Borefields and two animals sequenced had a CO1 divergence of 1.86% and a range of 22 km. Chiltoniidae sp. B01 was collected through the centre of the Yeo Borefield, with a known linear range of 14.5 km and CO1 divergence of 2.9% from three specimens.

The CO1 divergence between species was about 14% and it is likely that the ranges of all species are larger than shown by the sequenced specimens. Only 17 of the 773 amphipod specimens collected in 59 samples were sequenced.

Syncarida

Four species of syncarid were recorded in the palaeochannel, with two species recorded in the Yeo Borefield, Parabathynellidae gen. nov. 1 sp. B04 extended from the top of the southern Yeo Borefield to beyond the northern borefield, with a linear range of 50 km (Figure 11). Genetic analysis of six specimens (which had CO1 divergence of 5.0%) confirmed the accuracy of morphological identificat-

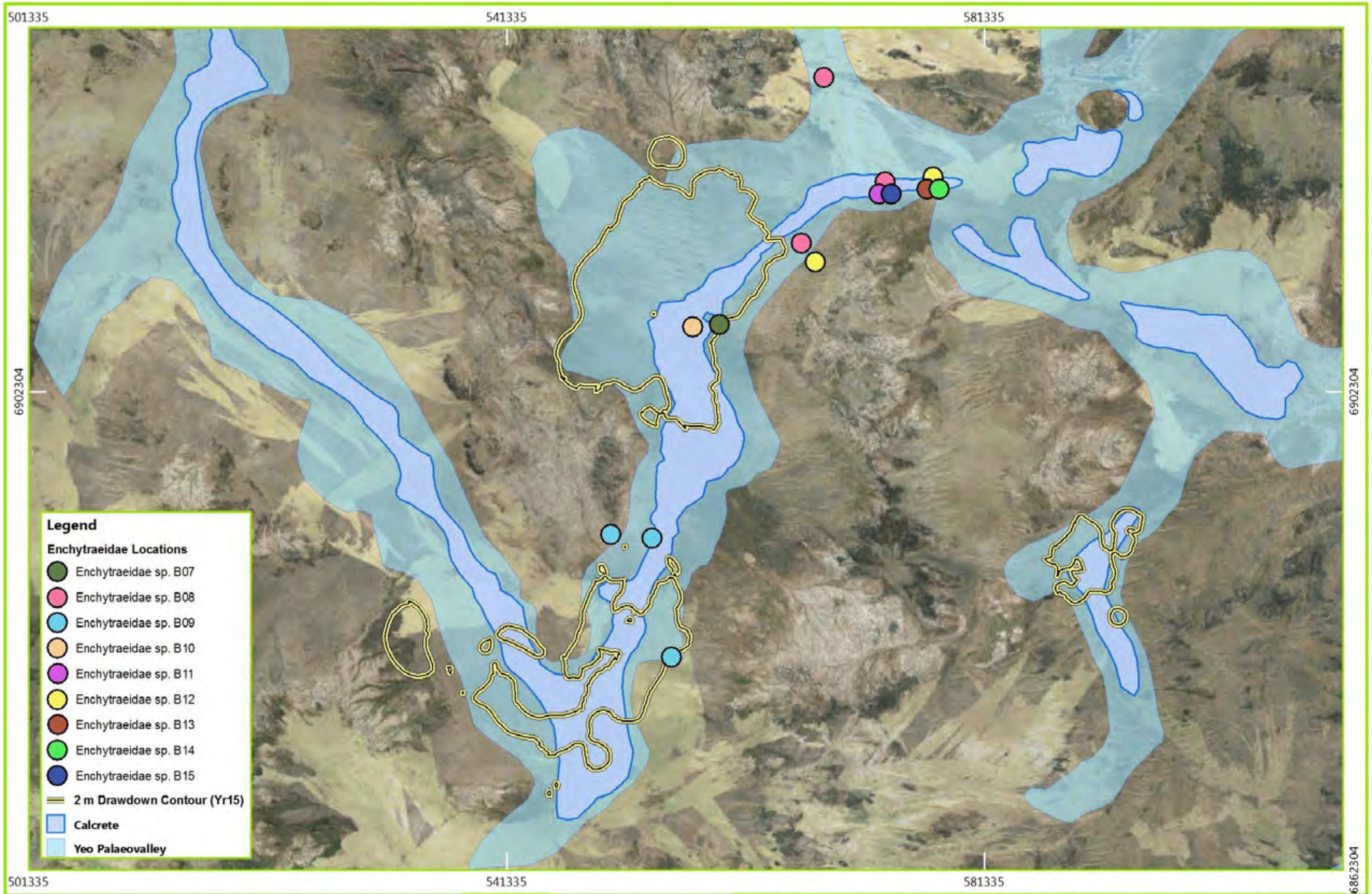
Table 2. Stygofauna species collected from the proposed Yeo and Anne Beadell Borefields.
Number of animals collected in impact and reference sites is shown. N/A, not assessed in EIA and identification is at higher order level. Note that it is inferred that all animals in a sample for which a sequenced was obtained belonged to the sequenced species; if more than one DNA-defined species was present numbers were assigned to the species in the most appropriate way.

Higher Group	Family	Species	Impact	Reference	Distribution
Primitive Worms					
Turbellaria		Turbellaria sp.		20	N/A
Nematoda		Nematoda sp.	26	78	N/A
Rotifers					
Rotifera		Bdelloidea sp. 2:2		3	N/A
	Lecanidae	*Lecane ludwigii*		1	Cosmopolitan
Worms					
	Aeolosomatidae	Aeolosomatidae sp.		5	Yamarna
	Enchytraeidae	Enchytraeidae sp. B07	1		Yeo Borefield
		Enchytraeidae sp. B08		20	Yamarna
		Enchytraeidae sp. B09		11	Yamarna
		Enchytraeidae sp. B10	2		Yeo Borefield
		Enchytraeidae sp. B11		2	Yamarna
		Enchytraeidae sp. B12		3	Yamarna
		Enchytraeidae sp. B13		3	Yamarna
		Enchytraeidae sp. B14		1	Yamarna
		Enchytraeidae sp. B15		2	Yamarna
	Phreodrilidae	*Insulodrilus* sp.		1	Yamarna
	Tubificidae	Tubificidae sp. B02	1	2	Yamarna
Crustaceans					
Calanoida		Calanoida sp.		1	Unknown, outside Yamarna?
Cyclopoida	Cyclopidae	*Dussartcyclops* nr *uniarticulatus*		6	North-west WA
		Dussartcyclops uniarticulatus	1	26	Yilgarn
		Fierscyclops (Fierscyclops) fiersi	3	441	Yilgarn
		Halicyclops eberhardi a	10	7	Yamarna
		Halicyclops eberhardi b		1	Yamarna
		Halicyclops eberhardi c		22	Yamarna
		Halicyclops kieferi		19	North-west WA
Harpacticoida	Ameiridae	Ameiridae gen. nov. 4 sp. B01	10	216	Yamarna
		Nitocrella sp. B06	20	985	Yamarna
		Nitocrella sp. B07		1	Yamarna
		Nitocrella sp. B10	5	1	Yamarna
		Nitocrella sp. B11		2	Yamarna
		Nitocrellopsis sp. B04	8	165	Yamarna
		Nitocrellopsis sp. B05		5	Yamarna
		Nitocrellopsis sp. B06		94	Yamarna
		Nitocrellopsis sp. B07		108	Yamarna
		Nitocrellopsis sp. B08	11	52	Yamarna
		Nitocrellopsis sp. B09	4	10	Yamarna
		Nitocrellopsis sp. B10		14	Yamarna
		Nitokra lacustris sp. B02		4	Yamarna
		Nitokra lacustris sp. B03a	2	2	Yamarna
		Nitokra lacustris sp. B03b		2	Yamarna
		Nitokra lacustris sp. B06		3	Yamarna
		Nitokra sp. B04		6	Yamarna
		Stygonitocrella sp. B05		2	Yamarna
	Canthocamptidae	*Australocamptus* sp. B12		76	Yamarna
	Miraciidae	*Schizopera* sp. B08	1	5	Yamarna
		Schizopera sp. B09	50	58	Yamarna
		Schizopera sp. B11	1	8	Yamarna
	Parastenocarididae	*Kinnecaris* sp.		1	Yamarna
		Parastenocaris sp. B24		44	Yamarna
		Parastenocaris sp. B33		20	Yamarna
Ostracoda	Cyprididae	*Sarscypridopsis* sp. BOS615	92	2	Yilgarn
Syncarida	Parabathynellidae	*Atopobathynella* sp. B13		1	Yamarna
		Kimberleybathynella sp. B07		2	Yamarna

Higher Group	Family	Species	Impact	Reference	Distribution
		Parabathynellidae gen. nov. 1 sp. B04	6	42	Yamarna
		Parabathynellidae gen. nov. 1 sp. B07	2		Yeo Borefield
		Parabathynellidae gen. nov. 1 sp. B08		1	Yamarna
Amphipoda	Chiltoniidae	Chiltoniidae sp. B01	18	131	Yamarna
		Chiltoniidae sp. B02	1	78	Yamarna
		Chiltoniidae sp. B03		5	Yamarna
Insects					
Coleoptera	Dytiscidae	*Limbodessus* sp. B05		35	Yamarna
		Limbodessus sp. B06	3	69	Yamarna
		Nirripirti sp. B01		2	Yamarna

Table 3. Higher level stygofauna identifications from the proposed Yeo and Anne Beadell Borefields. Number of samples containing each taxon is shown.

Higher Group	Family	Identification	Impact	Reference	Likely Species
Primitive Worms					
	Phreodrilidae	Phreodrilidae sp.		5	*Insulodrilus* sp.
		Enchytraeidae sp.	82	77	Any of the other oligochaetes in Table 2
Crustaceans					
Cyclopoida	Cyclopidae	*Halicyclops eberhardi* s.l.	77	202	Any of the *Halicyclops eberhardi* in Table 2
		Cyclopoida sp.	1	3	Any of the cyclopid species in Table 2
Harpacticoida	Ameiridae	Ameiridae sp.	1	3	Any of the ameirids in Table 2
		Nitocrella lacustris sp. B03 s.l.	2	2	Either *Nitocrella lacustris* sp. B03
		Nitocrella sp.	4		Any of the *Nitocrella* species in Table 2
		Nitocrellopsis sp.	2	1	Any of the *Nitocrellopsis* species in Table 2
	Canthocamptidae	Canthocamptidae sp.	1		*Australocamptus* sp. B12
	Parastenocarididae	Parastenocarididae sp.		1	*Parastenocaris* sp. B24 or B33
		Harpacticoida sp.	2	23	Any of the harpacticoid species in Table 2
		Copepoda sp.		1	Any of the the copepod species in Table 2
Syncarida	Parabathynellidae	Parabathynellidae sp.		1	Any of the parabatynellids in Table 2
Amphipoda	Chiltoniidae	Chiltoniidae sp.	6	524	Any of the chiltoniids in Table 2
		Amphipoda sp.	1	9	Any of the chiltoniids in Table 2
Insects					
Coleoptera	Dytiscidae	*Limbodessus* sp.	1	18	*Limbodessus* sp. B05 or B06



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

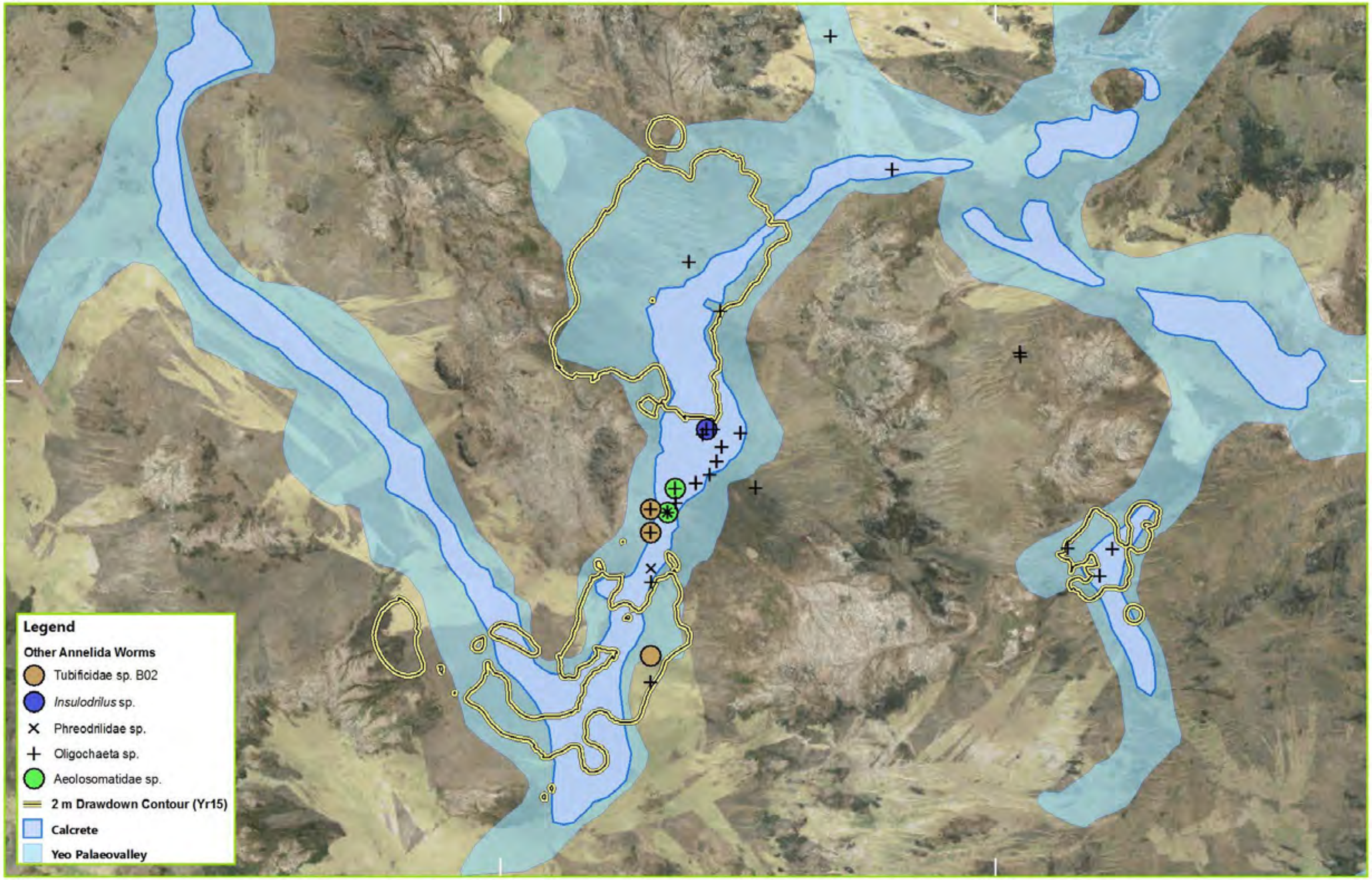
MGA94 (Zone 51)

Author: M. Curran

Date: 6 September 2016 Rev: A GRR\GRR_05\04_Report Maps\03_Species

Distribution of Enchytraeidae Oligochaeta

Figure: **8**

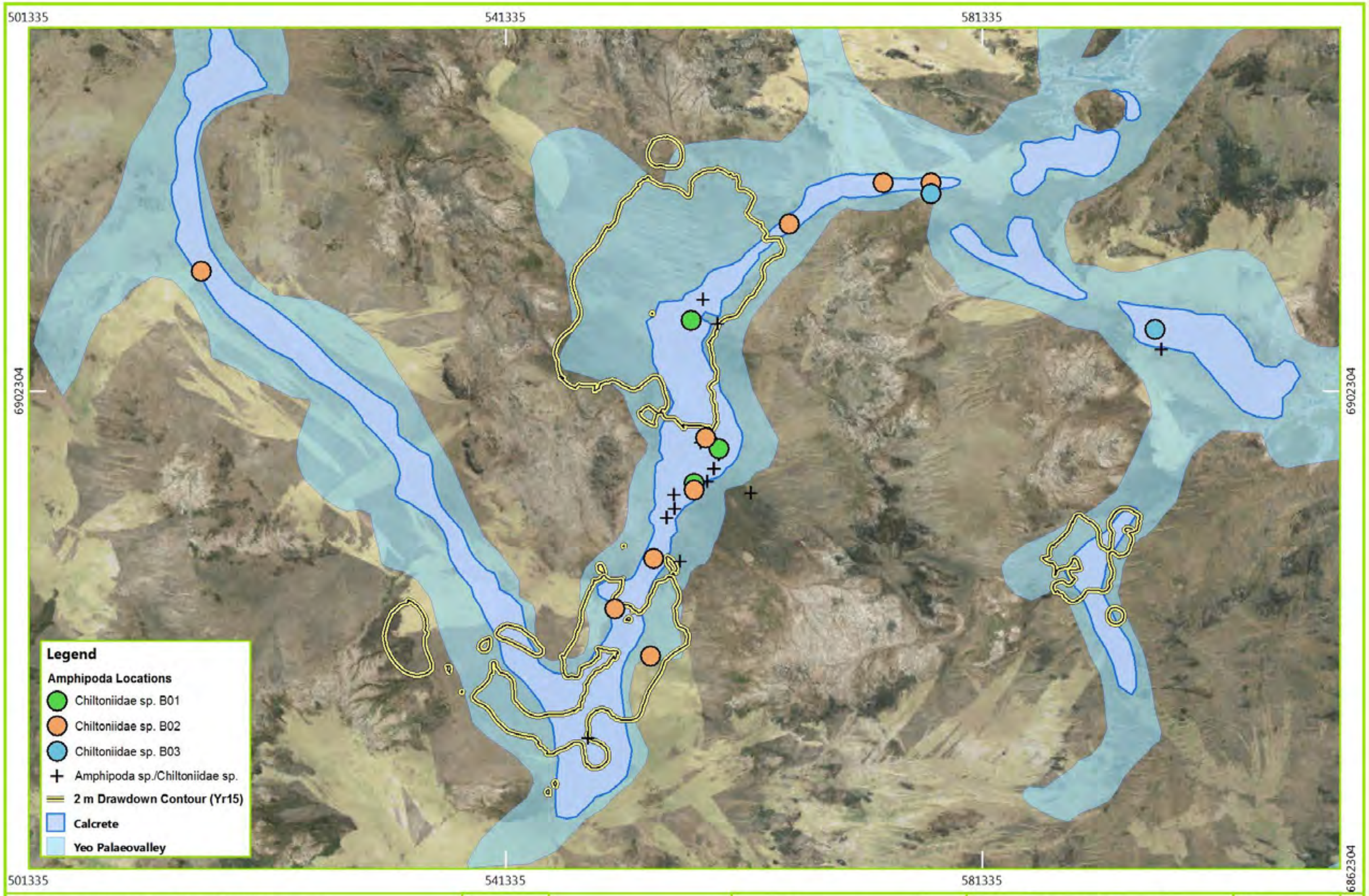


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.

Scale 1:500000 (0 5 10 km)
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A
Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Other Annelida Worms

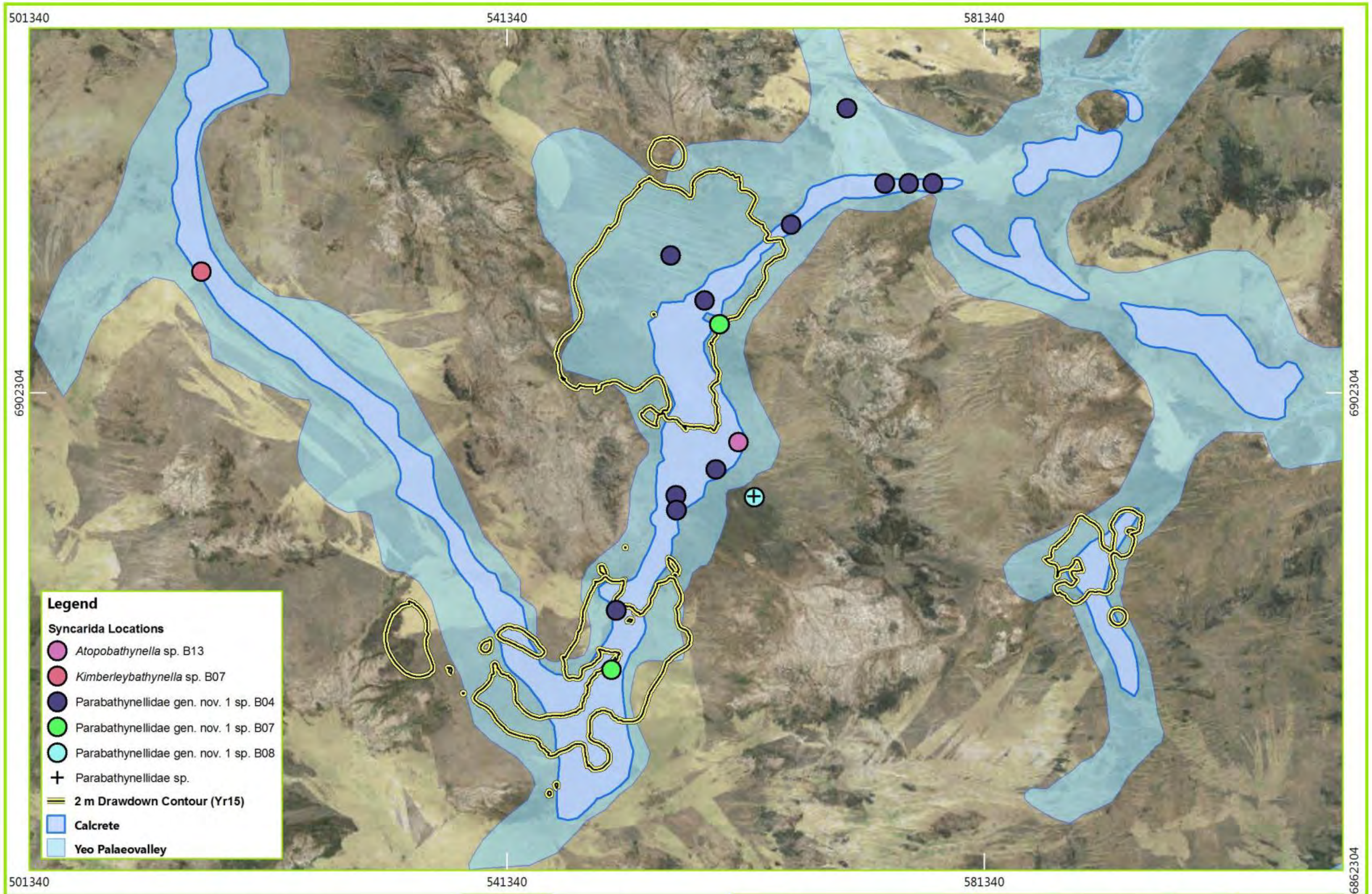
Figure: **9**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

Distribution of Chiltoniidae Amphipoda

Figure: **10**

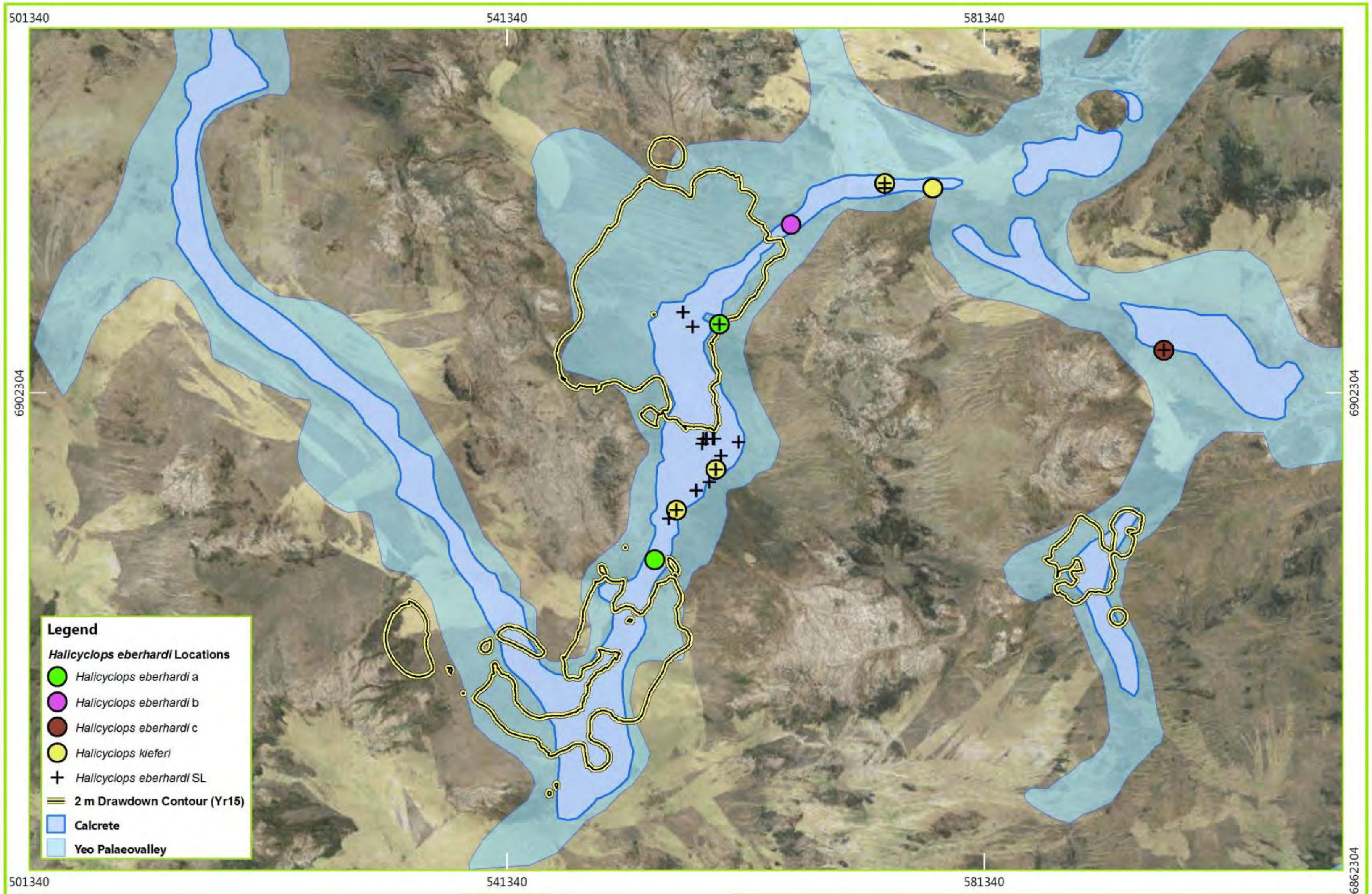


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51)
Author: M. Curran
Date: 6 September 2016 Rev: A GRR\GRR_05\04_Report Maps\03_Species

Distribution of Parabathynellidae Syncarida

Figure: **11**

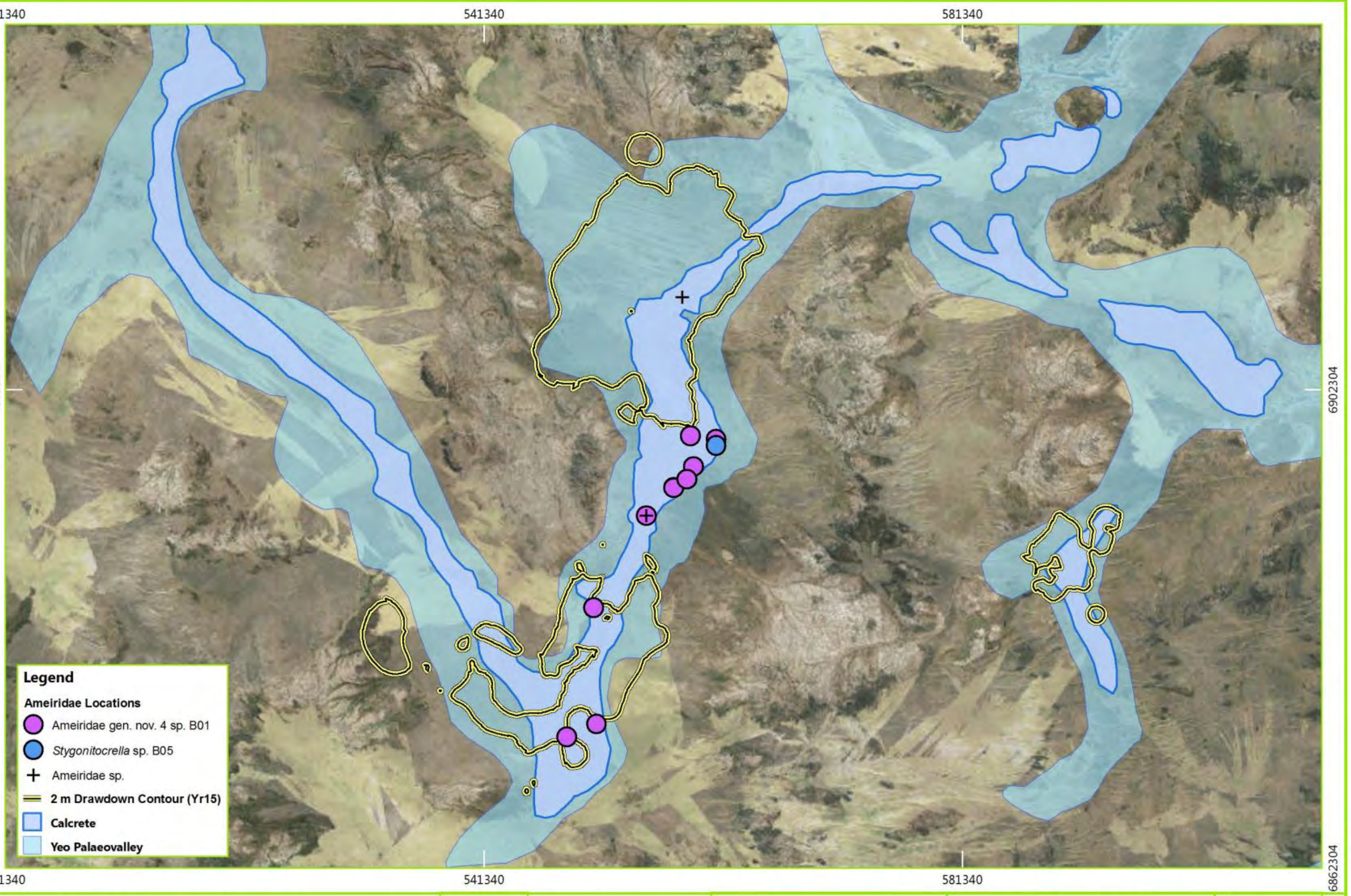


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51)
Date: 6 September 2016 Rev: A
Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of *Halicyclops eberhardi* Copepoda

Figure: **12**

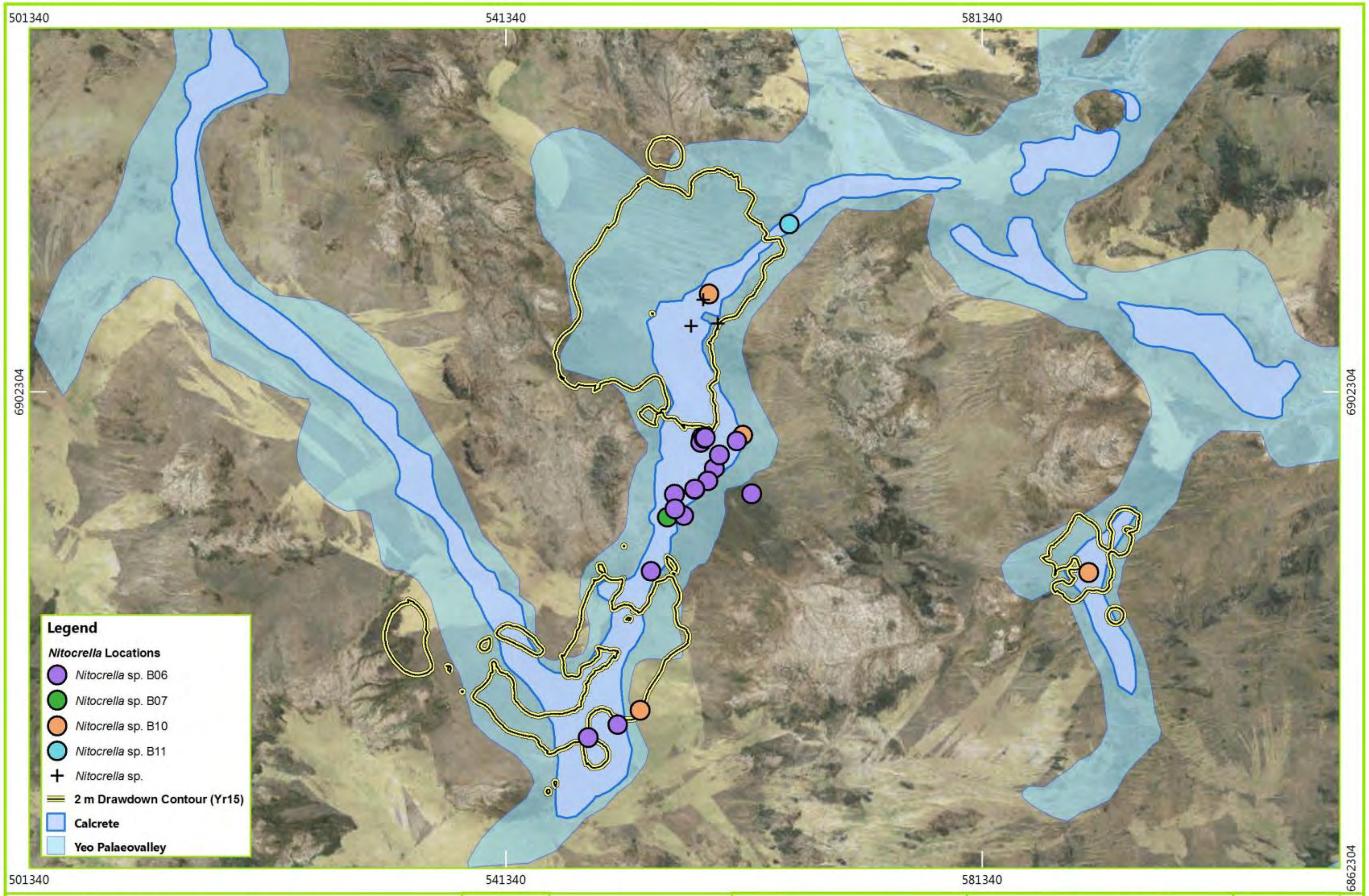


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51)
Date: 6 September 2016 Rev: A
Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Ameiridae Copepoda 1 of 4

Figure: **13**

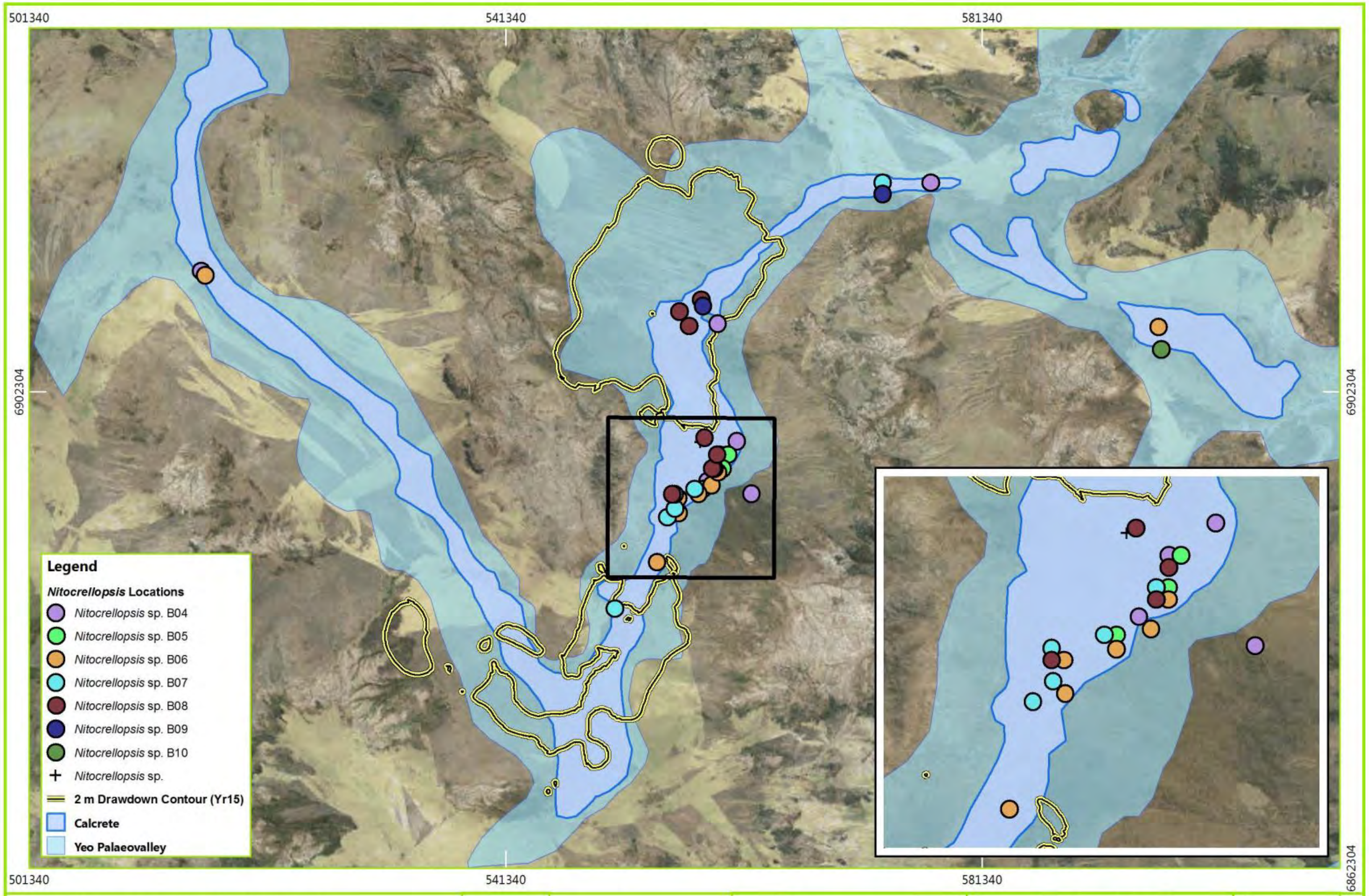


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51) | Author: M. Curran
Date: 6 September 2016 | Rev: A | GRR\GRR_05\04_Report Maps\03_Species

Distribution of Ameiridae Copepoda 2 of 4

Figure: **14**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

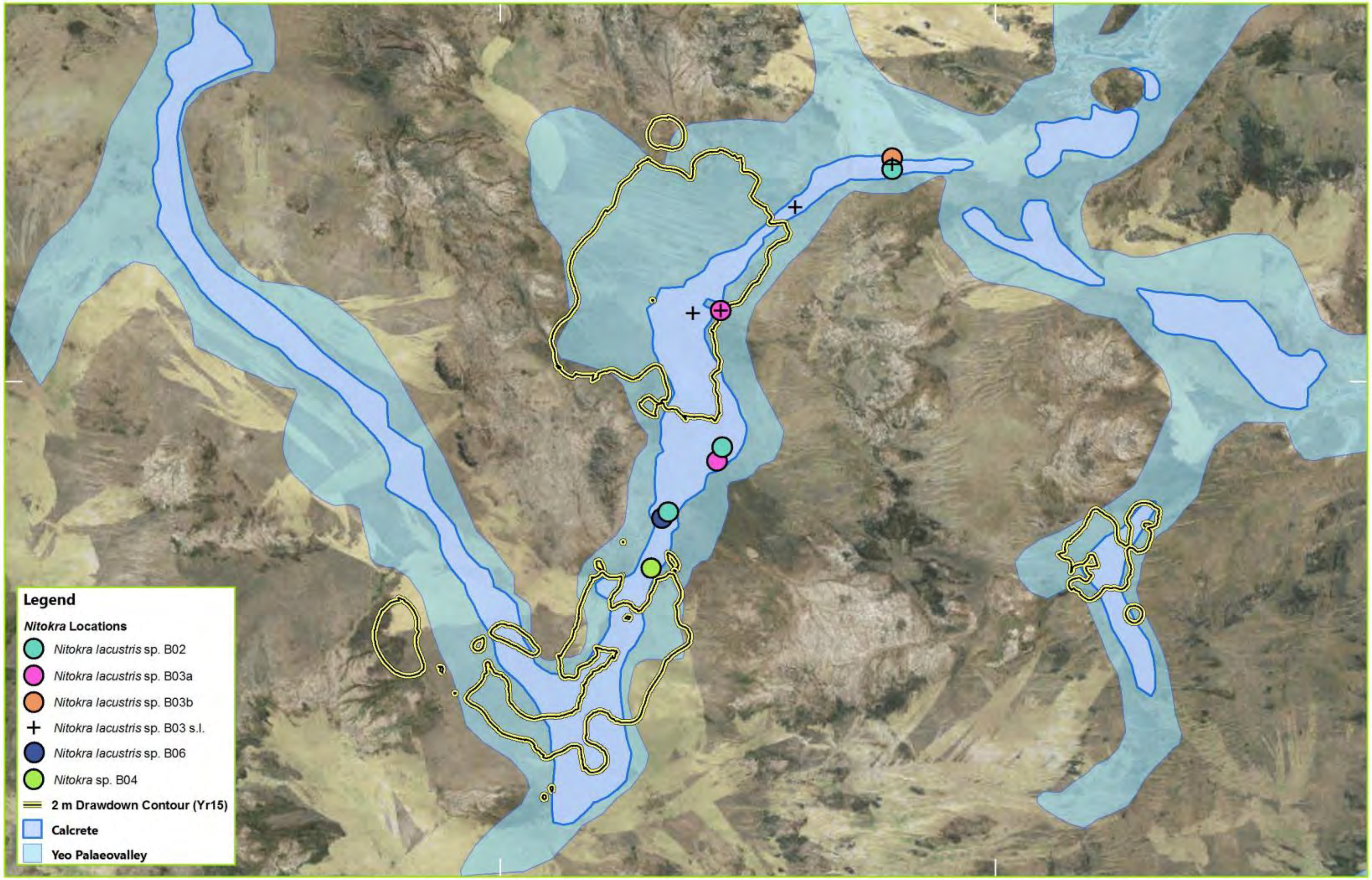
N

0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A

Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Ameiridae Copepoda 3 of 4

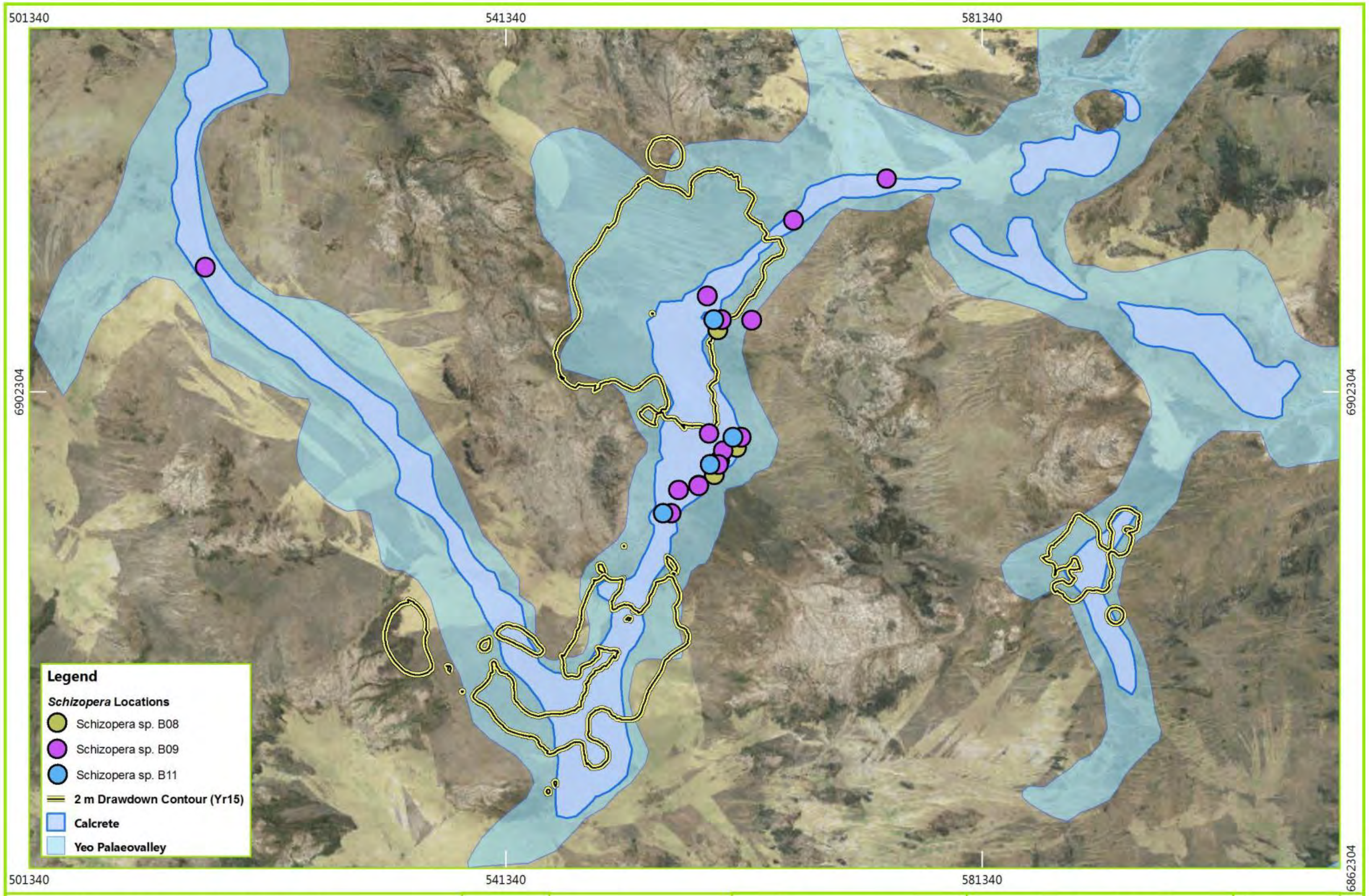
Figure: **15**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

Distribution of Ameiridae Copepoda 4 of 4

Figure: **16**

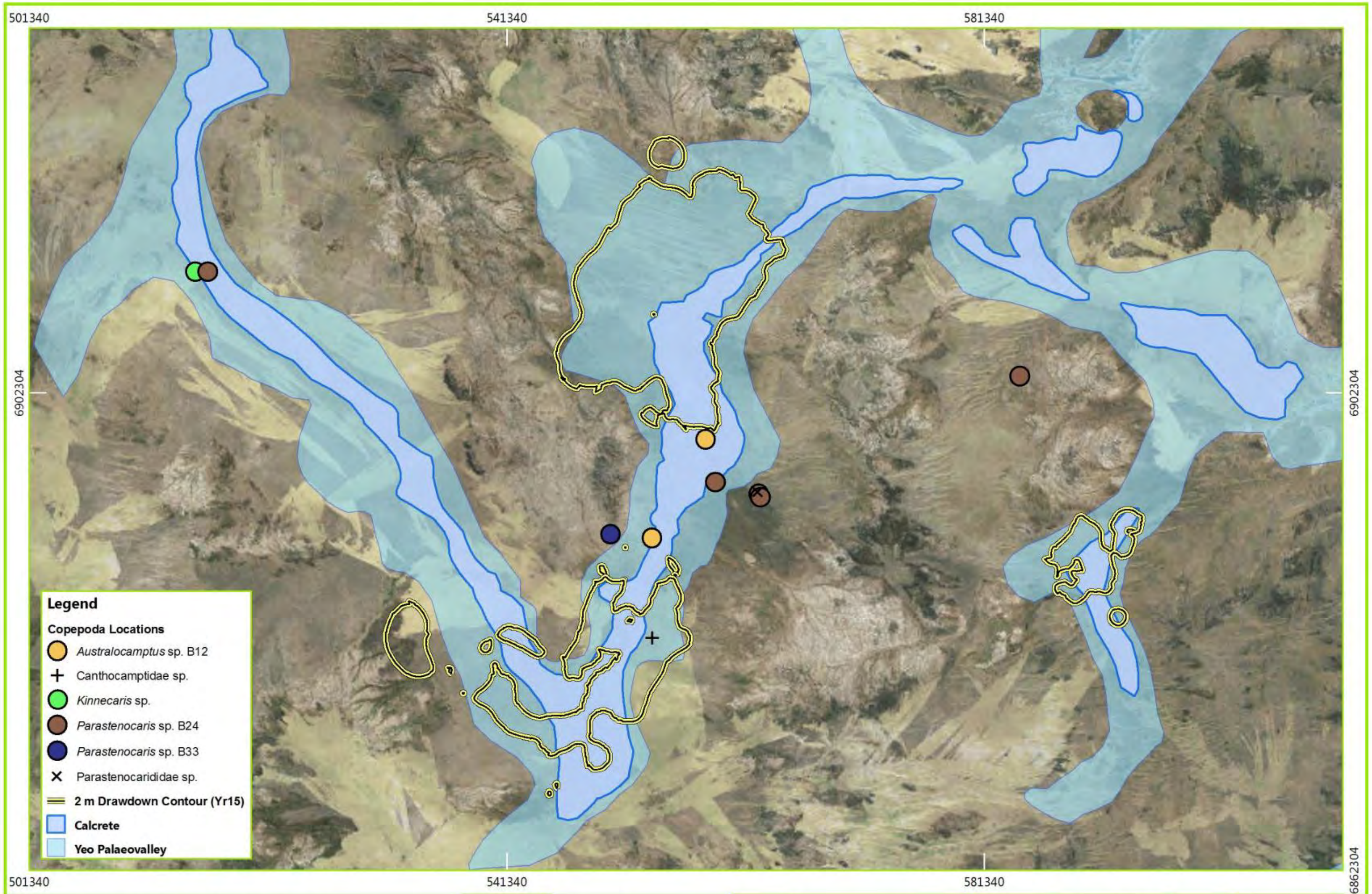


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51) | Author: M. Curran
Date: 6 September 2016 | Rev: A | GRR\GRR_05\04_Report Maps\03_Species

Distribution of Schizopera Copepoda

Figure: **17**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

N

0 5 10 km

Scale 1:500000

MGA94 (Zone 51)

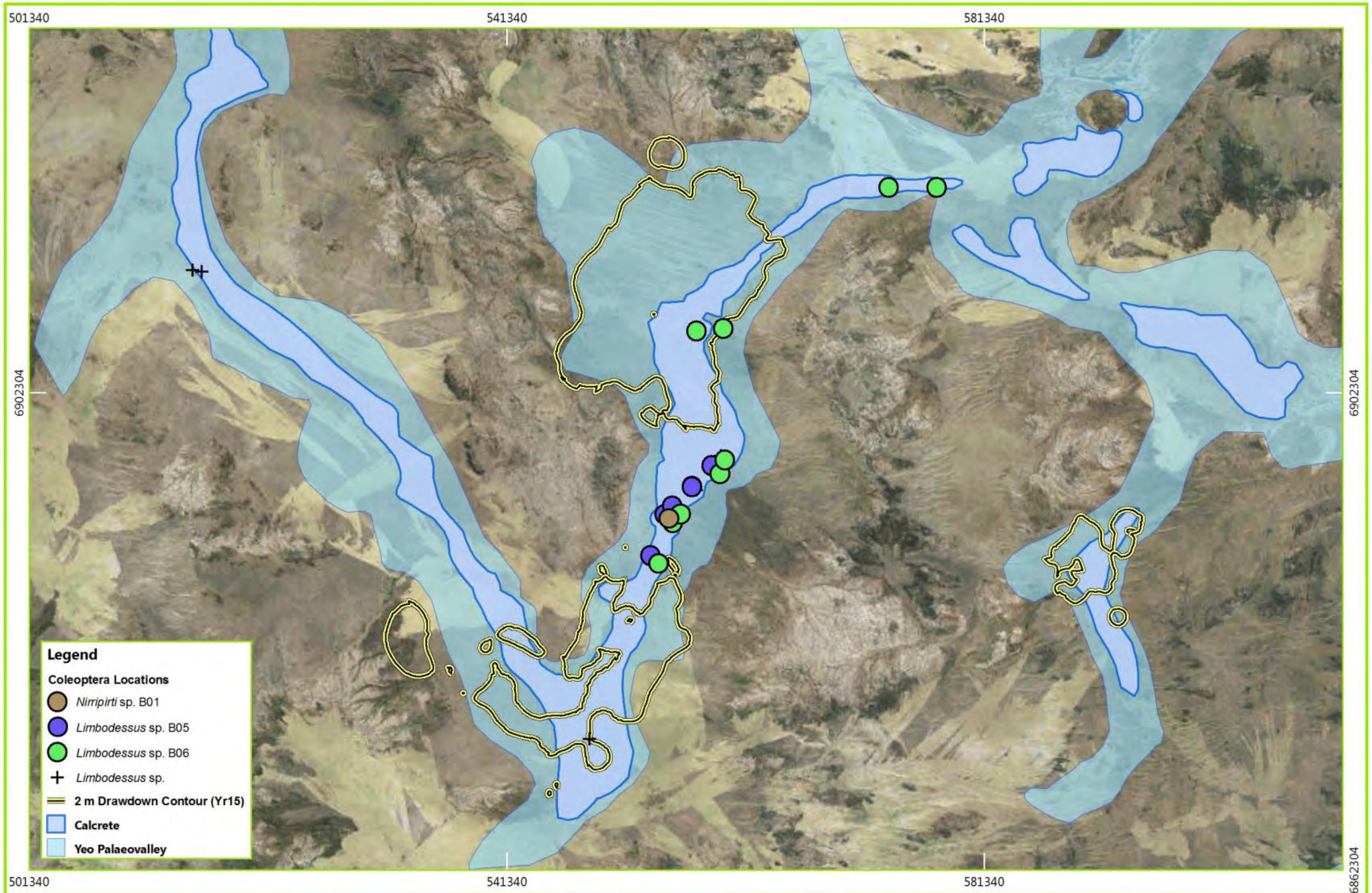
Date: 6 September 2016 Rev: A

Author: M. Curran

GRR\GRR_05\04_Report Maps\03_Species

Distribution of Canthocamptidae & Parastenocarididae

Figure: **18**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51) | Author: M. Curran
Date: 6 September 2016 | Rev: A | GRR\GRR_05\04_Report Maps\03_Species

Distribution of Dytiscidae Coleoptera

Figure: **19**

ions. Parabathynellidae gen. nov. 1 sp. B07 was collected as single specimens from both of the two proposed Yeo Borefields and is not known from outside these drawdown areas, although it is almost certain to occur in the intervening area (Figure 6). CO1 divergence between the two specimens was 1.0%.

The CO1 divergence between Parabathynellidae gen. nov. 1 sp. B04 and B07 was 14%.

Copepoda

The Yeo Palaeochannel is rich in copepods, with 33 species collected. None of these were recorded only in the proposed borefields (Figures 12 – 18), although the documentation of copepod species in this report is likely to have been affected to a small extent by the limited DNA analysis of copepods because of time constraints and the difficulties encountered extracting DNA from some of these small specimens. However, morphological identifications were correct for species such as *Schizopera* sp. B14 (3 specimens sequenced, 3.5% divergence) and *Nitocrella* sp. B06 (3 specimens, 3.2%). Furthermore, the pattern of occurrence in CO1-sequenced species suggests that copepods are likely to be found only in the borefields.

For example, while CO1 sequencing split the morphologically determined *Halicyclops eberhardi* into three species with 23 – 29% divergence and *Nitocrella* sp.B10 into *Nitocrella* sp. B10 and sp. B11 with 22% divergence, only *Halicyclops eberhardi* sp. 'a' occurred in the Yeo Borefield and it was also found outside as well (Figure 12). *Nitocrella* sp. B10 is widespread in the Yeo Borefield and other parts of the palaeochannel, with a linear range along the channel of 200 km, while *Nitocrella* sp. B11 was found outside the northern section of the Yeo Borefield (Figure 14).

Ostracoda

The single species of ostracod collected (*Sarscypridopsis* sp. BOS615) occurred outside, as well as in, the Yeo Borefield. Cypridopsid ostracods occur commonly in groundwater, usually with large ranges (Halse *et al*. 2014).

Coleoptera

Three species of dytiscid beetles were collected in the Yeo Palaeochannel, with *Limbodessus* sp. B06 occurring in the northern section of the Yeo Borefield and outside (Figure 19). It has a known linear range more than 40 km and the eight specimens sequenced had a divergence of only 0.71%. *Limbodessus* sp. B05 and *Nirripirti* sp. B01 were found only outside the proposed borefields.

6. DISCUSSION

Sixty-one species of stygofauna were recorded during sampling in the Yeo Palaeochannel in the vicinity of the Gruyere Gold Project. This represents a rich stygofauna community with a broad taxonomic composition dominated by copepods, as is typical of Yilgarn calcretes (e.g. MWH 2015; Bennelongia 2015).

Currently, three species are known only from within the Yeo Borefields. These species are:

- Enchytraeidae sp. B07 – known from a single animal in the northern section of the Yeo Borefield as a result of genetic analysis. Altogether, 159 specimens of enchytraeid sp. were collected in surveys and species were widely distributed in the Yeo Palaeochannel. Not all specimens could be sequenced (some were slide-mounted, some were considered unsuitable for DNA extraction and some of the specimens analysed did not yield DNA). It is considered highly likely that Enchytraeidae sp. B07 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.
- Enchytraeidae sp. B10 – known from a single animal in the northern section of the Yeo Borefield through genetic analysis. For the reasons outlined above for Enchytraeidae sp. B07,

it is considered highly likely that Enchytraeidae sp. B10 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.

- Parabathynellidae gen. nov. sp. B07 – known from two animals, one in the southern section and one in the northern section of the Yeo Borefield. The area between the two records is prospective stygofauna habitat and the species is almost certain to occur in this intervening area of highly prospective stygofauna habitat between the two sections of the Yeo Borefield.

In general, stygofauna species in the Yeo Palaeochannel appear to have relatively widespread occurrences for subterranean species in Yilgarn calcretes, with Chiltoniidae sp. B02 having a linear range of >100 km. This suggests that the subterranean habitat within the Yeo Palaeochannel is homogeneous and that, if the ranges of all species were fully documented, most species may occupy moderately large areas.

7. REFERENCES

Bennelongia (2013a) Yamarna Project, subterranean fauna assessment: desktop review and pilot-scale stygofauna survey. Report 2013/174. Bennelongia Pty Ltd, Jolimont, 15 pp.

Bennelongia (2013b) Yamarna Project subterranean fauna assessment. Report 2013/199. Bennelongia Pty Ltd, Jolimont, 37 pp.

Bennelongia (2015) Yeelirrie subterranean fauna assessment. Report 2015/236. Bennelongia Environmental Consultants Pty Ltd, Jolimont, 33pp.

Bennelongia (2016) Gruyere Gold Project: borefields stygofauna assessment. Report 2016/257. Bennelongia Environmental Consultants Pty Ltd, Jolimont, 21pp.

Cooper, S.J.B., Hinze, S., Leys, R., Watts, C.H.S., and Humphreys, W.F. (2002) Islands under the desert: molecular systematics and evolutionary origins of stygobitic water beetles (Coleoptera: Dytiscidae) from central Western Australia. *Invertebrate Systematics* **16**, 589-598.

DPaW (2015) Priority ecological communities and threatened ecological communities endorsed by the Minister of the Environment. Lists from June 2015 are available online at: https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities.

Eberhard, S.M., Halse, S.A., Scanlon, M.D., Cocking, J.S., and Barron, H.J. (2005) Assessment and conservation of aquatic life in the subsurface of the Pilbara region, Western Australia. In: J Gibert (Ed.), World Subterranean Biodiversity. Proceedings of an International Symposium, 8th - 10th December 2004, Villeurbanne, France. University Claude Bernard of Lyon 1, PASCALIS European Research Programme, Lyon, pp. 61-68.

EPA (2007) Sampling methods and survey considerations for subterranean fauna in Western Australia (Technical Appendix to Guidance Statement No. 54). Guidance Statement 54A (Draft). Environmental Protection Authority, Perth, 32 pp.

EPA (2013) Consideration of subterranean fauna in environmental impact assessment in WA. Environmental Assessment Guideline 12, Environmental Protection Authority, Perth, 20 pp.

Fisher, R.A., Corbet, A.S., and Williams, C.B. (1943) The relation between the number of species and the number of individuals in a random sample of an animal population. *Journal of Animal Ecology* **12**, 42-58.

Folmer, O., Black, M., Hoeh, W., Lutz, R., and Vrijenoek, R. (1994). DNA primers for amplification of mitochondrial cytochrome c oxidase subunit 1 from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* **3**, 294–299.

Gibert, J. and Deharveng, L. (2002) Subterranean ecosystems: a truncated functional biodiversity. *BioScience* **52**: 473-481.

Guzik, M.T., Abrams, K.M., Cooper, S.J.B., Humphreys, W.F., Cho, J.-L. and Austin, A.D. (2008) Phylogeography of the ancient Parabathynellidae (Crustacea: Bathynellacea) from the Yilgarn region of Western Australia. *Invertebrate Systematics* **22**, 205–216.

Halse, S.A., Scanlon, M.D., Cocking, J.S., H.J., B., Richardson, J.B., and Eberhard, S.M. (2014) Pilbara stygofauna: deep groundwater of an arid landscape contains globally significant radiation of biodiversity. *Records of the Western Australian Museum Supplement* **78**, 443-483.

Hebert, P.D.N., Ratnasingham, S., and deWaard, J.R. (2003) Barcoding animal life: cytochrome c oxidase subunit 1 divergences among closely related species. *Proceedings of the Royal Society B (Supplement)* **270**, S96–S99.

Karanovic, T. (2004) Subterranean copepods (Crustacea: Copepoda) from arid Western Australia. *Crustacean Monographs*, **3**, 1-366.

Karanovic, T., and Cooper, S.J.B. (2011) Molecular and morphological evidence for short range endemism in the *Kinnecaris solitaria* complex (Copepoda: Parastenocarididae), with descriptions of seven new species. *Zootaxa* **3026**, 1-64.

Karanovic, T., Eberhard, S., Cooper, S.B., and Guzik, M. (2014) Morphological and molecular study of the genus *Nitokra* (Crustacea, Copepoda, Harpacticoida) in a small palaeochannel in Western Australia. *Organisms Diversity & Evolution*, 1-35.

Lefébure, T., Douady, C.J., Gouy, M., and Gibert, J. (2006) Relationship between morphological taxonomy and molecular divergence within Crustacea: Proposal of a molecular threshold to help species delimitation. *Molecular Phylogenetics and Evolution* **40**, 435-447.

MBS (2015) Gruyere Project Level 1 subterranean fauna survey. Martnick Bosch Sell Pty Ltd, West Perth, 21 pp. + appendices.

MWH (2015) Wiluna Uranium Project: Millipede targeted subterranean fauna assessment. MWH, Jolimont, 53 pp + appendices.

Outback Ecology (2012) Lake Maitland Uranium Project, Level 2 troglofauna assessment. Outback Ecology Services, Jolimont, 87 pp.

Novo, M., Almodóvar, A., and Díaz-Cosín, D.J. (2009) High genetic divergence of hormogastrid earthworms (Annelida, Oligochaeta) in the central Iberian Peninsula: evolutionary and demographic implications. *Zoologica Scripta* **38**, 537–552.

Pearson, R.G., Raxworthy, C.J., Nakamura, M., and Peterson, A.T. (2007) Predicting species distributions from small numbers of occurrence records: a test case using cryptic geckos in Madagascar. *Journal of Biogeography* **34**, 102-117.

Pennington Scott (2012) Gold Road Resources H3 Hydrogeological Report, Yeo Palaeochannel Borefield. Pennington Scott, Herdsman, 145 pp.

Pennington Scott (2016) Hydrolgeogy summary: Gruyere Project. Pennington Scott, Herdsman, 26 pp.

Reeves J., De Deckker P., and Halse S.A. (2007) Groundwater ostracods from the arid Pilbara region of northwestern Australia: distribution and water chemistry. *Hydrobiologia* **585**, 99–118.

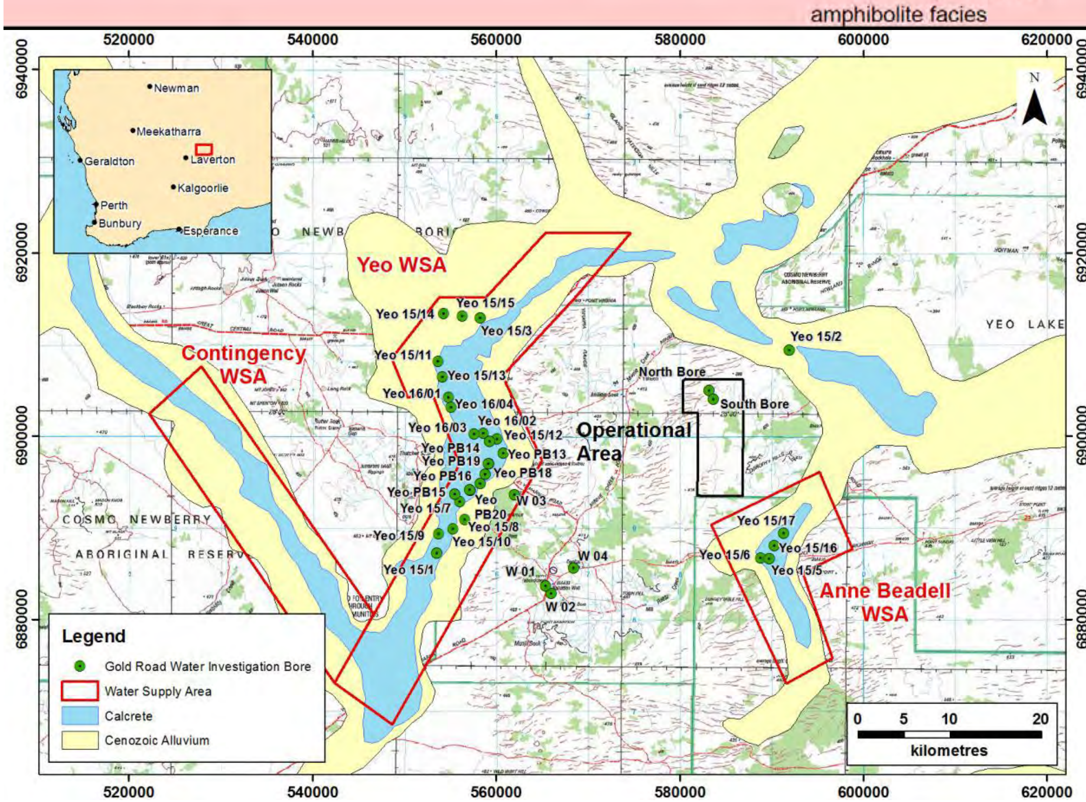
Runyan, C.W., and D'Odorico, P. (2010) Ecohydrological feedbacks between salt accumulation and vegetation dynamics: Role of vegetation-groundwater interactions. *Water Resources Research* **46**, doi 10.1029/2010WR009464.

Watts, C.H.S. and Humphreys, W.F. (2006) Twenty-six new Dytiscidae (Coleoptera) of the genera *Limbodessus* Guignot and *Nirripirti* Watts and Humphreys, from underground waters in Australia. *Transactions of the Royal Society of Australia* **130**, 123-185.

APPENDICES

Appendix 1. Stratigraphy of the Yeo Palaeochannel (Upper Panel); Pre-quaternary geology in the Project Area (Lower Panel)

Era	Period/Epoch	Formation	Unit	Lithology
Cenozoic	Quaternary *Pleistocene–Holocene <2.6 Ma*		Alluvial & lacustrine	Clay, silt & sand; saline, gypsiferous, evaporite deposits
			Eolian sandplain and dune	Sand
	Neogene *Late Oligocene to Miocene (~24-5.3Ma)*	Perkolilli Shale	Palaeochannel deposits	Clay, silt and sand with calcrete
	Paleogene *Late-Middle To Late Eocene (~40-34 Ma)*	Werillup Formation	Palaeochannel deposits	Gravel, sand, silt and clay with lignite
Palaeozoic	Permian *(~300Ma)*	Patterson Formation	Glacio-fluvial	Coarse sand & gravel with basal matrix-supported conglomerate
			Glacio-lacustrine	Clay, silt and minor sand
Archean	Neoarchaen *(2500 – 2800 Ma)*	Yamarna Domain	Granite	Gneissic granitoid
			Yamarna – Mount Gill Greenstone Belt	Felsic – mafic and ultramafic igneous, and sedimentary rocks; greenschist to amphibolite facies



From Pennington Scott (2012, 2016)

Appendix 2. Bores sampled for stygofauna

Bore Codes	Latitude	Longitude
11THAC013	-27.8444167	123.782
11THAC043	-27.8481389	123.741417
11THAC135	-27.94925	123.973833
12ALRC0117	-28.0806111	123.63075
15GYWB0003	-27.9122778	123.152694
15GYWB0004	-28.1330278	123.513944
15GYWB0005	-28.129709	123.547119
15GYWB0006	-28.097494	123.573218
15GYWB0007	-28.113868	123.573479
15GYWB0008	-28.0725278	123.971389
15GYWB0009	-27.96925	123.979778
15GYWB0010	-28.2787222	123.466917
15GYWB0011	-28.2656667	123.492167
15GYWB0012	-28.2494722	123.531028
15MNAC0169	-28.1233889	123.887722
15MNAC0187	-28.1233333	123.924444
15MNAC0206	-28.1378761	123.893015
16GYWB0001	-28.2561467	123.51724
16GYWB0002	-28.2228829	123.545157
16GYWB0003	-28.20371	123.545172
16GYWB0004	-28.2036244	123.561862
16GYWB0005	-28.1888975	123.545026
16GYWB0006	-28.1692643	123.544997
16GYWB0007	-28.1499371	123.545174
16GYWB0008	-28.1337713	123.59061
16GYWB0009	-28.1319525	123.570316
16GYWB0010	-28.0968067	123.544682
16GYWB0011	-28.1135153	123.544736
16GYWB0012	-27.8999482	123.559493
16GYWB0013	-27.9163229	123.574984
16GYWB0014	-27.8947937	123.670733
16GYWB0015	-27.9337592	123.588777
16GYWB0016	-27.9537538	123.578242
16GYWB0017	-27.9519622	123.626632
16GYWB0018	-27.9672435	123.614967
16GYWB0019	-27.9518864	123.601125
16GYWB0020	-27.9089091	123.682364
16GYWB0021	-28.133065	123.488044
16GYWB0022	-28.133254	123.508045
16GYWB0023	-28.1680799	123.514271
16GYWB0024	-28.205813	123.478022
16GYWB0025	-28.2132383	123.510778
16GYWB0026	-28.2116568	123.508977
16GYWB0027	-28.1675731	123.512353
16GYWB0028	-28.096222	123.366028
16GYWB0029	-27.8442972	123.782002
16GYWB0030	-27.8479078	123.782028
16GYWB0031	-27.8444108	123.761692
16GYWB0032	-27.7512141	123.690349
16GYWB0033	-27.7693938	123.688892
16GYWB0034	-27.7881651	123.70866
16GYWB0035	-27.8445214	123.741381
16GYWB0036	-27.848132	123.741406
16GYWB0037	-27.8639854	123.639939
16GYWB0038	-27.8761061	123.661709
16GYWB0041	-28.1659021	123.930323
16GYWB0042	-28.078979	123.914658
16GYWB0043	-28.08027	123.946545
16GYWB0044	-27.952001	123.524577

Bore Codes	Latitude	Longitude
16GYWB0045	-27.952147	123.499966
16GYWB0046	-27.923262	123.511552
16GYWB0047	-27.923226	123.511551
16GYWB0048	-27.892185	123.529765
16GYWB0049	-27.865371	123.528324
16GYWB0052	-27.8787112	123.547598
16GYWB0053	-28.132943	123.528042
AC267	-28.0384444	123.590194
AC268	-28.0383889	123.591056
AC269	-28.0383889	123.592139
AC270	-28.0384167	123.593167
AC271	-28.03825	123.595194
AC272	-28.0382778	123.597139
AC273	-28.0383611	123.596194
AC280	-28.0383889	123.588056
AC283	-28.0420833	123.587194
Bluey	-28.0805556	123.630917
Browns Well	-27.9936882	123.394807
FYRC051	-27.94275	123.570306
LIMESTONE MRD BORE	-27.9131662	123.160514
Near Mt Venn Bore	-28.1108889	123.509472
PB13	-28.0407222	123.618167
PB14	-28.0295556	123.603528
PB15	-28.0813056	123.564833
PB16	-28.0711389	123.593111
PB17	-28.0770833	123.581833
PB18	-28.0616389	123.59875
PB19	-28.0511667	123.602861
PB20	-28.0776667	123.581833
RC0022	-28.0839444	123.633222
RC0025	-28.0831389	123.632528
RC0044	-28.0805278	123.631778
RC0095	-28.0798333	123.630028
RC0096	-28.0798056	123.630139
RC0109	-28.0801111	123.630833
RC0110	-28.0805	123.630361
RC0151	-28.08225	123.631778
Sam Bore	-28.0962222	123.366028
TH01	-28.0094722	123.597944
TH02	-28.0095556	123.597028
TH03	-28.0095278	123.593889
TH04	-28.0095278	123.592944
TH05	-28.0095556	123.591889
TH06	-28.0094722	123.590917
TH07	-28.0095278	123.589833
W03	-28.0814722	123.63125
YE0008A	-28.0987222	123.558722
YEO 15/1	-28.1397715	123.5455
YEO 15/2	-27.9377418	123.934465
YEO 15/3	-27.9073933	123.592577
YEO 15/5	-28.1431947	123.914001
YEO 16/10	-27.957985	123.552472
Yeo 16/5	-28.1245124	123.545824
YUNK02	-27.9404444	123.571917
YUNK03	-28.0921111	123.565222
YUNK04	-28.0798056	123.630139

Appendix 3. Results of DNA analysis

A = number of animals for which DNA analysis was attempted; S = numbers of animals yielding a sequence. Percentage sequence differences within and between species are shown where appropriate.

			Difference (%)	
Species	**A**	**S**	**Intra**	**Inter**
Worms				
Enchytraeidae sp. B07	1	1	-	B10, 11.53
Enchytraeidae sp. B08	13	13	6.20	B09, 11.86
Enchytraeidae sp. B09	4	4	6.52	B12, 18.39
Enchytraeidae sp. B10	1	1	-	B12, 19.79
Enchytraeidae sp. B11	2	2	0.00	B08, 22.52
Enchytraeidae sp. B12	3	3	5.61	B13, 21.85
Enchytraeidae sp. B13	3	3	1.22	B08, 21.23
Enchytraeidae sp. B14	1	1	-	B15, 21.96
Enchytraeidae sp. B15	2	2	0.00	B12, 23.43
Tubificidae sp. B02	3	3	1.44	B07, 22.09; B10, 21.77
Oligochaeta sp.	8	0	-	-
Copepods				
Fierscyclops (Fierscyclops) fiersi	1	1	-	-
Halicyclops eberhardi a	2	2	4.61	b, 27.76; c, 25.45
Halicyclops eberhardi b	1	1	-	c, 23.01
Halicyclops eberhardi c	1	1	-	-
Nitocrella sp. B06	4	3	5.49	B10, 27.15; B11, 19.33
Nitocrella sp. B10	1	1	-	B11, 23.86
Nitocrella sp. B11	1	1	-	-
Nitocrellopsis sp. B04	3	2	10.46	B08, 51.68; B09, 27.02
Nitocrellopsis sp. B06	2	0	-	-
Nitocrellopsis sp. B07	1	0	-	-
Nitocrellopsis sp. B08	2	1	-	*N. lacustris* B06, 38.70
Nitocrellopsis sp. B09	2	1	-	*Nitocrella* B06, 24.10; B10, 20.76; B11, 24.23
Nitocrellopsis sp. B10	1	1	-	*Nitocrella* B06, 27.69; B10, 24.50; B11, 25.47
Ameiridae gen. nov. 4 sp. B01	2	1	-	*Nitocrella* B06, 26.34; B10, 22.81; B11, 23.43
Nitokra lacustris sp. B03a	2	2	0.00	B03b, 14.06; B06, 16.47
Nitokra lacustris sp. B03b	1	1	-	B06, 17.18
Nitokra lacustris sp. B06	1	1	-	-
Nitokra sp. B04	2	0	-	-
Schizopera sp. B08	1	1	-	B09, 24.00
Schizopera sp. B09	7	4	5.90	-
Schizopera sp. B11	3	0	-	-
Ostracods				
Sarscypridopsis sp. BOS615	2	2	-	-
Syncarids				
Parabathynellidae gen. nov. 1 sp. B04	12	11		
Parabathynellidae gen. nov. 1 sp. B07	2	2		
Parabathynellidae gen. nov. 1 sp. B08	1	1	-	
Amphipods				
Chiltoniidae sp. B01	4	4	2.88	B02, 16.26; B03, 12.98
Chiltoniidae sp. B02	11	11	8.62	B03, 15.32
Chiltoniidae sp. B03	2	2	1.86	-
Beetles				
Limbodessus sp. B05	1	1	-	B06, 7.21
Limbodessus sp. B06	8	8	1.34	-

APPENDIX 3: HYDROGEOLOGICAL MODELLING SYNOPSIS FOR API (PENNINGTON SCOTT 2016A)

Gold Road Resources

Hydrogeological Modelling Synopsis for API

Gruyere Gold Project

pennington scott
securing your water future

Gold Road Resources

Hydrogeological Modelling Synopsis for API

Gruyere Gold Project

2088 | Rev 0
30 Sept 2016

Pennington Scott ABN 76 747 052 070

GPO Box A10, Perth WA 6849
T +61 (0)8 9446 7090
www.penningtonscott.com.au

This report deals with and is based on geoscience data. Geoscience data are by their nature limited measurements, and interpretation of the data is necessarily based on interpolation, extrapolation and/or estimation. All interpretation of geoscience data therefore includes uncertainty. Substantial contingency for this uncertainty should be allowed for in any use of the information presented in this report.

REVISION	**ISSUED**	**DESCRIPTION**
Rev 0	30 Sep 2016	Issued to MBS for input to the API

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Gold Road Resources Limited (Gold Road) is seeking to develop the Gruyere Gold Project on the Yamarna Pastoral Station approximately 150 km ENE of Laverton in the Great Victoria Desert region of Western Australia (Figure 1-1). The project will include development of a 380m deep open pit, a 7.5 mtpa carbon in leach (CIL) plant and an integrated waste landform (IWL), referred to hereinafter as the "Project". The Project will be developed over a 15 year project life, which includes a 2 year construction phase, followed by a 13 year operational phase.

The bulk of the Project's raw process water during the operational phase will be sourced from a 65 km saline to hypersaline palaeochannel borefield located in Yeo Water Supply Area (WSA) in the Yeo palaeo-trunk drainage channel, 25 km west of the Project. Additional volumes will be taken for construction and for reverse osmosis treatment from the Anne Beadell Water Supply Area (WSA), located in a shallow palaeo-tributary channel 23 km southeast of the Project, and from dewatering and regional fractured rock bores.

This document provides a synopsis of the groundwater modelling of the palaeochannel borefield (Yeo and Anne Beadell) for input to the Environment Protection Authority's Assessment on Proponent Information (API) for the Project.

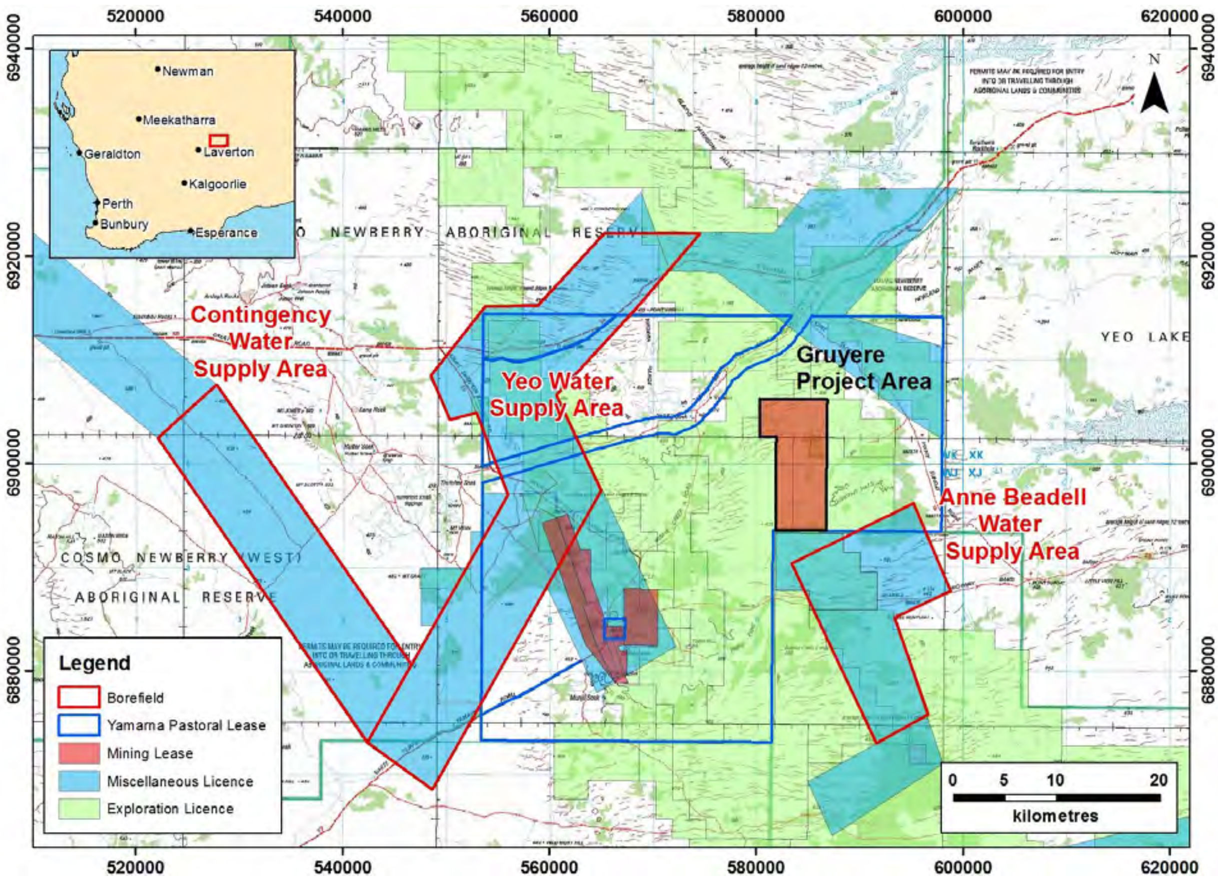


Figure 1-1 Location plan

1.1 Water requirements for the Project

A detailed water balance study was undertaken for the Project to quantify the water supply requirements. These are summarised in Table 1-1 below and provide the basis for the borefield simulation scenarios. The water balance study is documented in Pennington Scott (2016c).

Table 1-1 Proposed groundwater abstraction for the Project

	Water balance (GL/year)			
	Construction	Operations - startup	Operations - oxide	Operations - fresh
WATER BALANCE SOURCES	Years -2 to 0	Years 0 to 0.5	Years 0.5 to 2.5	Years 2.5 to 13
Anne Beadell Borefield to RO	0.4 to 0.1	0.3	0.3	0.3
Anne Beadell Borefield - construction makeup	0.1			
Regional Bores (central bore)	0.1			
Makeup water from Yeo Borefield		3.4 to 4.9	3.2 to 3.7	3.9 to 4.2
Pit dewatering/depressurisation bores	0.2 to 0.8	0.8 to 0.2	0.8 to 0.2	0.5 to 0.1
Supply bores in plant area	0.3 to 0.0			
Regional Bores	0.3	0.1	0.1	0.1
Total	**1.4**	**4.6 to 5.5**	**4.4 to 4.3**	**4.8 to 4.7**

1.2 Hydrogeological Investigations for the Project

This modelling information provided here is a short synopsis of the detailed modelling undertaken for the Project's Feasibility Study and documented in detail in Advisian (2015 and 2016). The modelling is one component of the Project's comprehensive hydrogeological feasibility assessment, documented in Pennington Scott (2016a). The extensive field investigations program supporting the feasibility assessment and modelling are documented in Pennington Scott (2016b) and included:

- 2,700 line kilometres of airborne helicopter XTEM time domain electromagnetic surveying over the Yeo Palaeochannel area;
- Construction of twenty six (26) mud rotary production bores in the Palaeochannel borefields;
- Construction of two (2) production dewatering bores and two (2) monitoring bores in fractured rock in the Project Area;
- Construction of four (4) production water supply bores in the fractured rock aquifer around Central Bore southwest of the Project Area;
- Down hole geophysical logging of twenty nine (29) bores using natural gamma to define the lithological stratification within the palaeochannel sediments;
- Hydraulic pump test and recovery analyses on thirty (30) production bores, two (2) dewatering bores, and two (2) fractured rock bores to determine intrinsic properties of the aquifer;
- Construction of nine (9) new dedicated monitoring bores, six bores completed with solar powered telemetry system;
- Construction of 63 new stygofauna sampling bores;
- Hydrochemical analysis of groundwater samples taken from selected bores; and
- A regional groundwater level survey of bores in the Project Area and historic third party investigation bores to define a regional water table surface.

2. MODEL OVERVIEW

The Yeo palaeochannel model was developed using the FEFLOW modelling software. FEFLOW was selected due to its finite element methodology which allows greater flexibility in model geometry to align with hydrogeological units.

2.1 Geometry

The model mesh and extent are shown in Figure 2-1. The model domain was selected to align with groundwater divides and flowlines, except where it crosses the palaeovalley where constant heads were used. These boundaries were selected to be sufficiently far from the borefield to avoid boundary effects.

The model comprises seven layers representing the key hydrogeological units, as follows:

- Fresh bedrock
- Weathered bedrock
- Werillup Formation – upper, middle and lower
- Perkolilli Shale
- Surficial

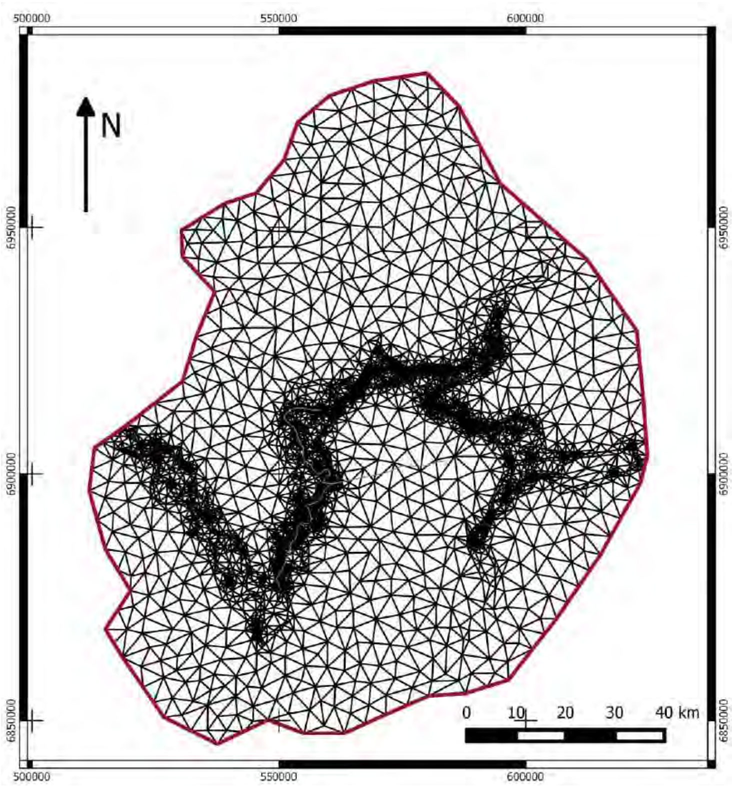


Figure 2-1 Model mesh

2.2 Parameters

Model parameterisation drew on the hydrogeological information gathered in the Project investigations, summarised in Section 1.2 and detailed in Pennington Scott (2016b). Steady state calibration was done to measured bore water levels and transient calibration was undertaken to pumping tests. The final calibrated model parameters are shown in Table 1-1 below and a comparison of observed versus modelled water levels in the steady state calibration is shown in Figure 2-2.

Note that, while the calibrated value of the vertical hydraulic conductivity (Kv) in the Perkolilli Shale was lower than 10^{-4} m/day in some areas, for conservativism in the Quaternary drawdown assessment, the Kv for the Perkolilli Shale has been set to a minimum of 10^{-4} m/day for the predictive scenarios.

Specific yield is a critical parameter for assessing drawdown impacts which cannot be determined from short-term pump tests because the aquifer needs to be substantially dewatered before this parameter has an impact and the "S" curve caused by delayed yield through the Perkolilli Shale can take several months to more than a year to develop. The most accurate measures of bulk Sy for the WA palaeochannels have been achieved, not through short/medium term pump testing; but through back analysis of years of borefield operational performance in several notable borefields. The bulk value of 3% for the palaeochannel sediments used here is based on the experience of Berry (1997) in the Albion Downs palaeochannel, Anaconda Nickel Limited (2000) in the Roy Valais palaeochannel and Kevin Morgan & Associates in the Raeside paleochannel (WAMW 2000) among others.

Table 2-1 Model values for hydraulic parameters

Unit	Description	K_h (m/d)		K_v (m/d)		Sy (%)	Ss	
		Min	Max	Min	Max		Min	Max
Quaternary	Poorly sorted gravel and sand with well developed calcrete in locations	0.34	5.1	2.7×10^{-4}	0.025	3	-	-
Perkolilli Shale	Clay with occasional sand layers	0.1	0.34	*5×10^{-5}	2.9×10^{-4}	3	7.8×10^{-6}	2.0×10^{-5}
Werillup Fm	Interbedded sand, gravel and clay with basal channel gravel and sands	0.1	9.0	1.4×10^{-5}	0.036	3	1.4×10^{-6}	4.4×10^{-5}
Saprolite and Saprock	Predominantly clay profile and fractured bedrock	0.027		5×10^{-4}		0.1	1.0×10^{-4}	
Bedrock		4.1×10^{-3}		5.9×10^{-4}		0.1	6.2×10^{-4}	

*For conservatism, the lower bound of the Kv for the Perkolilli Shale was set to 1×10^{-4} for predictive scenarios.

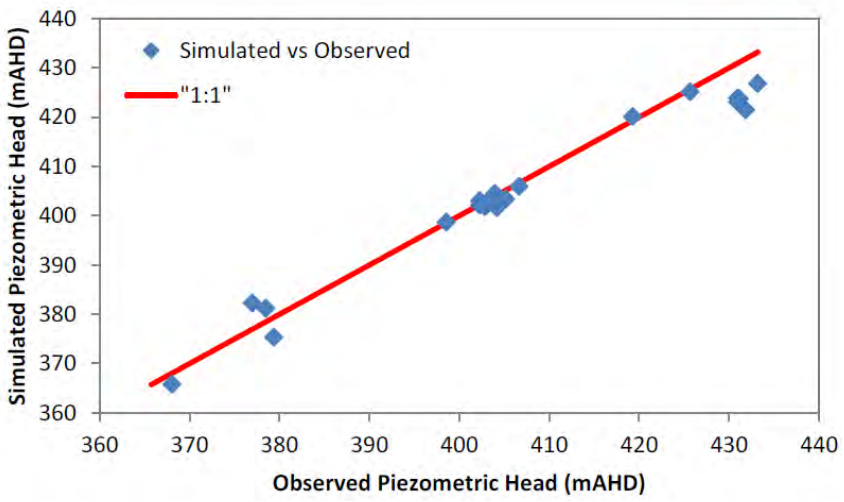


Figure 2-2 Observed versus modelled water levels for steady state calibration

2.3 Boundaries

Specific heads were used at the palaeochannel system boundaries. Evaporation was included in areas of shallow water table, and one-way constant heads were set at salt lakes to represent discharge.

In the initial calibrated model, constant recharge rates were applied in six zones relating to the hydrogeological units and surface water features (Table 2-2). In a second revision of the model which was used to simulate the drawdowns, to better reflect actual recharge processes in the valley areas, this zonal recharge was supplemented with episodic recharge in low-lying areas subject to inundation.

Estimation of the episodic recharge involved development of a rainfall runoff model using XP-Storm for the catchment contributing runoff to the major watercourse in the palaeochannel area. The model was then used to simulate 1, 2, 5 and 10 year Average Recurrence Interval (ARI) events. These were then modelled in a hydraulic model to estimate the depth, extent and duration of flooding which was in turn compared to the depth to water table to assess potential recharge in these areas. Based on these surface water model results, a synthetic series of episodic recharge comprising the 1, 2, 5 and 10 year events was incorporated into the model over the life of mine scenarios.

Table 2-2 Recharge rates in model

Unit	Recharge (mm/year)
Bedrock	0.16
Bedrock – weathered	0.32
Paterson Formation	1.0
Calcrete	1.1
Surficial Palaeochannel Sediments	3.6
Surface pools	44
Low-lying calcrete areas subject to inundation	Variable, based on episodic surface water modelling

3. MODEL RESULTS & INTERPRETATION

3.1 Drawdowns

Two simulations were run over the life of mine, one with no abstraction and one with the proposed palaeochannel borefield abstraction volumes shown in Table 1-1. Drawdowns were then calculated as the difference between the final water levels in the two simulations. Modelled drawdowns for slice 2, representing the shallow Quaternary Alluvial and Calcrete Aquifer, and for slice 5, representing the pumped Werillup Formation are shown in Figure 3-1 and Figure 3-2.

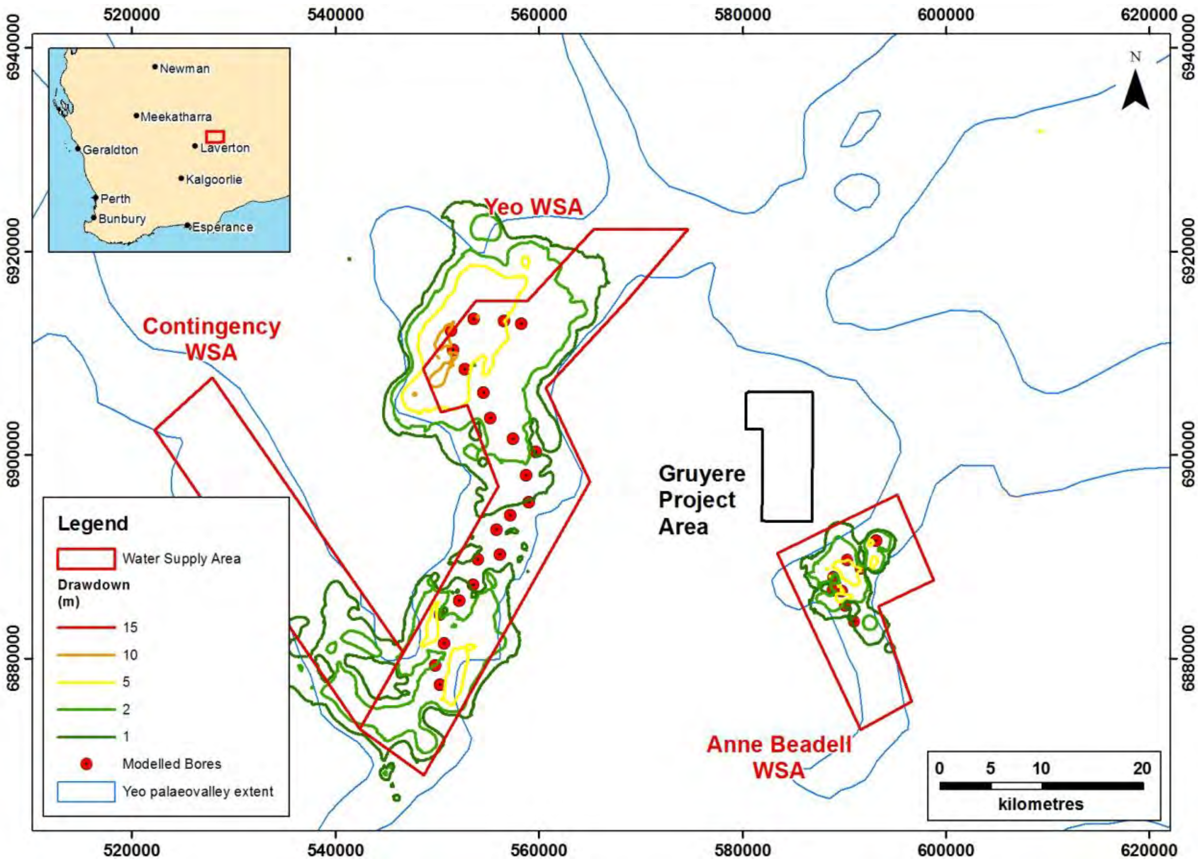


Figure 3-1 Modelled drawdown at year 15 (end of mining) for the Quaternary Alluvial and Calcrete Aquifer (Slice 2)

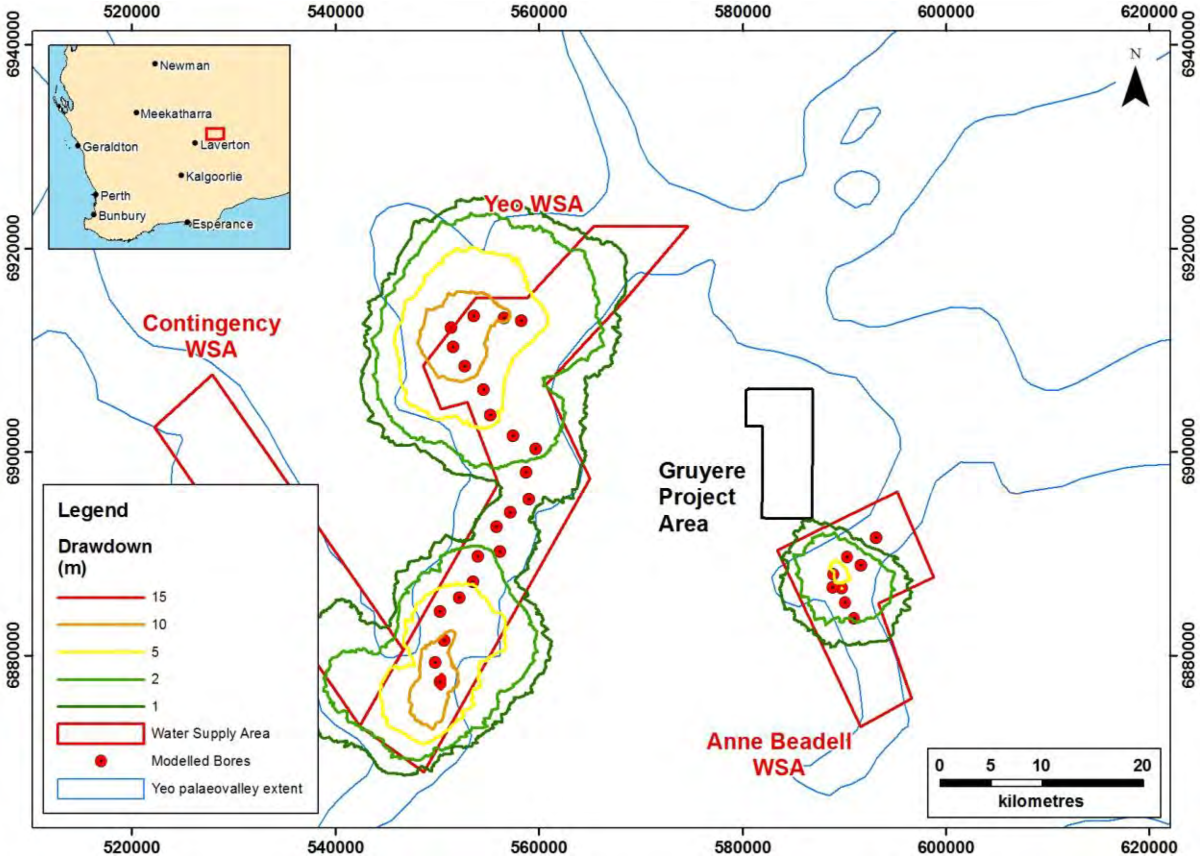


Figure 3-2 Modelled drawdown at year 15 (end of mining) for the Werillup Formation (Slice 5)

3.2 Change in Quaternary Aquifer Saturated Thickness

For input to the assessment of stygofauna habitat as part of the API, a surface of saturated thickness of the Quaternary Alluvial and Calcrete Aquifer was prepared. This used detailed LiDAR digital elevation data collected by Gold Road as part of the Feasibility Study. The spatial distribution of Quaternary saturated thickness was calculated using raster manipulation in ArcGIS as follows:

- A water table elevation surface was created through expert interpolation by a hydrogeologist of available water level data from the Project's investigation bores and other regional bore data, taking into account hydrogeological boundaries and other features;
- A surface of base elevation of the Quaternary Alluvial and Calcrete Aquifer was prepared through expert interpolation of the logged base of the aquifer from all of the investigation bores constructed for the Project that penetrated this unit;
- The base elevation raster was then subtracted from the water table elevation raster to give the saturated thickness.

The resulting saturated thickness of the Quaternary Alluvial and Calcrete Aquifer is shown in Figure 3-3. The predicted drawdowns from the modelling were then subtracted from the saturated thickness raster to give a predicted saturated thickness at the end of mining, as shown in Figure 3-4.

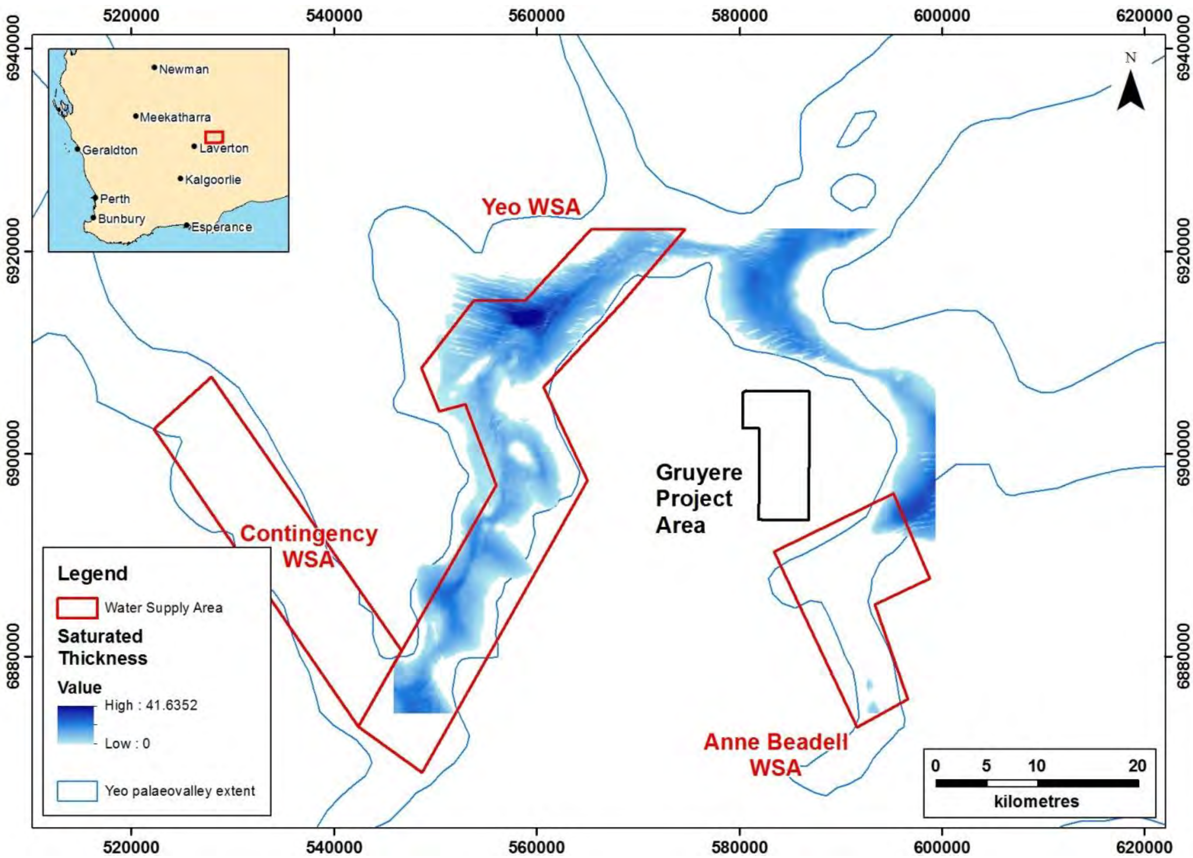


Figure 3-3 Interpreted saturated thickness of the Quaternary Alluvial and Calcrete Aquifer

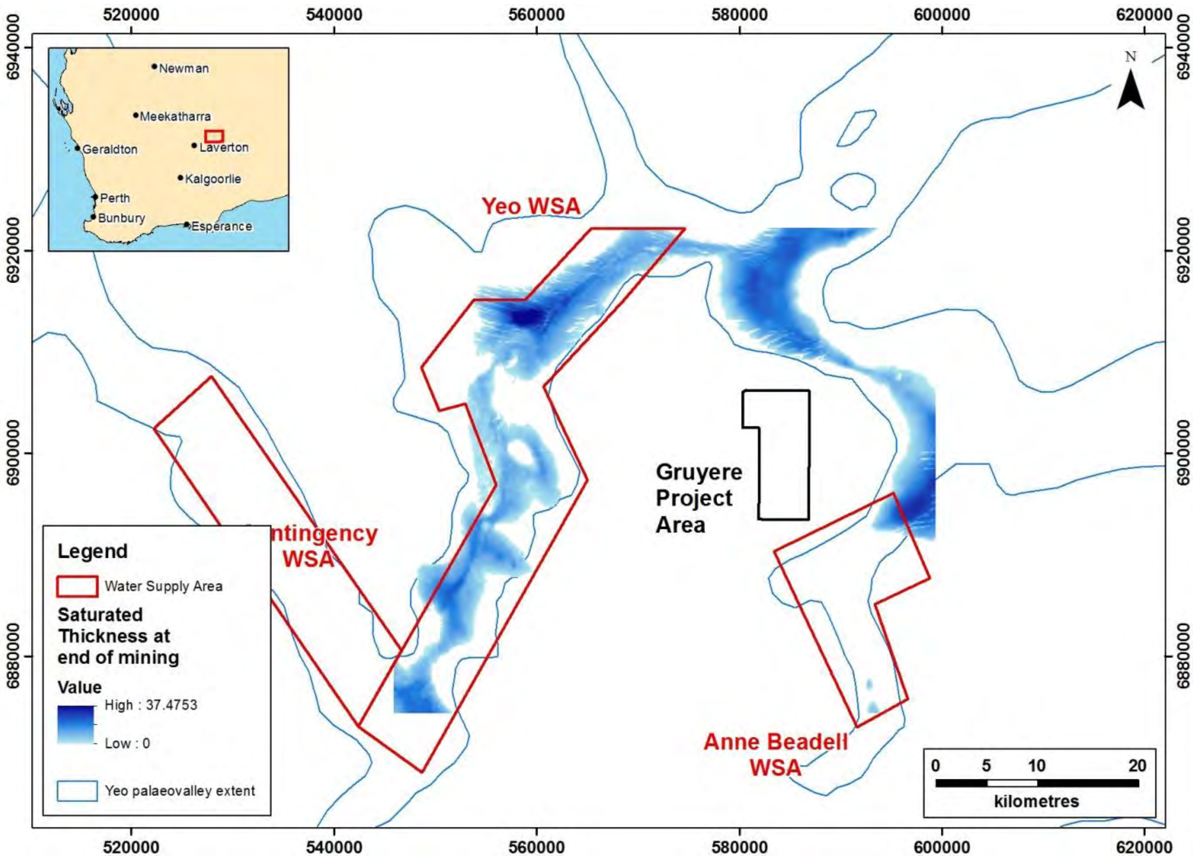


Figure 3-4 Predicted saturated thickness of the Quaternary Alluvial and Calcrete Aquifer at the end of mining

4. REFERENCES

Advisian. 2015. Gruyere Mine Hydrogeological Modelling. Project 201320-08283. Rev. 0. 30 Nov 15.

Advisian. 2016. Gruyere Mine. Yeo Palaeochannel Recharge Investigation. Rev C. 16 Mar 2016.

Anaconda Nickel NL. 2000. Roy/Valais Borefield Aquifer Review Report for 1999/2000. Internal company report to DoW.

Berry, K. 1997. Albion Downs borefield review and update of numerical model, preliminary report. WMC Resources Limited.

Pennington Scott. 2016a. Feasibility Study Hydrogeological Investigations. Gruyere Gold Project. Prepared for Gold Road Resources. Rev 0. 1 July 2016.

Pennington Scott. 2016b. Attachment A. Field Investigation Completion Report. Gruyere Gold Project. Prepared for Gold Road Resources. Rev 3. 23 June 2016.

Pennington Scott. 2016c. Gruyere Project: Whole of project water balance assessment. Rev 0. 29 June 2016.

WA Wardens Court. 2001. Murrin Murrin East Pty Ltd v. Sons of Gwalia Ltd and Tarmoola (Australia) Pty Ltd [2001] WAMW Vol. 14 No. 22

APPENDIX 4: PRELIMINARY INTEGRATED GROUNDWATER AND SUBTERRANEAN FAUNA HABITAT MANAGEMENT PLAN

Gruyere Gold Project

Preliminary Integrated Groundwater and Subterranean Fauna Habitat Management Plan

Prepared for:

Gold Road Resources

October 2016

Prepared by:

Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005
Ph: (08) 9226 3166
Fax: (08) 9226 3177
Email: info@mbsenvironmental.com.au
Web: www.mbsenvironmental.com.au

GRUYERE GOLD PROJECT
PRELIMINARY INTEGRATED GROUNDWATER AND SUBTERRANEAN FAUNA HABITAT MANAGEMENT PLAN

Distribution List:

Company	Contact name	Copies	Date
Environmental Protection Authority	Peter Tapsell, Principal Environmental Officer Maree Heath, Environmental Officer EPA Registrar	[01] [Electronic]	4 October 2016
Gold Road Resources	Glenn Firth, Approvals Manager Sim Lau, Project Manager	[01] [Electronic]	4 October 2016

Document Control for Job Number: GRRGAPI

Document Status	Prepared By	Authorised By	Date
Draft Report for client review	Jonathon Barker	Kristy Sell	9 August 2016
Draft Report for Yilka review	Jonathon Barker	Kristy Sell	10 August 2016
Final Report	Jonathon Barker Nicole Garbin	Kristy Sell	4 October 2016

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

This Condition Preliminary Environmental Management Plan (Condition EMP) is submitted in accordance with the Assessment of Proponent Information (API) document for the Gruyere Gold Project which will be developed by Gold Road Resources Limited (Gold Road). As discussed with the Office of the Environmental Protection Authority (OEPA) on 29 September 2016 this Integrated Groundwater and Subterranean Fauna Habitat Management Plan is preliminary and will be developed over the construction phase of the project (approximately two years) as further baseline data is obtained.

Prior to the Yeo borefields being commissioned (for the operational phase of the Gruyere Gold Project) Gold Road will update this plan in consultation with the OEPA and Department of Water (DoW). As such this plan remains a working document.

The following table presents the environmental criteria to measure achievement of the conditioned environmental objective that must be met through implementation of this Condition EMP.

Environmental Management Targets

Title of Proposal	Gruyere Gold Project.
Proponent	Gold Road Resources Limited.
Purpose of this Condition EMP	The purpose of this Integrated Groundwater and Subterranean Fauna Habitat Management Plan is to provide information to assist the EPA in determining whether the EPA's objective for the Preliminary Environmental Factor can be met.
EPA's environmental objective for the key environmental factor/s	Subterranean Fauna - to maintain representation, diversity, viability and ecological function at the species, population and assemblage level.
Condition environmental outcome or proposed measurable outcome	Ensure that: • Subterranean fauna restricted to the Yeo Palaeochannel are protected. • Groundwater levels are maintained at appropriate levels that support subterranean fauna habitat. • Groundwater chemistry is maintained within acceptable limits for subterranean fauna survival.
Environmental Criteria	
Trigger Criteria (*proposal-specific)*	• *Trigger Criterion 1*: Groundwater level drawdown within groundwater/stygofauna monitoring bores. • *Trigger Criterion 2*: Groundwater quality within groundwater/stygofauna monitoring bores.
Threshold Criteria (*proposal-specific)*	• *Threshold Criterion 1*: Groundwater level drawdown within groundwater/stygofauna monitoring bores. • *Threshold Criterion 2*: Groundwater quality within groundwater/stygofauna monitoring bores. • *Threshold Criterion 3*: Total groundwater abstraction.

Corporate Endorsement

I hereby certify that to the best of my knowledge, the Condition EMP provisions within this Integrated Groundwater and Subterranean Fauna Habitat Management Plan are true and correct and address the Subterranean Fauna preliminary environmental factor identified during the s38 EPA Referral Document and subsequent API-A decision document.

Name: Glenn Firth

Signed:

Designation: Approvals Manager

Date: 4 October 2016

1. CONTEXT, SCOPE AND RATIONALE

1.1 PROPOSAL

The Gruyere Gold Project will comprise mining of gold from the Gruyere open pit over a 10 – 15 year life of mine (LoM) with the potential to transition to underground mining operations at depth in the future. The processing facility will be designed to process 7.5 Mt/a of fresh ore and up to 8.8 Mt/a of oxide ore using a conventional Carbon in Leach (CIL) processing methodology. In addition, the project will involve the construction and use of:

- An integrated waste landform (IWL) *i.e.* a combined tailings storage facility (TSF) and waste rock landform (WRL).
- A brackish-saline water borefield located within the Central Palaeochannel (Anne Beadell borefield) to be used in the raw water system during the construction phase (1 - 2 years) and thereafter to supply non-process water requirements during the operational phase (10 - 15 years).
- A hypersaline water borefield located within the Yeo Palaeochannel to be used for process water during the operational phase (10 - 15 years).
- Support infrastructure including a run of mine (ROM) pad, workshops, laydown areas, power station, reagent storages, explosives magazine, washdown facility, fuel facility, stormwater management infrastructure (bunds and drains), water storage ponds and tanks, wastewater treatment plant (WWTP), landfill, accommodation village, buildings, offices, telecommunications infrastructure, access road, internal mine roads and an airstrip.

1.2 LOCATION

The Gruyere Gold Project is located approximately 200 km north east of Laverton in Western Australia (Figure 1). It is accessed from Laverton, east along the Laverton–Warburton Highway, commonly known as the Great Central Road and then south along the existing Mt Shenton–Yamarna Road.

The Gruyere Gold Project is located within the Yamarna Pastoral Lease (PL N49674) which is wholly owned and managed by Gold Road. Gold Road currently holds a number of Exploration and Miscellaneous Licenses over the area as well as one mining tenement as per Table 1 and Figure 2.

Table 1: Gold Road Tenements

Tenement	Area (ha)	Grant Date	Expiry Date	Purpose
M 38/1267	6,845.5	05/05/2016	05/05/2037	Mining
L38/250	13,090	*Pending*	*Pending*	Yeo Borefield
L38/251	789.9	03/10/2016	02/10/2037	Anne Beadell Borefield
L38/253	788.5	*Pending*	*Pending*	Mt Shenton-Yamarna Road Access
L38/254	568.8	27/09/2016	26/09/2037	Accommodation Village and Airstrip
L38/255	482.8	27/09/2016	26/09/2037	Main Access Road
L38/256	190.2	03/10/2016	02/10/2037	Anne Beadell Borefield Access Road

Figure 1: Location Plan

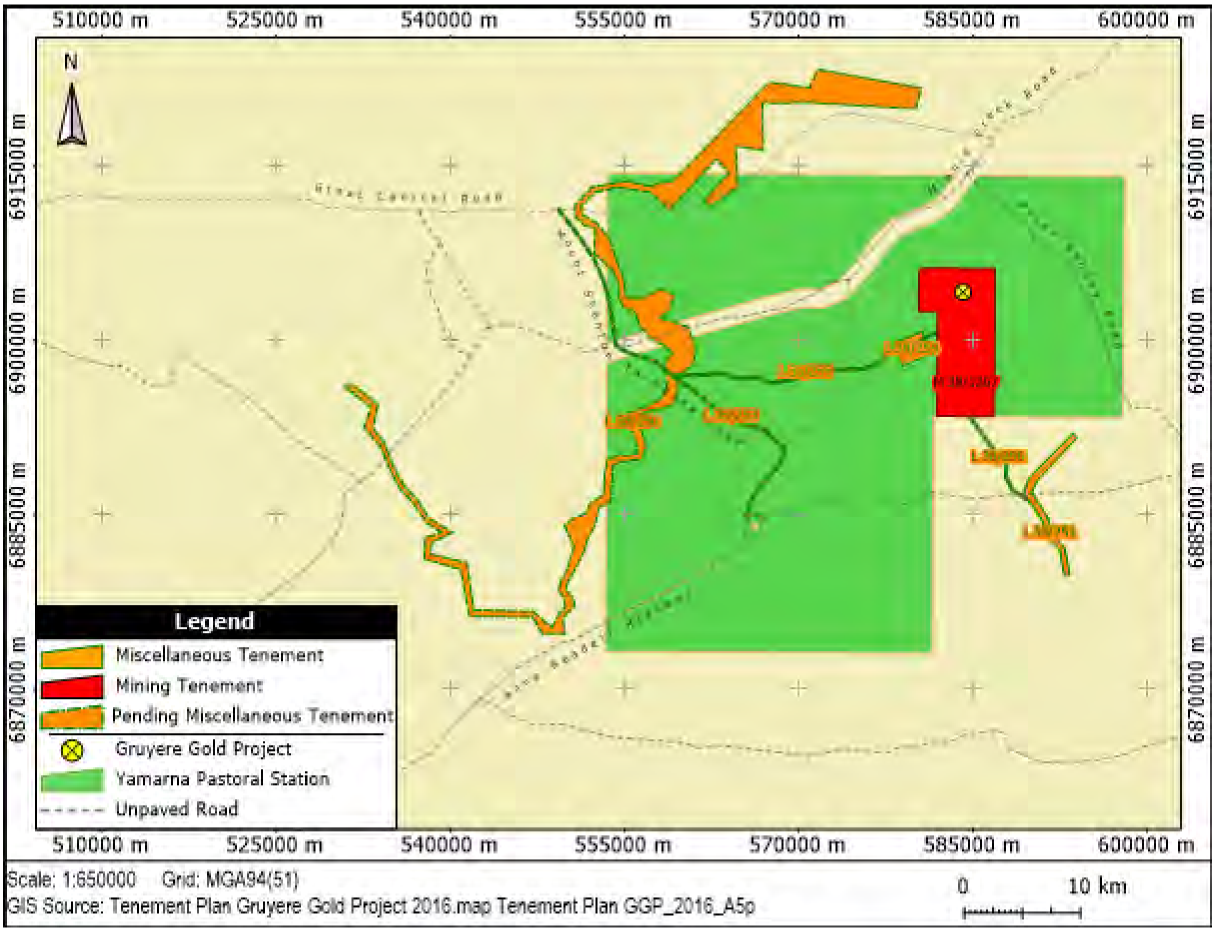


Figure 2: Tenement Plan

1.3 PRELIMINARY ENVIRONMENTAL FACTOR: SUBTERRANEAN FAUNA

This integrated Groundwater and Subterranean Fauna Habitat Management Plan applies to the Yeo Palaeochannel Borefield and specifically addresses two interlinked environmental factors, namely hydrogeological processes and the role they play in providing a suitable habitat for subterranean fauna found within the Yeo Palaeochannel.

Stygofauna are highly adapted to live in niche underground environments and are often highly localised in their particular underground water habitats. Stygofauna sampling from the Yeo Palaeochannel aquifer has determined that:

- Sixty one species of stygofauna were collected in the Yeo Palaeochannel.
- Three of the species collected are potentially restricted to the vicinity of the Yeo Palaeochannel.

Threatening processes are those which pose a risk in significantly altering their habitats and as such threaten the ongoing survival of a species. Habitat loss represents the most significant potential threat to subterranean fauna and is considered here as the principal threatening process.

The following environmental aspects of this proposal have the potential to affect the above two preliminary environmental factors:

- Groundwater abstraction from the Werrilup Aquifer within the Yeo palaeochannel is predicted to cause drawdown on water levels within the Werrilup Aquifer and the above lying Quaternary aquifer. The resultant aquifer drawdown may reduce groundwater levels within the Quaternary aquifer resulting in a loss of subterranean fauna habitat and consequently subterranean fauna.
- Groundwater abstraction from the borefield may impact upon groundwater quality within the aquifer resulting in a change to subterranean fauna habitat.
- Groundwater abstractions/drawdown may result in changes to groundwater salinities which appear to be stratified, with better quality brackish water overlying saline to hypersaline water at depth.
- Surface activities may result in changes to groundwater recharge.

Hydrogeological processes are thus an important factor for this proposal due to the fact that changes to quality and/or quantity of groundwater may have an impact on the habitat of restricted stygofauna species.

1.4 REQUIREMENTS OF THE CONDITION

Specifically, this Condition EMP is submitted as an Appendix to the API approval document in order to satisfy the EPA that Gold Road has taken into consideration the environmental objectives set for subterranean fauna and are committed to undertaking a project that meets these objectives. This will occur through the application of stringent monitoring of habitat quantity and quality.

1.5 RATIONALE AND APPROACH IN MEETING THE ENVIRONMENTAL OUTCOME

Results of baseline surveys and a number of assumptions and uncertainties inform the management approach for meeting the environmental objective stated in Section 2.1. The identified trigger criteria, threshold criteria, trigger level actions and threshold contingency actions are aligned with the overall management approach.

1.5.1 Results of Existing Surveys and Modelling Conducted

Several groundwater and subterranean fauna surveys have been undertaken for the Gruyere borefields, including the Yeo Palaeochannel as well as the general area surrounding the Gruyere Gold Project as depicted in Table 2. The most recent and final subterranean fauna survey is provided in Appendix 1 (Bennelongia 2016).

Table 2: Surveys Applicable to the Yeo Palaeochannel Borefield

Survey Title	Author	Project Area	Sampling Dates
Desktop review and pilot scale stygofauna survey	Bennelongia	Central Bore / Borefield	July 2012
Subterranean fauna assessment	Bennelongia	Central Bore / Borefield	December 2012 February 2013
Subterranean fauna survey (mine area)	MBS Environmental	Gruyere	May 2015
Subterranean fauna survey	Bennelongia	Gruyere Borefields	July 2012
			December 2012
			February 2013
			October 2015
			December 2015
			January 2016
			June - September 2016
Hydrogeological Study	Pennington Scott	Gruyere	2012 - 2015

Baseline surveys undertaken for the Gruyere Gold Project addressed both troglofauna and stygofauna and considered impacts associated with mine dewatering and groundwater abstraction via purpose developed borefields.

The geology of the Gruyere Gold Project area and immediate surrounds above the water table, comprise of lithologies that do not typically provide subterranean habitat suited to troglofauna. This has been substantiated by nil recordings during project specific baseline surveys. Risks to troglofauna from the project are considered to be low to negligible given that no excavation of habitat is planned to occur in the two borefields associated with the Gruyere Gold Project. Drawdown of the water table by dewatering within the borefields is unlikely to lead to significant reduction in above water table humidity and in fact, drawdown may increase the amount of troglofauna habitat available (Bennelongia 2016).

Baseline surveys have identified stygofauna populations within the mine site and borefield development envelopes. On this basis, information presented in the following subsections addresses stygofauna specifically.

1.5.2 Stygofauna Habitat

1.5.2.1 Yeo Palaeochannel

Within the Yeo palaeochannel, the Quaternary Detritals aquifer, which lies within colluvium, alluvium, eolian and saturated calcrete (hereafter referred to collectively as the calcrete habitat), are considered the main habitats for stygofauna. The Perkolilli Shale Aquitard that lies between the Quaternary Detritals and the Werillup Formation reduces opportunities for colonisation by stygofauna and also reduces inflow of nutrients and carbon. Thus, while stygofauna species may be present below the aquitard, they would be expected in low numbers and to be relatively insensitive to changes in the upper aquifer (Bennelongia 2016).

The calcrete unit is not continuous along the length of the palaeovalley and also varies in width across the valley with significant variability in thickness. The extent of the alluvial valley and near surface calcrete is shown in Figure 3.

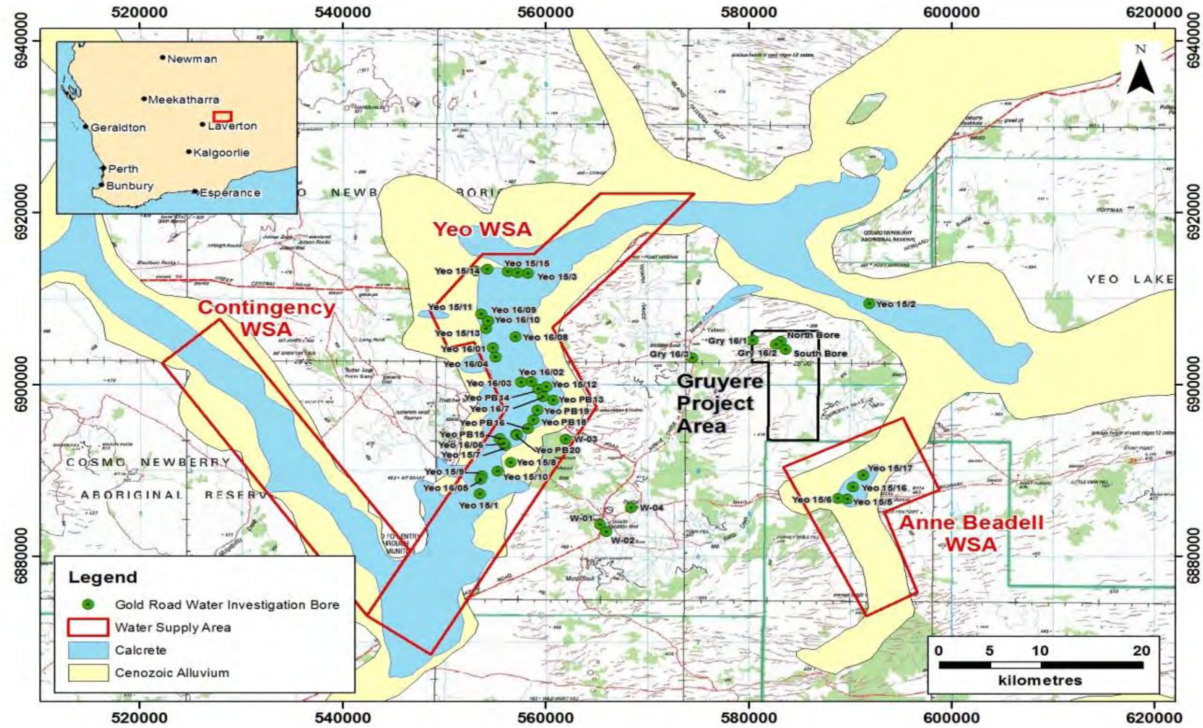


Figure 3: Extent of the Alluvial Valley and Near Surface Calcrete over the Yeo Borefield

The depth to water within the Quaternary aquifer has been shown through baseline studies to be variable within the Yeo Palaeochannel WSA with an average depth to ground water of zero to ten meters over the calcrete (Figure 4). Water within the Ann Beadell WSA is deeper at about 15 to 30 m below ground level. Figure 5 shows an interpretation of the geological long and cross section through the Yeo borefield moving north to south along the proposed Yeo and Anne Beadell borefields, whilst Figure 6 depicts the depth of the mapped calcrete extent (both saturated and unsaturated). From this it can be seen that the calcrete extent ranges from only a few metres thick, particularly at the extremities, up to 44.5 m in the northern Yeo borefield and 22 m in the Anne Beadell borefield.

The optimal salinity for stygofauna varies according to the particular species that occur at a site. While saline groundwater would be expected to have fewer species than fresh groundwater, the species occupying brackish and saline groundwater mostly have relatively narrow salt tolerances that will occupy only part of a palaeochannel that exhibits a large salinity gradient, as is the case with the Yeo Palaeochannel. Given that groundwater salinity is variable over time, it is possible species will occur in a series of disjunct areas along the palaeochannel where salinity is favourable. However, relatively few stygofauna species are likely to occur at groundwater salinities greater than 35,000 mg/L and probably no species occur at salinities >50,000 mg/L (Bennelongia 2016).

As can be seen in Figure 7 salinity in the Anne Beadell borefield is approximately 6,000 to 14,000 mg/L TDS with carbonate content relatively high whilst groundwater salinity at depth in the Yeo borefield is approximately 14,000 to 25,000 mg/L TDS. There is often a vertical gradient of salinity in the Yeo Palaeochannel, with the top metre of groundwater having a salinity that is approximately half that found at depth. Groundwater in the valley flanks outside the palaeochannel is fresh.

Although Figure 7 presents salinity as a parameter with broad gradients, in reality levels are often heterogeneous at a fine scale and can show variation as a result of a number of elements. As a result of this, salinity levels of a species may sometimes only occur in small portions of the Palaeochannel and the species will have a patchy distribution.

1.5.2.2 Mine Site

Within the vicinity of the Gruyere orebody the aquifer system generally occurs within the weathered profile (saprolite and saprock) and fractured bedrock. The weathered profile and underlying fractured bedrock often form moderately permeable aquifers, and are characterised by secondary porosity and permeability through the break-down of the primary rock material. The fractured rock aquifer within the vicinity of the Gruyere Project area represents the main stygofauna habitat.

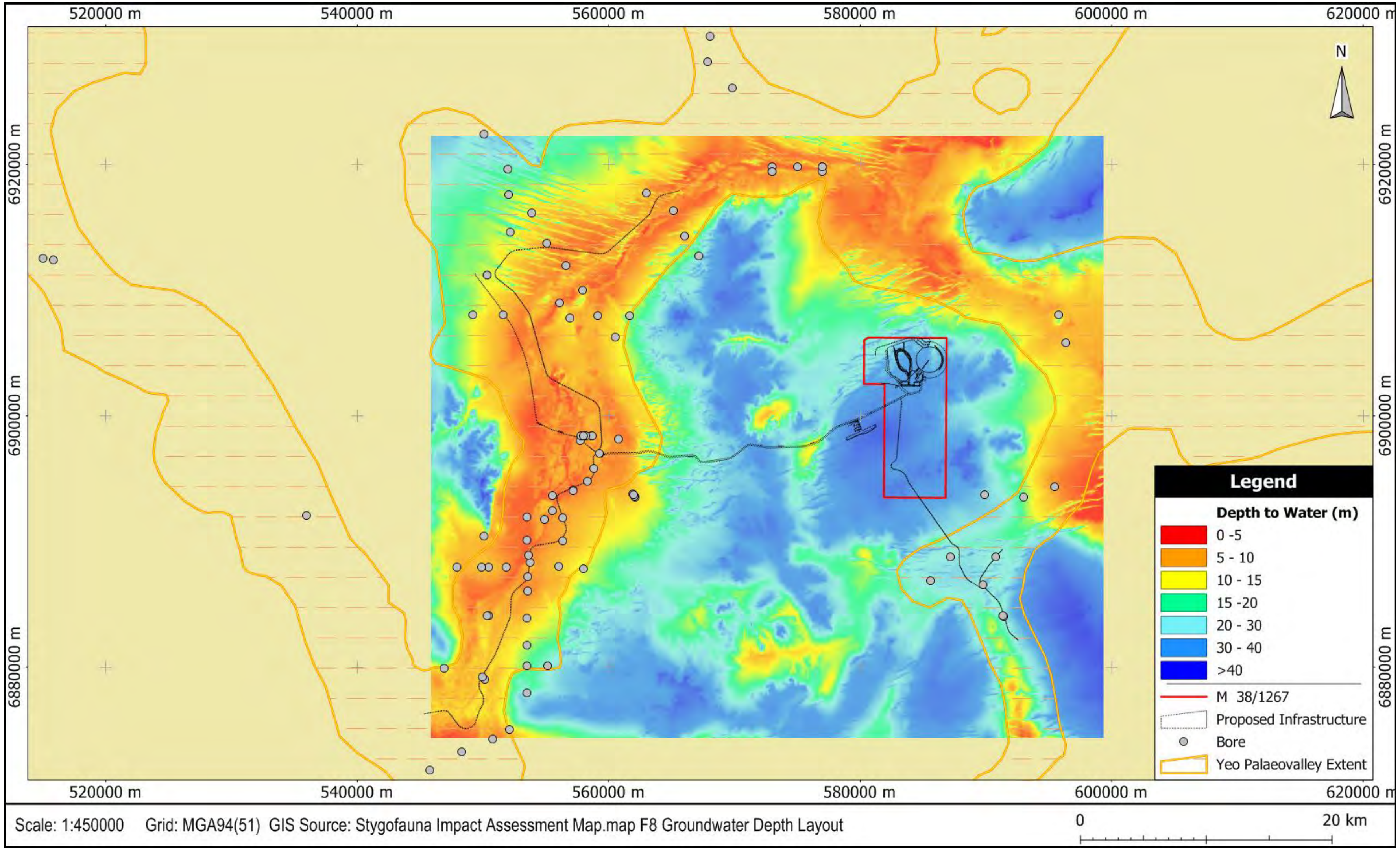


Figure 4: Depth to Groundwater within the Yeo Palaeochannel

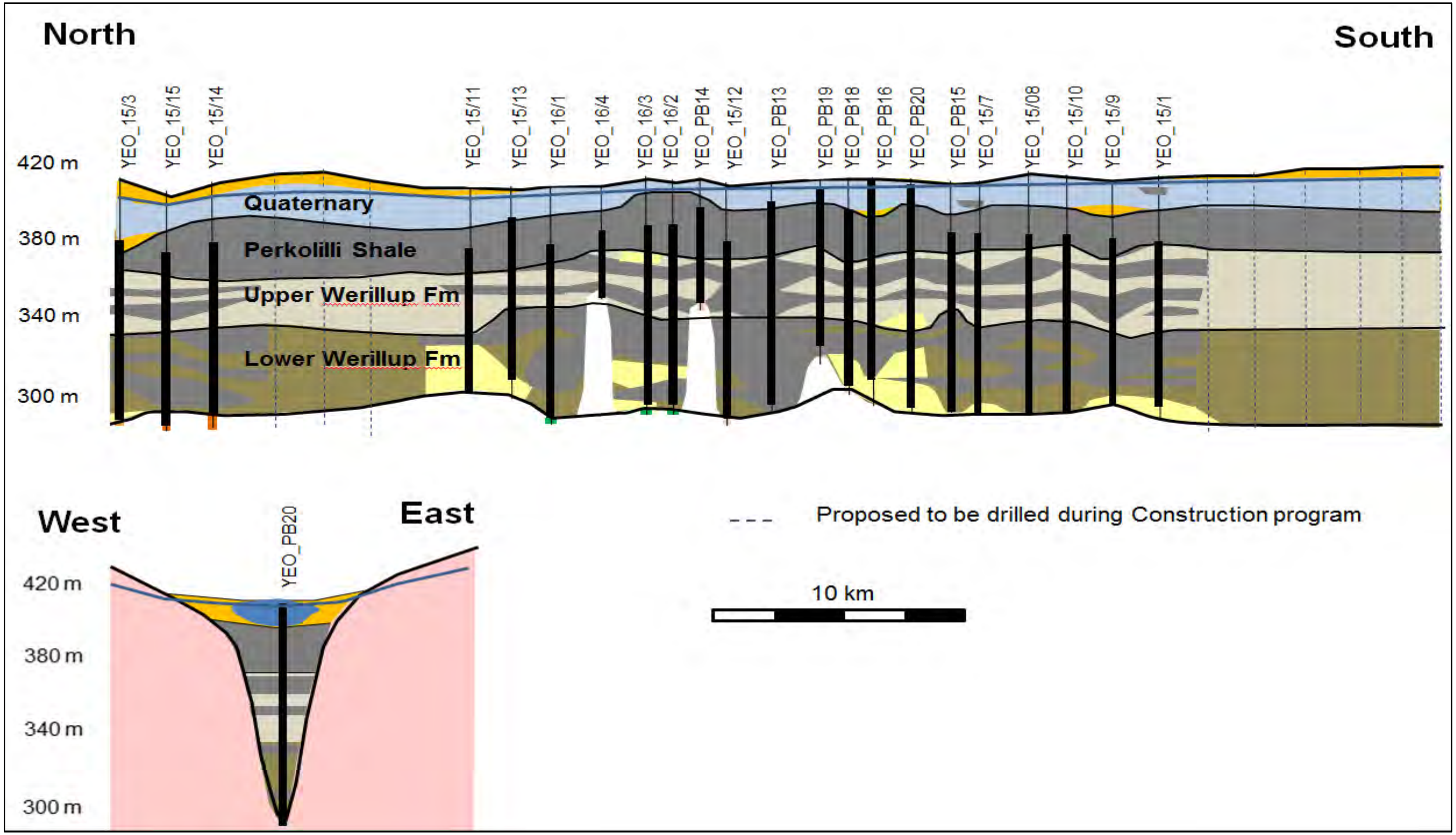


Figure 5: Geological Long and Cross Section through the Yeo Borefield

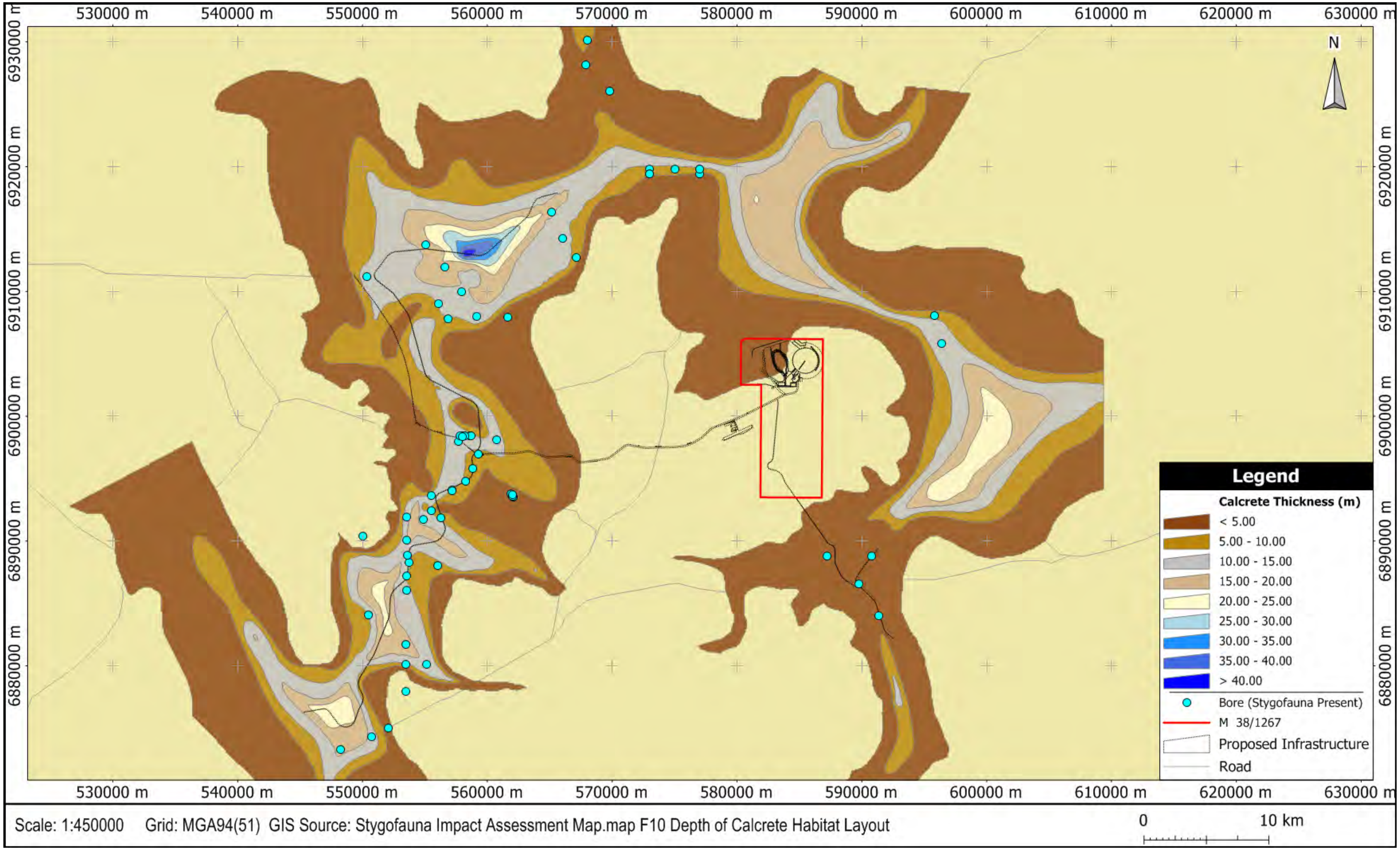


Figure 6: Depth of the Calcrete Extent (Saturated and Unsaturated) of the Yeo Palaeochannel

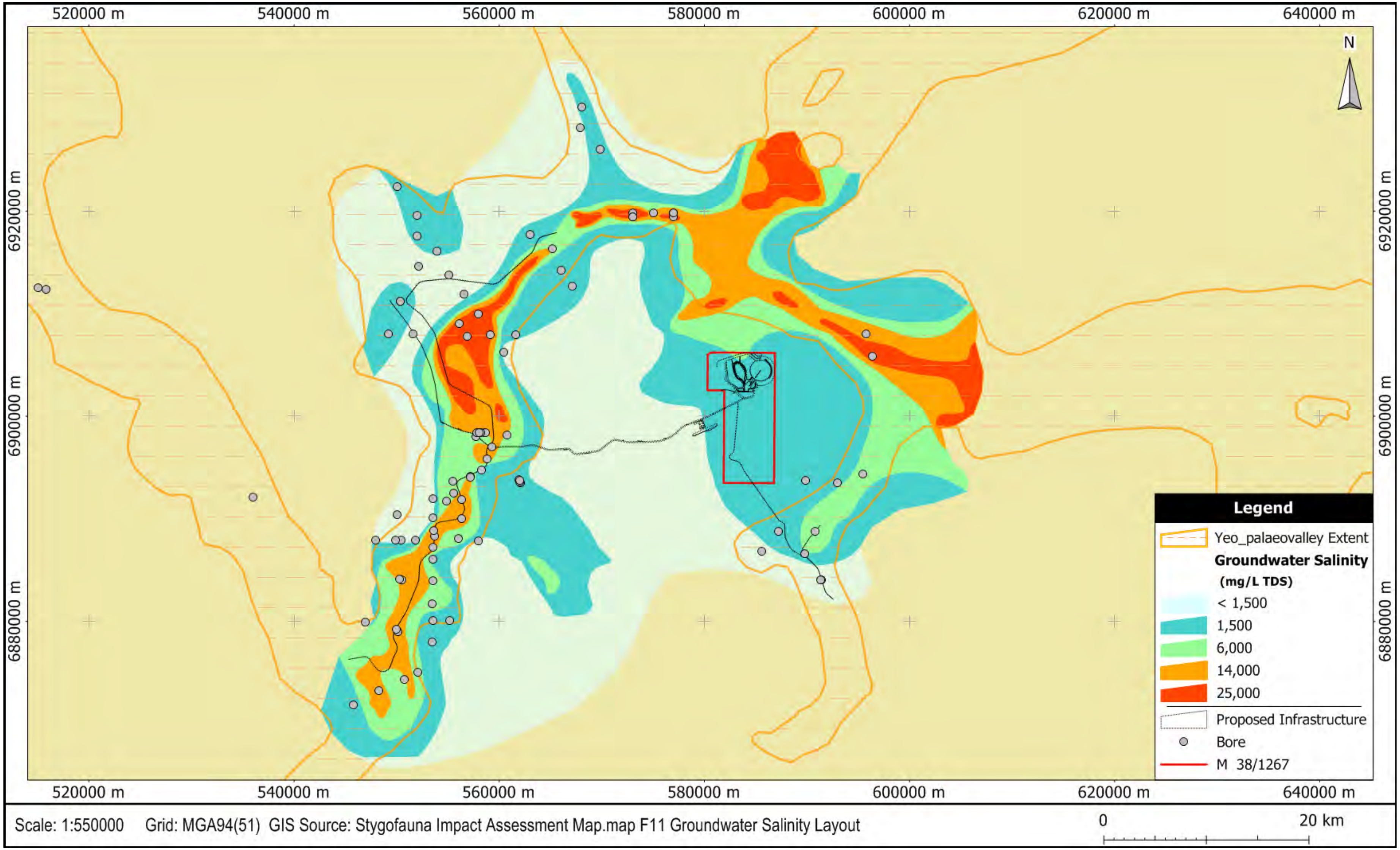


Figure 7: Groundwater Salinity (mg/L TDS) within the Quaternary Detrital Aquifer

1.5.3 Stygofauna Populations

Figure 8 displays the location of all stygofauna sampling undertaken for the project, including species per bore, calcrete habitat, salinity of the borefield and the predicted groundwater drawdown contours for the Quaternary detritals aquifer. Stygofauna populations and distribution patterns for all species identified from the Yeo Palaeochannel are presented in the Bennelongia report provided in the API document.

Studies of local stygofauna populations have shown that stygofauna species in the Yeo Palaeochannel appear to have relatively widespread occurrences for subterranean species in Yilgarn calcretes. Studies showed that 48 species were identified both within and outside of the predicted impact area associated with establishment of two borefields within the Yeo Palaeochannel. One species *Chiltoniidae sp. B02* was recorded as having a linear range of >100 km. This suggests that the subterranean habitat within the Yeo Palaeochannel is homogeneous and that, if the ranges of all species were fully documented, most species may occupy moderately large areas (Bennelongia 2016).

Three species were identified as being restricted to locations within the predicted impact area of the Yeo Palaeochannel.

1.5.4 Key Assumptions and Uncertainties

The proposed development envelope and surrounds have been the subject of several investigations into subterranean fauna for the purpose of the API. It is assumed that investigations and studies undertaken for the API and management plans that have been developed have adequately:

- Mapped stygofauna habitat within the Yeo Palaeochannel to identify areas of high and low endemicity.
- Determined areas within the Yeo Palaeochannel where dewatering activities will have minimal impact upon stygofauna habitat and thus stygofauna.
- Calculated total volumes of water able to be withdrawn from the Werrilup aquifer within the Yeo Palaeochannel without critically impacting upon stygofauna and stygofauna habitat.

1.5.5 Management Approach

A condition based management approach has been adopted for the Yeo Palaeochannel Borefield during the design phase of the project and will continue throughout the life of the Gruyere Gold Project.

This management approach was initially based and developed around the mitigation hierarchy of avoid, minimise, rehabilitate and off-set to ensure impacts to stygofauna have been avoided or reduced as far as practicable. The monitoring of environmental criteria in order to meet conditions will ensure the Gruyere Gold Project meets its environmental objectives for the preliminary environmental factor.

Risks and management measures were identified and prioritised using information gained from baseline surveys and other regional and local information within the public domain. Consultation with Traditional Owners and regulators also informed the risk identification and prioritisation process.

1.5.6 Rationale for Choice of Environmental Criteria

Environmental criteria have been developed based upon baseline surveys which have been undertaken over the Yeo Palaeochannel between 2012 and 2016 as well as current scientific knowledge available in relation to stygofauna and the impacts which may affect their habitat.

These studies have identified a number of environmental parameters which are important to the conservation and survival of endemic stygofauna within the Yeo Palaeochannel. All of these parameters are well studied in the scientific literature and have consistently been shown to have the highest negative impact upon stygofauna as well as stygofauna habitat.

These environmental parameters have been translated into Environmental Trigger and Environmental Threshold criteria which are discussed below.

1.5.7 Rationale for Choice of Trigger Level Actions and Threshold Contingency Actions

Trigger level actions and threshold contingency actions have been chosen based upon current scientific knowledge and research available for subterranean fauna as well as the three dimensional habitat in which they live. Multiple hydrogeological assessments and subterranean fauna surveys have also been undertaken for the project to ensure this Management Plan was created with accurate data.

Figure 8: Stygofauna Sampling Sites, Results, Species, Habitat and Predicted Drawdown Contours for the Gruyere Gold Project


Stygofauna Sampling Results
2, 5, 10 metre Drawdown Contours
Centre of Palaeochannel
Calcrete Habitat Image (Water Saturation)
GOLD ROAD RESOURCES
Project: GRUYERE PROJECT
kilometres
Projection: MGA Zone 51 (GDA 94)
Date: 30/09/2016
Scale: 1:75000
Technical Report No.
Figure No.
LEGEND
Species Count
15 to 25 (7)
10 to 15 (8)
5 to 10 (13)
1 to 5 (47)
Drawdown Contours
2 m drawdown contour
5 m drawdown contour
10 m drawdown contour
Sampled - Stygofauna
No (40)
Centre of Palaeochannel (60-80m depth)
Yamarna Pastoral Lease
REMAINING HABITAT
100 % Calcrete Habitat- RED
50% Calcrete Habitat-ORANGE
0% Calcrete Habitat-CREAM
6,920,000 mN
6,900,000 mN
520,000 mE
540,000 mE
560,000 mE
580,000 mE
Bore_ID Species
16GYWB0033 Enchytraeidae sp. B08
16GYWB0034 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0032 Oligochaeta sp.
16GYWB0036 Halicyclops eberhardi s.l.
16GYWB0036 Nitocrellopsis sp. B09
11THAC013 Chiltoniidae sp. B02
11THAC013 Enchytraeidae sp. B12
11THAC013 Enchytraeidae sp. B13
11THAC013 Enchytraeidae sp. B14
11THAC013 Limbodessus sp. B06
16GYWB0029 Chiltoniidae sp. B02
16GYWB0029 Nitocrellopsis sp. B04
16GYWB0029 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0030 Chiltoniidae sp. B03
16GYWB0030 Halicyclops kieferi
16GYWB0049 Sarscypridopsis sp. BOS615
16GYWB0038 Chiltoniidae sp. B02
16GYWB0038 Halicyclops eberhardi b
16GYWB0038 Nitocrella sp. B11
16GYWB0038 Nitokra lacustris sp. B03 s.l.
16GYWB0038 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0038 Schizopera sp. B09
16GYWB0052 Cladocera sp. unident.
16GYWB0052 Sarscypridopsis sp. BOS615
16GYWB0013 Oligochaeta sp.
15GYWB0003 Limbodessus sp.
11THAC043 Enchytraeidae sp. B08
11THAC043 Enchytraeidae sp. B11
11THAC043 Enchytraeidae sp. B15
11THAC043 Nitocrellopsis sp. B09
11THAC043 Nitokra lacustris sp. B02
11THAC043 Oligochaeta sp.
16GYWB0048 Sarscypridopsis sp. BOS615
16GYWB0031 Parabathynellidae gen. nov. 1 sp. B04
LIMESTONE BORE Chiltoniidae sp. B02
LIMESTONE BORE Kimberleybathynella sp. B07
LIMESTONE BORE Kinnecaris sp.
LIMESTONE BORE Limbodessus sp.
LIMESTONE BORE Nitocrellopsis sp. B04
LIMESTONE BORE Nitocrellopsis sp. B06
LIMESTONE BORE Parastenocaris sp. B24
LIMESTONE BORE Schizopera sp. B09
16GYWB0012 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0014 Enchytraeidae sp. B08
16GYWB0047 Acari sp.
16GYWB0047 Nematoda sp.
16GYWB0047 Sarscypridopsis sp. BOS615
16GYWB0020 Enchytraeidae sp. B12
YUNK02 Nematoda sp.
16GYWB0015 Ameiridae sp.
16GYWB0015 Halicyclops kieferi
16GYWB0015 Nitocrella sp.
16GYWB0015 Nitocrella sp. B10
16GYWB0015 Nitocrellopsis sp.
16GYWB0015 Nitocrellopsis sp. B08
16GYWB0015 Nitocrellopsis sp. B09
16GYWB0015 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0015 Schizopera sp. B09
16GYWB0035 Chiltoniidae sp. B02
16GYWB0035 Halicyclops eberhardi s.l.
16GYWB0035 Limbodessus sp. B06
16GYWB0035 Nitocrellopsis sp. B07
16GYWB0035 Nitokra lacustris sp. B03 s.l.
16GYWB0035 Nitokra lacustris sp. B03b
16GYWB0035 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0035 Schizopera sp. B09
11THAC135 Chiltoniidae sp. B03
11THAC135 Nitocrellopsis sp. B06
FYRC051 Halicyclops eberhardi s.l.
FYRC051 Nitocrellopsis sp. B08
PB13 Ameiridae gen. nov. 4 sp. B01
PB13 Atopobathynella sp. B13
PB13 Halicyclops eberhardi s.l.
PB13 Nitocrella sp. B06
PB13 Nitocrella sp. B10
PB13 Nitocrellopsis sp. B04
PB13 Oligochaeta sp.
PB13 Schizopera sp. B08
PB13 Schizopera sp. B09
PB13 Schizopera sp. B11
PB13 Stygonitocrella sp. B05
16GYWB0016 Chiltoniidae sp. B01
16GYWB0016 Enchytraeidae sp. B10
16GYWB0016 Halicyclops eberhardi s.l.
16GYWB0016 Limbodessus sp. B06
16GYWB0016 Nitocrella sp.
16GYWB0016 Nitocrellopsis sp. B08
16GYWB0016 Nitokra lacustris sp. B03 s.l.
14GYRC0213 Atopobathynella sp. B19
14GYWB003 Oligochaeta sp.
14GYWB002 Oligochaeta sp.
14GYRC0130 Parastenocaris sp. B24
14GYRC0026 nr Atopobathynella sp. B19
16GYWB0017 Schizopera sp. B09
AC269 Nitocrellopsis sp. B08
AC273 Ameiridae gen. nov. 4 sp. B01
AC273 Chiltoniidae sp.
AC273 Halicyclops eberhardi s.l.
PB19 Chiltoniidae sp. B01
PB19 Halicyclops eberhardi s.l.
PB19 Limbodessus sp.
PB19 Limbodessus sp. B06
PB19 Nitocrella sp. B06
PB19 Nitocrellopsis sp. B04
PB19 Nitocrellopsis sp. B05
PB19 Nitocrellopsis sp. B08
PB19 Nitokra lacustris sp. B02
PB19 Oligochaeta sp.
PB19 Schizopera sp. B08
PB19 Schizopera sp. B09
PB18 Ameiridae gen. nov. 4 sp. B01
PB18 Chiltoniidae sp.
PB18 Halicyclops eberhardi s.l.
PB18 Halicyclops kieferi
PB18 Limbodessus sp.
PB18 Limbodessus sp. B05
PB18 Limbodessus sp. B06
PB18 Nitocrella sp. B06
PB18 Nitocrellopsis sp. B04
PB18 Nitocrellopsis sp. B05
PB18 Nitocrellopsis sp. B06
16GYWB0019 Chiltoniidae sp.
16GYWB0019 Enchytraeidae sp. B07
16GYWB0019 Halicyclops eberhardi a
16GYWB0019 Halicyclops eberhardi s.l.
16GYWB0019 Limbodessus sp. B06
16GYWB0019 Nitocrella sp. B12
16GYWB0019 Nitocrellopsis sp.
16GYWB0019 Nitocrellopsis sp. B04
16GYWB0019 Nitokra lacustris sp. B03 s.l.
16GYWB0019 Nitokra lacustris sp. B03a
16GYWB0019 Oligochaeta sp.
16GYWB0019 Parabathynellidae gen. nov. 1 sp. B07
16GYWB0019 Schizopera sp. B08
16GYWB0019 Schizopera sp. B09
16GYWB0019 Schizopera sp. B11
AC267 Australocamptus sp. B12
AC267 Halicyclops eberhardi s.l.
AC267 Insulodrilus sp.
AC267 Nitocrella sp. B06
AC267 Oligochaeta sp.
AC272 Halicyclops eberhardi s.l.
12ALRC0117 Atopobathynella sp. B21
PB16 Ameiridae gen. nov. 4 sp. B01
PB16 Chiltoniidae sp.
PB16 Halicyclops eberhardi s.l.
PB16 Nitocrella sp. B06
PB16 Nitocrellopsis sp. B04
PB16 Nitocrellopsis sp. B06
PB16 Oligochaeta sp.
PB16 Parastenocaris sp. B24
15GYWB0009 Chiltoniidae sp.
15GYWB0009 Halicyclops eberhardi c
15GYWB0009 Halicyclops eberhardi s.l.
15GYWB0009 Nitocrellopsis sp. B10
AC268 Chiltoniidae sp. B02
AC268 Halicyclops eberhardi s.l.
AC268 Nitocrella sp. B06
AC268 Schizopera sp. B09
AC280 Halicyclops eberhardi s.l.
AC280 Nitocrella sp. B06
YUNK04 Chiltoniidae sp.
YUNK04 Parastenocaris sp. B24
PB17 Ameiridae gen. nov. 4 sp. B01
PB17 Chiltoniidae sp. B01
PB17 Halicyclops eberhardi s.l.
PB17 Limbodessus sp.
PB17 Limbodessus sp. B05
PB17 Nitocrella sp. B06
PB17 Nitocrellopsis sp. B04
PB17 Nitocrellopsis sp. B05
PB17 Nitocrellopsis sp. B07
PB17 Oligochaeta sp.
PB17 Schizopera sp. B09
16GYWB0043 Nematoda sp.
AC283 Chiltoniidae sp.
AC283 Halicyclops eberhardi s.l.
AC283 Nitocrella sp. B06
AC283 Nitocrellopsis sp.
AC283 Oligochaeta sp.
RC0151 Parabathynellidae gen. nov. 1 sp. B08
RC0151 Parastenocaris sp. B24
16GYWB0010 Oligochaeta sp.
16GYWB0010 Tubificidae sp. B02
W03 Parabathynellidae sp.
W03 Parastenocarididae sp.
Bluey Nitocrella sp. B06
Bluey Nitocrellopsis sp. B04
Bluey Oligochaeta sp.
PB20 Ameiridae gen. nov. 4 sp. B01
PB20 Chiltoniidae sp. B02
PB20 Halicyclops eberhardi s.l.
PB20 Limbodessus sp. B05
PB20 Nitocrella sp. B06
PB20 Nitocrellopsis sp. B06
PB20 Oligochaeta sp.
PB20 Schizopera sp. B09
Soma Bore Bdelloidea sp. 2:2
Soma Bore Nematoda sp.
Mt Venn Bore Enchytraeidae sp. B09
Mt Venn Bore Parastenocaris sp. B33
15GYWB0006 Nitocrella sp. B06
16GYWB0011 Australocamptus sp. B12
16GYWB0011 Enchytraeidae sp. B09
16GYWB0011 Oligochaeta sp.
16GYWB0011 Tubificidae sp. B02
YUNK03 Chiltoniidae sp.
YUNK03 Halicyclops eberhardi s.l.
YUNK03 Halicyclops kieferi
YUNK03 Limbodessus sp.
YUNK03 Limbodessus sp. B05
YUNK03 Limbodessus sp. B06
YUNK03 Nitocrella sp. B06
YUNK03 Nitocrellopsis sp. B04
YUNK03 Nitocrellopsis sp. B06
YUNK03 Nitocrellopsis sp. B07
YUNK03 Oligochaeta sp.
YUNK03 Parabathynellidae gen. nov. 1 sp. B04
PB15 Aeolosomatidae sp.
PB15 Chiltoniidae sp.
PB15 Nitocrella sp. B06
PB15 Nitocrellopsis sp. B04
PB15 Nitocrellopsis sp. B06
PB15 Nitocrellopsis sp. B07
PB15 Nitocrellopsis sp. B08
PB15 Oligochaeta sp.
PB15 Parabathynellidae gen. nov. 1 sp. B04
15GYWB0012 Nitocrella sp. B10
15GYWB0005 Chiltoniidae sp. B02
15GYWB0005 Halicyclops eberhardi a
15GYWB0005 Limbodessus sp.
15GYWB0005 Limbodessus sp. B05
15GYWB0005 Limbodessus sp. B06
15GYWB0005 Nitocrellopsis sp. B06
Yeo 16/5 Limbodessus sp.
15GYWB0009 Chiltoniidae sp.
YEO 15/1 Nitocrella sp. B06
YEO 15/1 Nitokra sp. B04
YEO 15/1 Phreodrilidae sp.
16GYWB0007 Oligochaeta sp.
16GYWB0001 Ameiridae gen. nov. 4 sp. B01
16GYWB0001 Nitocrella sp. B06
15MNAC0169 Oligochaeta sp.
15MNAC0187 Oligochaeta sp.
16GYWB0027 Fierscyclops (Fierscyclops) fiersi
YE0008A Aeolosomatidae sp.
YE0008A Ameiridae gen. nov. 4 sp. B01
YE0008A Ameiridae sp.
YE0008A Chiltoniidae sp.
YE0008A Halicyclops eberhardi s.l.
YE0008A Limbodessus sp. B05
YE0008A Limbodessus sp. B06
YE0008A Nirripirti sp. B01
YE0008A Nitocrella sp. B07
YE0008A Nitocrellopsis sp. B04
YE0008A Nitocrellopsis sp. B07
YE0008A Nitokra lacustris sp. B02
YE0008A Nitokra lacustris sp. B06
YE0008A Oligochaeta sp.
YE0008A Phreodrilidae sp.
YE0008A Schizopera sp. B09
YE0008A Schizopera sp. B11
16GYWB0005 Canthocamptidae sp.
16GYWB0023 Ameiridae gen. nov. 4 sp. B01
16GYWB0023 Chiltoniidae sp. B02
16GYWB0023 Nitocrellopsis sp. B07
16GYWB0023 Parabathynellidae gen. nov. 1 sp. B04
16GYWB0004 Enchytraeidae sp. B09
15GYWB0011 Ameiridae gen. nov. 4 sp. B01
15GYWB0011 Chiltoniidae sp.
15GYWB0011 Limbodessus sp.
15GYWB0011 Nitocrella sp. B06
YEO 15/5 Nitocrella sp. B10
YEO 15/5 Oligochaeta sp.
16GYWB0003 Chiltoniidae sp. B02
16GYWB0003 Tubificidae sp. B02
15GYWB0010 Cyclopoida sp.
16GYWB0002 Oligochaeta sp.
16GYWB0025 Parabathynellidae gen. nov. 1 sp. B07

2. CONDITION EMP PROVISIONS

This section identifies the legal provisions that Gold Road proposes to implement to ensure subterranean fauna habitat is protected, thereby protecting the potentially restricted species living within this habitat. It identifies the environmental criteria that will be used to measure performance and monitoring that will be undertaken in relation to these environmental criteria. Finally, it defines the trigger level actions and threshold contingency actions that will be undertaken if the environmental criteria are exceeded.

2.1 CONDITION ENVIRONMENTAL OBJECTIVE

The objective of this Management Plan is to ensure that impact on subterranean fauna habitat from groundwater abstraction is minimised and impacts do not conflict with the EPA objectives for subterranean fauna.

2.2 ENVIRONMENTAL CRITERIA

Two levels of criteria were considered during development of this Condition EMP. They are trigger criteria and threshold criteria, which will vary in function.

Trigger criteria were set at a conservative level to ensure trigger level actions are implemented well in advance of the environmental outcome being compromised.

Threshold criteria were framed to measure achievement of the environmental outcome. A failure to meet threshold criteria signals the environmental outcome is not being met and implies non-compliance.

Trigger and threshold criteria for monitoring impacts to stygofauna habitat are presented in Table 3 with trigger and threshold location monitoring points to be determined by suitably qualified hydrogeologists prior to borefield commissioning.

Table 3: Environmental Criteria

Number	Trigger Criteria
Trigger Criterion	
Trigger Criterion 1	Groundwater level drawdown within monitoring bores.
Trigger Criterion 2	Groundwater quality within monitoring bores.
Threshold Criterion	
Threshold Criterion 1	Groundwater level drawdown within monitoring bores.
Threshold Criterion 2	Groundwater quality within monitoring bores.
Threshold Criterion 3	Total groundwater abstraction.

2.3 MONITORING

The purpose of monitoring is to inform, through the environmental criteria, if the condition environmental outcome is being achieved and when trigger level actions or threshold contingency actions will be implemented. This section describes how Gold Road will undertake monitoring to determine the performance against the environment criteria. Table 4, Table 5 and Table 6 discuss the monitoring to be undertaken in further detail.

2.4 IMPLEMENTATION OF TRIGGER LEVEL ACTIONS

Gold Road has developed trigger level actions that would be implemented if the associated trigger criterion signals the need for increased mitigation or protection (Table 4). These trigger level actions will be implemented to mitigate and manage impacts to stygofauna habitat by ensuring environmental conditions return to acceptable limits below their trigger criteria.

2.5 IMPLEMENTATION OF THRESHOLD CONTINGENCY ACTIONS

Gold Road has developed a number of threshold contingency actions that would be implemented if the associated threshold criterion signals that an environmental outcome is exceeded (Table 4). The threshold contingency actions will be implemented to manage and reduce exceedances to below threshold and trigger criteria again in order to bring the project back into compliance.

Table 4: Monitoring to Measure Environmental Outcome against Trigger Criteria and Threshold Contingency Actions for the Yeo Palaeochannel Borefield

Indicator	Aquifer	Method	Location	Frequency	Trigger Level Actions	Timing to Implement
Trigger Criteria Actions						
Trigger Criterion 1: Groundwater levels within groundwater/stygofauna monitoring bores						
Groundwater levels drop more than 2 m.	Upper Lower	Telemetry based in-situ groundwater level loggers.	See and Table 5.	To be determined.	To be determined.	To be determined.
Trigger Criterion 2: Groundwater quality within groundwater/stygofauna monitoring bores						
Groundwater quality not to exceed values as per Table 6 column A.	Upper Lower	Water quality analysis from subterranean fauna monitoring bores.	See and Table 5.	To be determined.	To be determined.	To be determined.
Threshold Contingency Actions						
Threshold Criterion 1: Groundwater levels within groundwater/stygofauna monitoring bores						
Groundwater levels drop more than 2 m.	Upper Lower	Telemetry based in-situ groundwater level loggers.	See and Table 5.	To be determined.	To be determined.	To be determined.

Indicator	Aquifer	Method	Location	Frequency	Trigger Level Actions	Timing to Implement
Threshold Criterion 2: Groundwater quality within groundwater/stygofauna monitoring bores						
Groundwater quality not to exceed values as per Table 6 column B.	Upper Lower	Water quality analysis from subterranean fauna monitoring bores.	See and Table 5.	To be determined.	To be determined.	To be determined.
Threshold Criterion 3: Total groundwater abstraction						
Groundwater abstraction not to exceed values as per DoW licence conditions.	Lower	Water abstraction measuring through flow meters attached to production bores.	See and Table 5.	To be determined.	To be determined.	To be determined.

Table 5: Location of Preliminary Monitoring Bores

Bore ID	Bore Type		Easting	Northing
	Production	Monitoring		
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.	To be determined.	To be determined.

Table 6: Groundwater Quality Limits

Analyte	Trigger Criterion (Column A)	Threshold Criterion (Column B)
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.
To be determined.	To be determined.	To be determined.

2.6 REPORTING PROVISIONS

2.6.1 Annual Reporting

The environmental outcome will be reported against trigger and threshold criteria as per Table 7 for 1 July to 30 June by 30 September in an Annual Report.

In the event that trigger criteria or trigger and threshold criteria were exceeded during the reporting period, the annual report will include a description of the effectiveness of trigger level actions, and threshold contingency actions that have been implemented to manage the impact, as well as an analysis of trends.

2.6.2 Reporting on Exceedance of Trigger Criteria and Threshold Criteria

In the event of exceedance of any trigger or threshold criteria, Gold Road will notify the OEPA in writing within 10 calendar days.

Table 7: Condition Environmental Management Plan Reporting Table

Key Environmental Factor: Subterranean Fauna		
Condition Environmental Objective and Threshold and Trigger Criteria set in the Condition EMP	**Reporting on the Environmental Outcome, Threshold and Trigger Criteria for 1 July to 30 June**	**Status[1] Yes/No**
Trigger Criteria:		
1. Groundwater levels drop more than 2 m	Groundwater levels were maintained such that subterranean fauna of the Yeo Palaeochannel Borefield were not adversely affected as a result of proposal implementation.	
2. Groundwater quality not to exceed values as per Table 6 column A.	Groundwater quality did not exceed limits as per Table 6 column A and thus subterranean fauna of the Yeo Borefield were not adversely affected as a result of proposal implementation.	
Threshold Criteria:		
1. Groundwater levels drop more than 2 m.	Groundwater levels were maintained such that subterranean fauna of the Yeo Borefield were not adversely affected as a result of proposal implementation.	
2. Groundwater quality not to exceed values as per Table 6 column B.	Groundwater quality did not exceed limits as per Table 6 column B and thus subterranean fauna of the Yeo Borefield were not adversely affected as a result of proposal implementation.	

Notes:

1. *The status of achievement of environmental outcome is indicated by the following:*

   YES: Condition environmental outcome achieved

   NO: Condition environmental outcome not achieved

3. ADAPTIVE MANAGEMENT AND REVIEW OF THE CONDITION EMP

Groundwater modelling results indicate impacts on specific areas of stygofauna habitat can be avoided or minimised with careful attention to placement and abstraction rates of the production bores within the Yeo Palaeochannel.

Gold Road intends to manage the borefield in an adaptive manner whereby pumping locations and rates can be readily changed to manage drawdown impacts across the borefield. This will require monitoring equipment to be installed in a number of key monitoring bores sited to provide information on both the Quaternary and Werillup aquifers' response to pumping throughout the borefield area and in areas of stygofauna habitat value.

Based on the hydrogeological and stygofauna investigations, water level drawdown constraints for maintenance of stygofauna habitats will be defined. The groundwater model will be used to develop an abstraction regime that is predicted to meet these drawdown constraints.

A comprehensive suite of water level triggers will be defined based on the model results. The triggers will be defined at each monitoring point and will be time-varying in accordance with the model predictions. The purpose of the triggers will be to identify deviations between modelled and actual aquifer responses to allow pro-active actions to be taken. Where triggers are exceeded, the model will be recalibrated, and scenarios rerun to determine changes to the abstraction regime required to ensure the drawdown constraints continue to be met. Adjustments could include in the first instance, changes to the timing of abstraction or the distribution of abstraction among bores.

4. STAKEHOLDER CONSULTATION

Consistent with the EPA's expectations for this Condition EMP to align with the principles of EIA, Gold Road consulted with stakeholders while developing this Condition EMP. The comments raised during consultations with stakeholders were considered in the development of this Condition EMP. A register of stakeholder consultation and Gold Road's response to stakeholder comments is provided within Appendix 1 of the API document.

APPENDICES

APPENDIX 1: GRUYERE GOLD PROJECT: BOREFIELDS STYGOFAUNA ASSESSMENT (BENNELONGIA 2016)

Bennelongia Environmental Consultants

Gruyere Gold Project: Borefields Stygofauna Assessment

Prepared for:

Gold Road Resources Ltd

September 2016

Final Report

Short-Range Endemics I Subterranean Fauna

Waterbirds I Wetlands

Gruyere Gold Project: Borefields Stygofauna Assessment

Bennelongia Pty Ltd
5 Bishop Street
Jolimont WA 6014

P: (08) 9285 8722
F: (08) 9285 8811
E: info@bennelongia.com.au

ABN: 55 124 110 167

Report Number: 279

Report Version	Prepared by	Reviewed by	Submitted to Client	
			Method	Date
Draft	Stuart Halse		email	18 August 2016
Draft 2	Stuart Halse Mike Scanlon		Dropbox	19 August 2016
Final	Stuart Halse Michael Curran		Dropbox	7 September2016

K:\Prjects\GRR_05\Report\BEC_Gruyere Borefield Stygofauna Assessment2_final24viii16

EXECUTIVE SUMMARY

Introduction

The Gruyere Gold Project is a greenfields gold deposit in the Yamarna greenstone belt of the Yilgarn Region of Western Australia. The Project is owned by Gold Road Resources Limited, which aims to develop an open pit mining operation to extract and process gold.

The Gruyere Project will require one or more sources of groundwater to supply water for mine operations, ore processing and accommodation village supplies. This report documents the stygofauna species present in groundwater within the Yeo Palaeochannel in the vicinity the Gruyere Project, including the proposed Yeo and Anne Beadell Borefields that will supply the Project with groundwater.

Stygofauna are aquatic animals that live in groundwater. They occur in an array of different groundwater habitats including calcrete and alluvium. The calcrete bodies in the palaeovalleys of the Yilgarn have been identified as areas rich in stygofauna species, with the ranges of many species being restricted to single calcretes

Yeo Palaeochannel

The Yeo Palaeochannel represents an ancient river system, flowing east for about 60 km to Lake Yeo and then ultimately discharging into the Eucla Basin. The palaeochannel varies from 2 to 12 km in width, with calcrete and halite deposits occurring at intervals along its length.

Extensive calcrete deposits with saturated depths of 4 to 14 m occur within Quaternary detritals in the vicinity of the Gruyere Gold Project. The calcrete is cavernous in places with high permeability and groundwater storage. Groundwater salinity in the palaeochannel in the vicinity of the two proposed sections of the Yeo Borefield west of the Project is approximately 14,000-50,000 mg L^{-1}. Groundwater in the Anne Beadell Borefield south of the Project is about 1,500-6,000 mg L^{-1}.

Stygofauna Sampling

Ten rounds of stygofauna sampling were conducted in palaeochannel areas between 2012 and 2016, with a total of 239 samples collected overall from 115 bores. Methods and approach followed those recommended in the Environmental Protection Authority's Environmental Assessment Guideline 12 and Guidance Statement 54A.

A total of 4,263 stygofauna specimens were collected, representing at least 61 species and 12 higher taxonomic groups occurring in the palaeochannel. These included worms in the groups Nematoda (1 species), Aphanoneura (1 species), Oligochaeta (11 species) and Turbellaria (1 species), as well as rotifers (2 species), crustaceans belonging to the 'orders' Copepoda (33 species), Ostracoda (1 species), Syncarida (5 species), Amphipoda (3 species), and diving beetles in the insect family Dytiscidae (3 species). Three additional syncarid species were collected only in bores outside the palaeochannel.

Sequences of the CO1 gene of 100 specimens were used to refine or confirm species identifications based on morphology. Most species were relatively widespread in the Yeo Palaeovalley around the Gruyere Gold Project but three of the species collected are currently known only from within the Yeo Borefield. These species are:

- Enchytraeidae sp. B07 – known from a single animal in the northern section of the Yeo Borefield as a result of genetic analysis. Altogether, 159 specimens of enchytraeid sp. were collected in surveys and species were widely distributed in the Yeo Palaeochannel. Not all specimens could be sequenced (some were slide-mounted, some were considered unsuitable for DNA extraction and some of the specimens analysed did not yield DNA). It is considered highly likely that Enchytraeidae sp. B07 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.

- Enchytraeidae sp. B10 – known from a single animal ion the northern section of the Yeo Borefield through genetic analysis. For the reasons outlined above for Enchytraeidae sp. B07, it is considered highly likely that Enchytraeidae sp. B10 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.
- Parabathynellidae gen. nov. sp. B07 – known from two animals, one in the southern section and one in the northern section of the Yeo Borefield. The area between the two records is prospective stygofauna habitat and the species is almost certain to occur in this intervening area of highly prospective stygofauna habitat between the two sections of the Yeo Borefield.

In general, stygofauna species in the Yeo Palaeochannel appear to have relatively widespread occurrences for subterranean species in Yilgarn calcretes, with Chiltoniidae sp. B02 having a linear range of >100 km. This suggests that the subterranean habitat within the Yeo Palaeochannel is homogeneous and that, if the ranges of all species were fully documented, most species may occupy moderately large areas.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The Yamarna greenstone belt is a newly discovered gold region covering approximately 5,000 km^2 on the eastern side of the Yilgarn Craton of Western Australia. The Gruyere Gold Project is a greenfields gold deposit in the Yamarna greenstone belt (Figure 1) that is owned by Gold Road Resources Limited (Gold Road). Gold Road aims to develop an open pit mining operation to extract and process gold from the Gruyere Deposit, which is located within the Yamarna Pastoral Lease. This lease is wholly owned and managed by Gold Road.

The Gruyere Gold Project will require one or more sources of groundwater to supply water for mine operations, ore processing and accommodation village supplies. This report builds on earlier reports by Bennelongia (2013a,b, 2016) to document the stygofauna species occurring in groundwater of the Yeo Palaeochannel in the vicinity the Gruyere Gold Project, including the two proposed sections of borefield to the west of the Project that are referred to as the Yeo Borefield and a proposed smaller borefield to the south of the Project that is referred to as the Anne Beadell Borefield. Stygofauna are aquatic animals that live in groundwater.

2. STYGOFAUNA

Stygofauna occur in an array of different groundwater habitats including porous, karstic and fractured rock aquifers, springs and hyporheos of streams (Eberhard *et al.* 2005). Stygofauna inhabit interstitial spaces, fissures and voids in aquifers (Gibert and Deharveng 2002) and, in general terms, the likelihood of them occurring in an aquifer is directly related to its transmissivity.

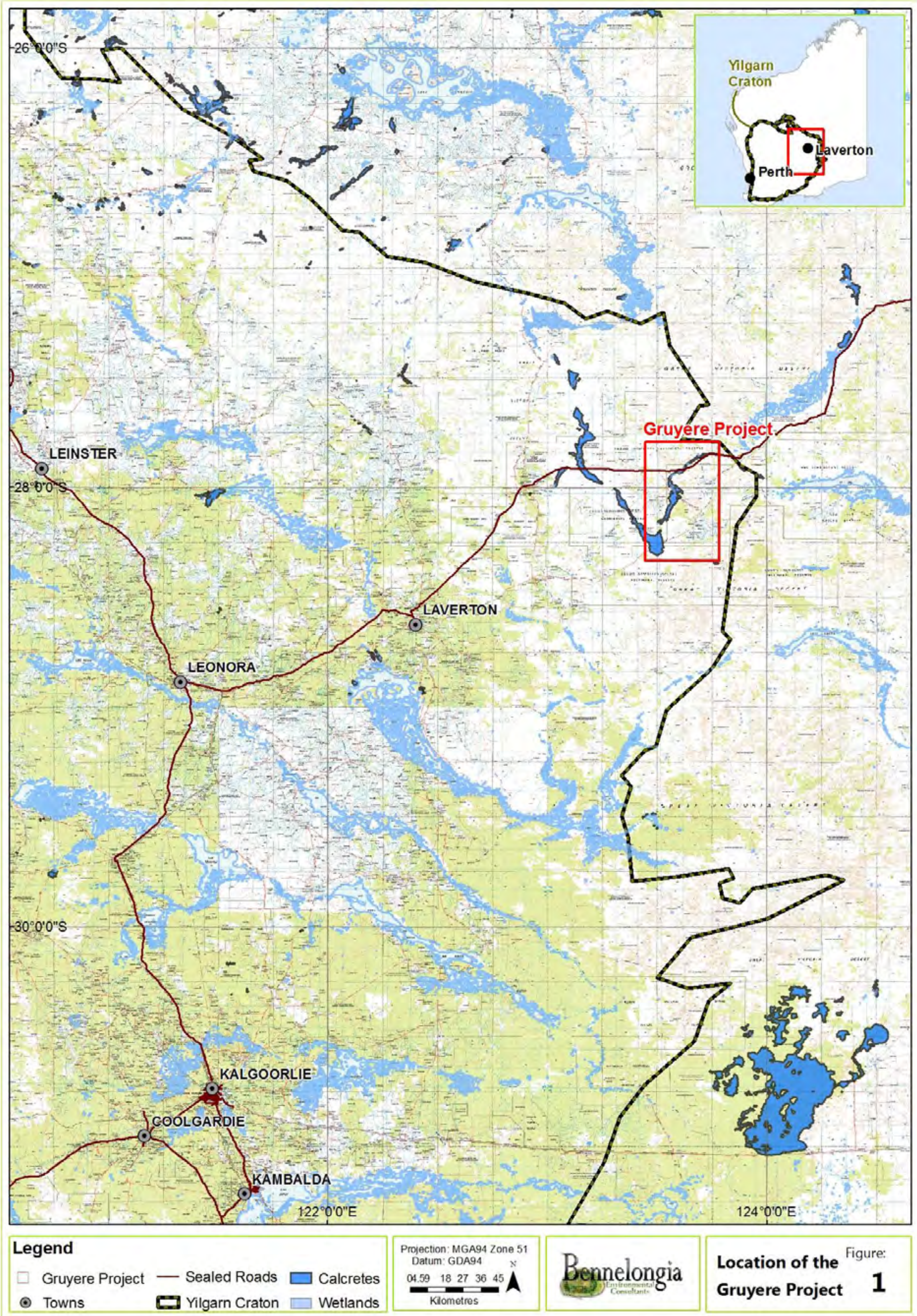
The physiochemical tolerances of stygofauna have not been well defined, although some information is available on salinity tolerances and more can be inferred from salinity tolerance information for surface wetland species. Stygofauna have mostly been recorded in fresh to brackish groundwater but may possibly occur in salinities up to 50,000 mg/L TDS (Watts and Humphreys 2006; Reeves *et al.* 2007).

Calcrete and alluvium are typically considered to be productive habitats for stygofauna because the fissures and voids in groundwater aquifers provide highly suitable habitat for small aquatic invertebrates. The calcrete bodies in the palaeovalleys of the Yilgarn have been identified as areas rich in stygofauna species, with many species being restricted to single calcretes (Guzik *et al.* 2008, Karanovic and Cooper 2011, Karanovic *et al.* 2014). The belief that most stygofauna species are restricted to individual calcretes is often termed the 'calcrete island' hypothesis (Cooper *et al.* 2002). It is suggested that calcretes have endemic faunas because the fine alluvial and clay deposits that occur around the calcrete bodies have limited voids or spaces through which the animals can move, therefore providing a barrier to dispersal for subterranean species. In many cases, high salinities may also provide barriers to movement of stygofauna between different calcretes. Many of the stygofauna communities restricted to individual calcretes have been listed as either Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) (DPaW 2015). In both cases, the communities are seen as having high conservation value during any environmental impact assessment process. The mapped calcretes of the Yeo Palaeochannel in the vicinity of the Gruyere Project are not listed as TECs or PECs.

3. YEO PALAEOCHANNEL HYDROLOGY

3.1. Aquifer characteristics

The Yeo Palaeochannel represents an ancient river system, flowing east for about 60 km to Lake Yeo (Figures 1 and 2) and then ultimately discharging into the Eucla Basin. The palaeochannel varies from 2 to 12 km in width, with calcrete and halite deposits occurring at intervals along its length.



The Yeo Palaeochannel extends to a depth of 130 to 150 m and typically consists of a basal sand and gravel unit up to 40 m thick, overlain by interbedded clayey sequences of colluvium and alluvium with minor sand lenses (Commander *et al*. 1992 in Pennington Scott 2012). Although the surface expression of the palaeochannel is 2 to 12 km across, the buried channels are less than 1.5 km wide. Outside the central trunk, the surface colluvium and alluvium rapidly thins out to have a depth of less than 20 m (Johnson *et al*. 1999; ANL 2000 in Pennington Scott 2012). The extensive calcrete deposits can be up to 1.5 km wide and over 5 km in length, with depths of 4 to 14 m. The calcrete is cavernous in places with high permeability and groundwater storage, although most of the calcrete occurs as a matrix that binds the dominant sand substrate (Pennington Scott 2012, 2016).

The most significant aquifers in the Yeo Palaeochannel lie within the Quaternary detritals and within the thicker Werillup Formation. Areas of calcrete occur within the Quaternary detritals aquifer, which contains brackish to saline water. The Werillup Formation aquifer lies within sand, gravel and clay and contains saline to hypersaline water. The Perkolilli Shale, which consists of clay and silt, forms an aquitard between the Quaternary detritals aquifer and Werillup Formation aquifer, which would be expected to be a barrier to stygofauna movement (Figure 3; Appendix 1).

In broad terms, the depth from the surface to the water table is approximately 8 m in much of the Yeo Palaeochannel. On average, the Quaternary detritals aquifer is about 4 m thick although its thickness ranges from 0 to 12 m (Figure 4). The Perkolilli Shale aquitard is about 20 m thick and the deeper Werillup Formation is on average about 90 m thick and underlain by saprolite formed by weathering of the Archean Basin rock. The proposed borefields will extract groundwater from this deeper Werrilup Formation. Reduction of pressure in this aquifer will lead to lowering of water levels over time in the overlying Quaternary detritals.

3.2. Groundwater salinity

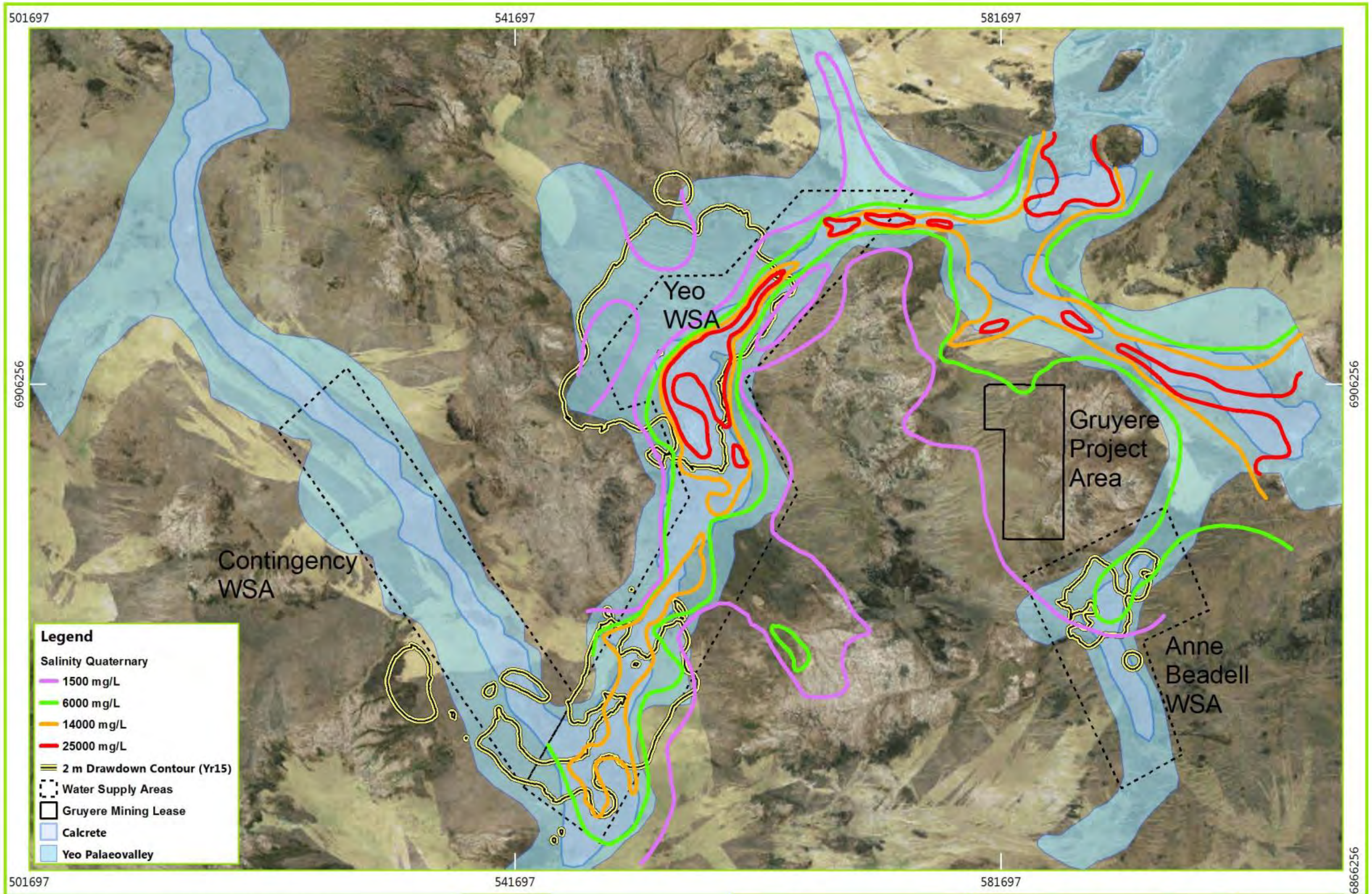
Groundwater salinities in the Yeo Palaeochannel increase as groundwater flows from catchment headwaters towards Lake Yeo (Figure 2). Groundwater salinity in the surficial aquifer is approximately 1,500 - 6,000 mg L^{-1} in the southern tributary of the Yeo Palaeochannel where the Anne Beadell borefield is located and carbonate content is relatively high. Groundwater salinity at depth in the main trunk of the Yeo Palaeochannel, west of the Gruyere Gold Project, where the Yeo Borefield are located is approximately 14,000-50,000 mg L^{-1}.

There is often a vertical gradient of salinity in the Yeo Palaeochannel, with the top metre of groundwater having a salinity that is approximately half that found at depth. Groundwater in the valley flanks outside the palaeochannel is fresh.

3.3. Prospective stygofauna habitat

The surficial Quaternary detritals aquifer in the Yeo Palaeovalley, which lies principally within colluvium, alluvium and saturated calcrete, is up to 14 m thick and is likely to comprise the main habitat for stygofauna in the Yeo Palaeochannel. The Werillup Formation aquifer lies under an aquitard formed by the Perkolilli Shale that reduces opportunities for colonisation by stygofauna and also reduces inflow of nutrients and carbon. Thus, while stygofauna species may be present below the aquitard in the Werillup Formation, they would be expected to be present in low numbers and to be relatively insensitive to changes in the upper aquifer.

In general, stygofauna are unlikely to occur at salinities >50,000 mg L^{-1} although there are records of stygofaunal amphipods and copepods at salinities >100,000 mg L^{-1} near Wiluna (Outback Ecology 2012). Below 50,000 mg L^{-1}, provided physical habitat is suitable, the number of stygofauna species present is expected to be inversely proportional to salinity, with individual species mostly occurring across a limited range of salinities (i.e. in fresh groundwater or hyposaline groundwater or saline groundwater) (see Pinder *et al*. 2005 for surface water examples).



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.

MGA94 (Zone 51)
Date: 7 September 2016 Rev: A
Author: M.Scanlon, M. Curran
Source Destination

Salinity levels in the Quaternary Detritals aquifer

Figure: **2**

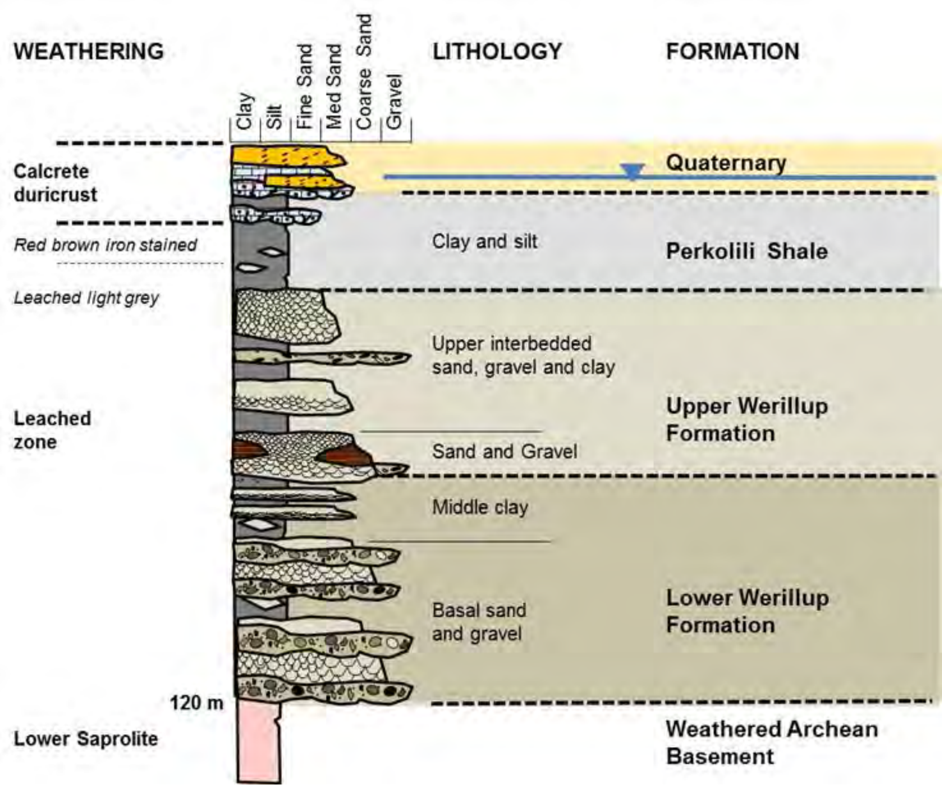


Figure 4. Profile through the Yeo Palaeochannel (from Pennington Scott 2016).

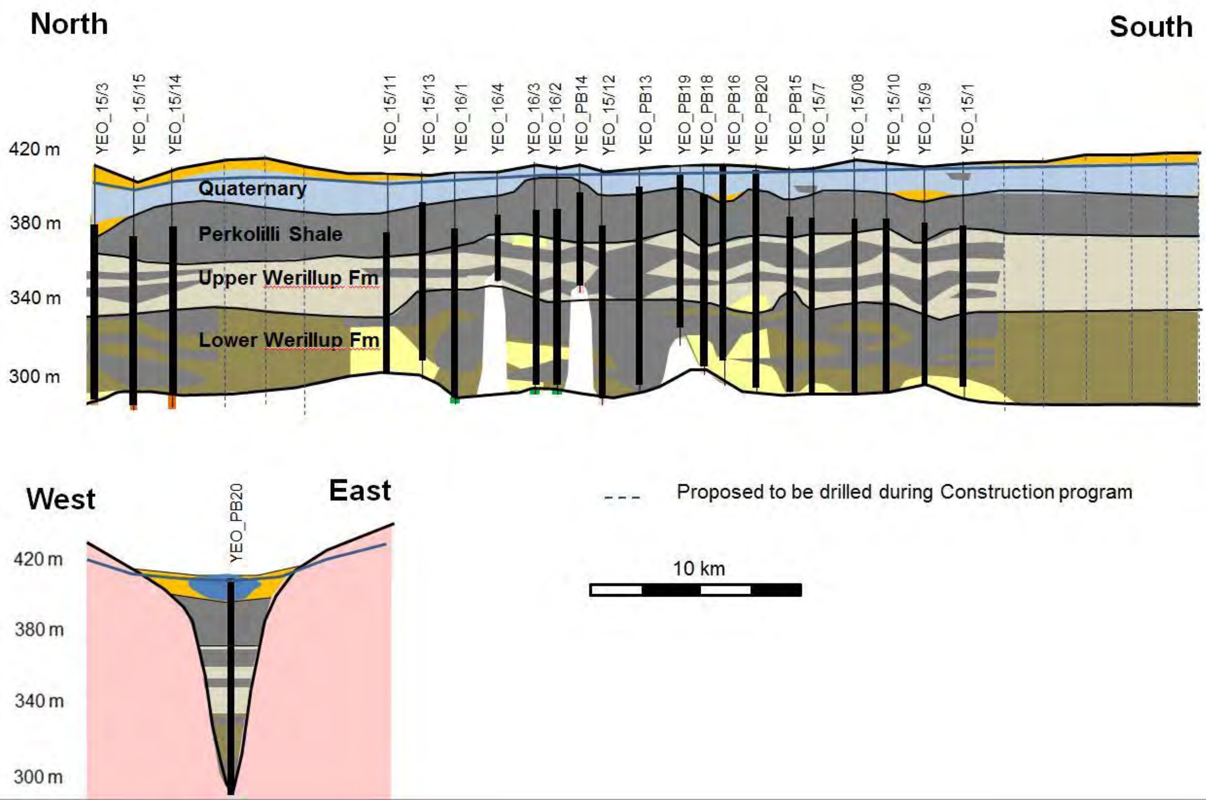


Figure 5. Longitudinal and cross section of the Yeo Palaeochannel.
(From Pennington Scott 2016).

While salinity in the surficial aquifer is shown in Figure 2 as a parameter with broad gradients, in reality salinity is heterogeneous at a fine scale and shows variation as a result of local surface topography, vegetation and soil type (Runyan and d'Odorico 2010). A consequence of this is that the preferred salinity levels of a species may sometimes occur in only a small proportion of the palaeochannel and the species will have a patchy distribution that is not easily predicted without fine-scale salinity mapping.

4. STYGOFAUNA SURVEYS

4.1. Sampling Methods

The sampling methods used followed those outlined by Eberhard *et al*. (2005) and recommended in Environmental Assessment Guideline 12 and Guidance Statement 54A (EPA 2007, 2013). At each bore, six net hauls were collected using a weighted plankton net. Three hauls were made using a 50 µm mesh net and three with a 150 µm mesh net. After the net was lowered to the bottom of the bore it was jerked up and down briefly to agitate benthic stygofauna into the water column. The net was then slowly retrieved. Contents of the net were transferred to a 125 ml polycarbonate vial after each haul and preserved in 100% ethanol. Nets were washed between bores to minimise contamination among sites.

4.2. Sampling effort and locations

Ten rounds of sampling were conducted in palaeochannel areas between 2012 and 2016, with a total of 239 samples collected overall from 115 bores (Table 1, Figure 5). Of these, 227 samples were collected from the proposed Yeo Borefield and surrounding areas while 12 samples were collected within, or in close proximity to, the proposed Anne Beadell Borefield. Given the extensive nature of palaeovalley areas around the Gruyere Gold Project, we have reported all samples outside the areas of >2 m drawdown associated with these borefields as 'reference' samples.

Details for all sampled bores are given in Appendix 2.

4.3. Species identification

Samples were returned to the Bennelongia laboratory in Perth for sorting and identification.

After elutriation and sieving to remove as much detritus as possible, samples were sorted under dissecting microscopes. All stygofauna specimens present were identified morphologically to species level or, in a few cases, to morphological entity representing several species. Morphological identifications were made using published keys or the characters in those keys were used to distinguish undescribed species.

DNA analyses were carried out on 125 animals using the CO1 barcoding gene to confirm or refine morphological identifications. A dissecting microscope was used when the individual animals to be used in analyses were selected from samples that had previously been subject to morphological examination. Either legs or whole animals (depending on their size) were transferred directly into ATL buffer and proteinase K after confirming species identification. DNA was extracted using a Qiagen DNeasy Blood & Tissue kit. PCR amplifications of 487 - 883 base pair fragments of the CO1 gene were attempted with four primers (LCO1490:HCO2198, LCO1490:HCOoutout, C1-J-1718:HCO2198, C1-J-1718:HCOoutout; Folmer *et al*. 1994). Sequencing was undertaken by AGRF (Australian Genome Research Facility). Sequences were obtained for 102 animals.

4.4. Compiling species lists

In many cases, animals could not be identified morphologically to species level because they were damaged, juvenile or the wrong sex for morphological determination. While many of the animals were potentially identifiable using DNA analysis (although a significant number of copepods failed to yield DNA), for reasons of cost only a small proportion of the animals collected were analysed for CO1.

The higher level (i.e. above species level) identifications were included in calculations of the number of species present only if the specimens could not belong to a species already recorded. Other records

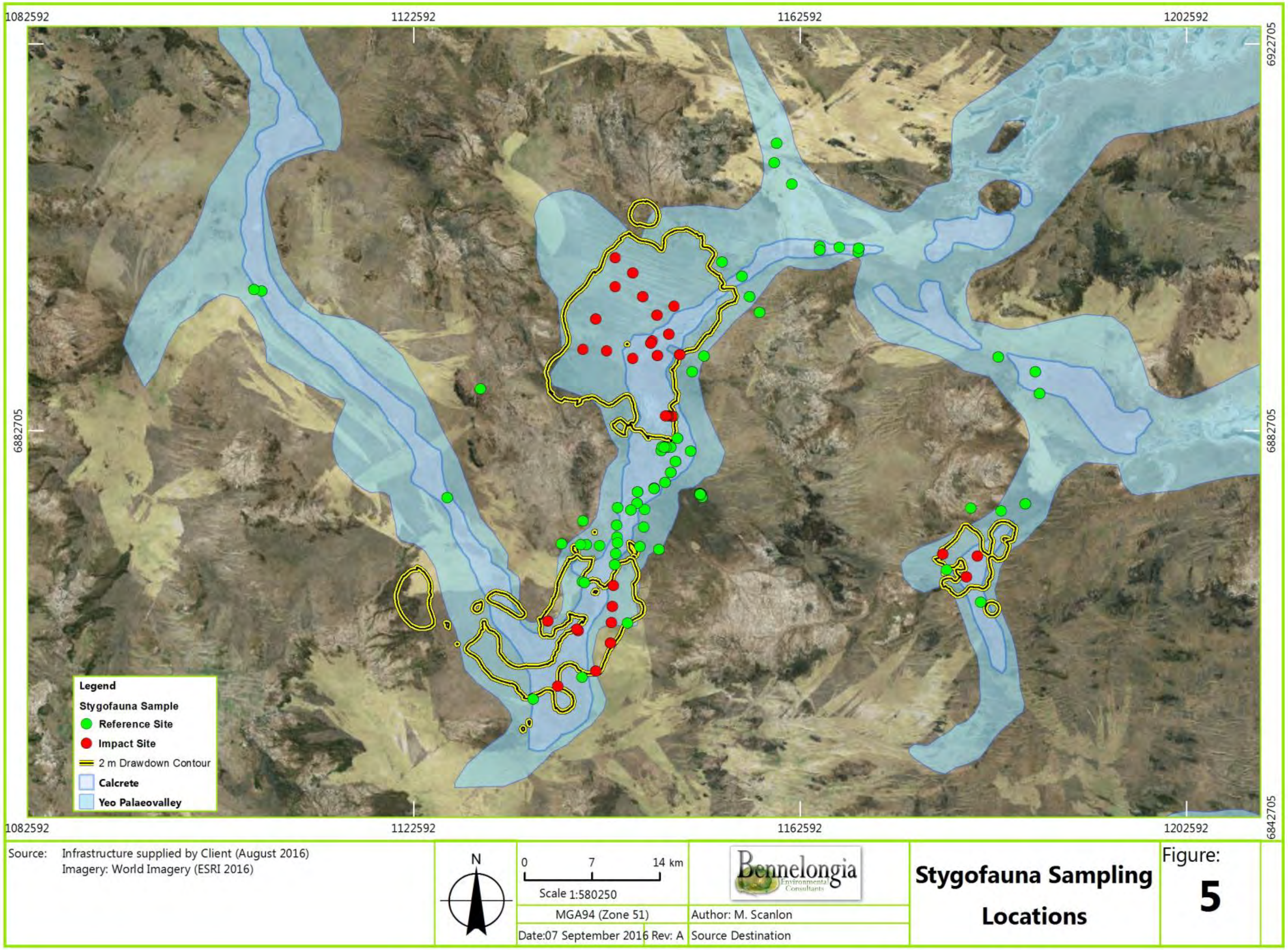

1082592
1122592
1162592
1202592
6922705
6882705
6842705
Legend
Stygofauna Sample
Reference Site
Impact Site
2 m Drawdown Contour
Calcrete
Yeo Palaeovalley
Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
N
0 7 14 km
Scale 1:580250
MGA94 (Zone 51)
Date:07 September 2016 Rev: A
Bennelongia Environmental Consultants
Author: M. Scanlon
Source Destination
Stygofauna Sampling Locations
Figure:
5

Table 1. Sample effort for stygofauna at the Project.

	Borefield Impact		Reference	Total
	Yeo	Anne Beadell		
Jun-12	-	-	8	8
Dec-12	8	-	27	35
Feb-13	-	-	37	37
Oct-15	2	1	8	11
Dec-15	1	1	5	7
Jan-16	2	-	16	18
Apr-16	3	1	9	13
May-16	11	1	12	24
Jun-16	9	-	15	24
Jul-16	20	-	42	62
Total	**56**	**4**	**179**	**239**

of higher level identifications are provided in a separate table from the species list. One of the implications of the higher level identifications is that the frequency of occurrence (and ranges) of some species are likely to have been underestimated.

4.5. Personnel

Fieldwork was undertaken by Jim Cocking, Dean Main, Jeremy Quartermaine, Sean Bennet, Mike Scanlon and Michael Curran. Samples were sorted by Jane McRae, Michael Scanlon, Jim Cocking, Grant Pearson, Dean Main and Jeremy Quartermaine. All identifications were undertaken by Jane McRae except for Aphanoneura, Oligochaeta and Nematoda which were identified by Mike Scanlon, and ostracods which were identified by Stuart Halse. DNA analyses were run by Michael Curran.

5. SURVEY RESULTS

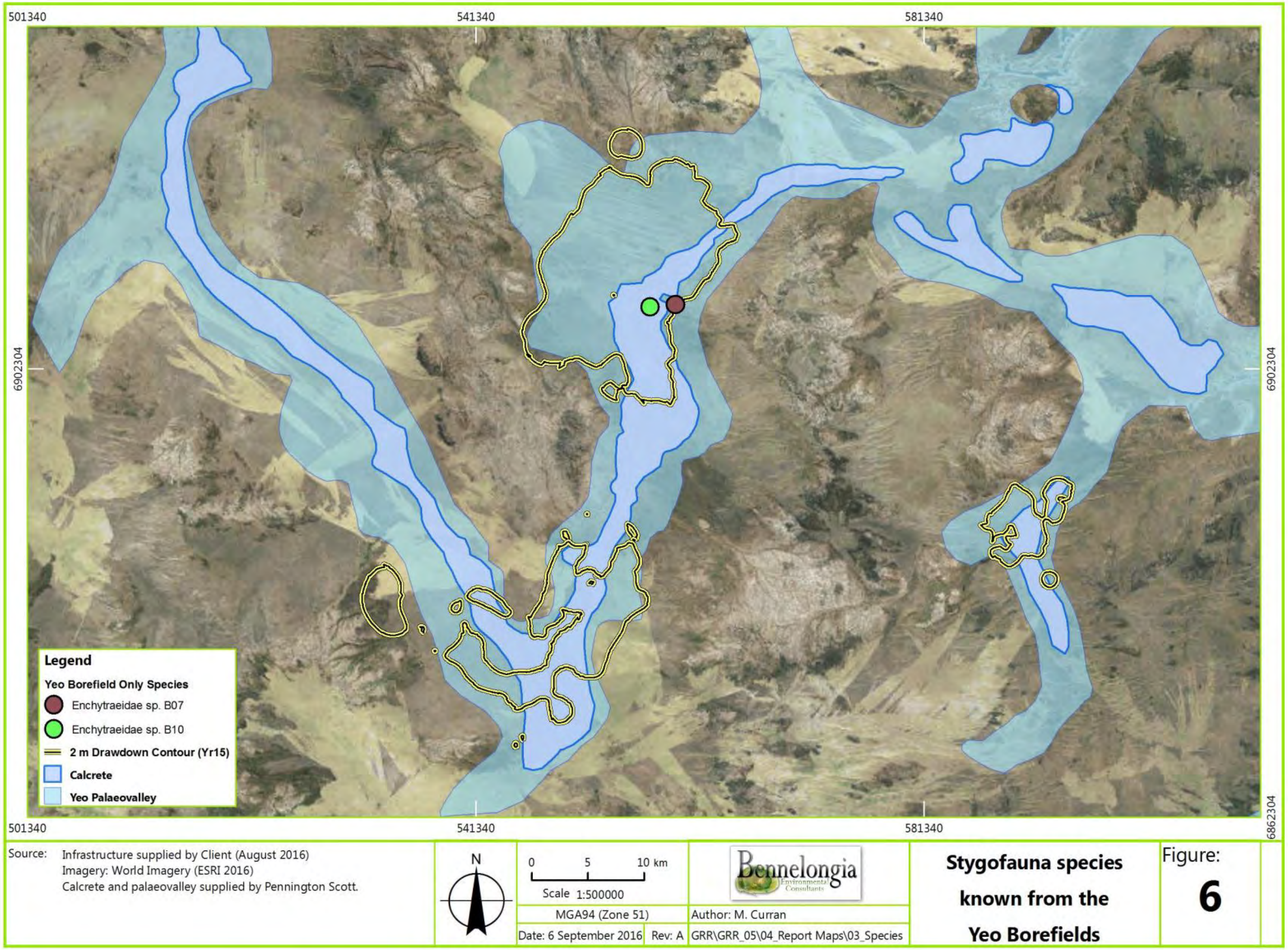
5.1. Species collected

A total of 4,263 stygofauna specimens were collected, representing at least 61 species and 12 higher taxonomic groups occurring in the palaeochannel (Tables 2 and 3). These included worms in the groups Nematoda (1 species), Aphanoneura (1 species), Oligochaeta (11 species) and Turbellaria (1 species), as well as rotifers (2 species), crustaceans belonging to the 'orders' Copepoda (33 species), Ostracoda (1 species), Syncarida (5 species), Amphipoda (3 species), and diving beetles in the insect family Dytiscidae (3 species). Three additional syncarid species were collected only in bores outside the palaeochannel (*Kimberleybathynella* sp. B07, *Atopobathynella* sp. B21, Parabathynellidae gen. nov. 1 sp. B06) and are omitted from the total list of species in Table 2.

Copepods were both the most diverse and the most abundant group, representing 53% of all species and 77% of all specimens collected (3,289 specimens in total). Amphipods also represented a significant proportion of total abundance (18%) with 763 specimens collected. The abundance of individual species was not always clear because, in some cases, DNA analyses altered the results of morphological determinations which resulted in a fairly large number of specimens identified only to higher order level. However, among the copepods *Nitocrella* sp. B06 was an abundant species and the amphipod *Stygochiltonia* sp. B03 is also likely to be abundant although DNA confirmation is required when identifying this species.

5.2. Distribution patterns

Four of the 61 species collected from the Yeo Palaeochannel belong to groups that are not assessed in environmental impact assessments in Western Australia because of poor taxonomic frameworks and


501340
541340
581340
6902304
6862304
Legend
Yeo Borefield Only Species
Enchytraeidae sp. B07
Enchytraeidae sp. B10
2 m Drawdown Contour (Yr15)
Calcrete
Yeo Palaeovalley
Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
N
0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A
Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species
Stygofauna species known from the Yeo Borefields
Figure: 6

difficulties in identification (nematodes, turbellarians, rotifers), although one of the rotifers was able to be identified as a cosmopolitan species.

Six other species have known ranges extending well beyond the Yamarna area, with three species known widely in the Yilgarn (copepods *Dussartcyclops uniarticulatus*, *Fierscyclops fiersi* and ostracod *Sarscypridopsis* sp. BOS615), two in north-western Australia (copepods *Dussartcyclops* nr *uniarticulatus*, *Halicyclops kieferi* and a calanoid copepod with an unknown distribution (Table 2). It is considered likely that Calanoida sp. is a species of *Calamoecia* with a predominantly surface occurrence and a moderately large, inland range but all animals collected were female and not readily identifiable. Calanoids occasionally occur in the Perth water supply but usually only as fragments. All calanoids in the Yamarna samples were in good condition and Bennelongia has filters on all taps, so it is unlikely contamination from the water supply is the source of the calanoids.

The remaining 51 species are known only from the Yamarna area, with 48 of these species having been recorded both within and outside, or only outside, the proposed borefields (Table 2). Just three species are known only from the proposed Yeo Borefield (Figure 6). No species is known only from the Anne Beadell borefield.

Two of three 'restricted' species are enchtraeid worms (Enchytraeidae sp. B07 and Enchytraeidae sp. B10), known only from the northern section of proposed Yeo Borefield (Figure 6). The third 'restricted' species is the syncarid Parabathynellidae gen. nov. 1 sp. B07, which was collected as a single specimen from both the southern and the northern sections of the Yeo Borefield. The species is almost certain to occur in the palaeochannel between the two proposed borefields.

5.3. Comments on selected species

Enchytraeidae

Enchytraeids were speciose in the Yeo palaeochannel, with genetic lineages recorded on the basis of differences in CO1 sequences. This is a group for which there has traditionally been little attempt to undertake morphological identification, although in fact the results of a morphological assessment undertaken while preparing specimens for sequencing were in full agreement with the genetic results.

The genetic differences observed between species were 11 –23% or more. This is interpreted to mean the lineages represent different species. Hebert *et al.* (2003) reported the mean CO1 sequence divergence for 128 species pairs of annelids was 15.7% but divergences of 10 – 11% are frequently regarded as indicative of the existence of cryptic oligochaete species (Novo *et al.* (2009). It is possible, however, that the 10 – 11% threshold is too low for some subterranean oligochaetes, which have limited dispersal capacity and are therefore likely to exhibit a high degree of genetic structuring.

Among the 33 enchytraeids that yielded sequences, only Enchytraeidae sp. B10 was abundant, being represented by 13 sequenced specimens in three bores. Three species occurred in moderate abundance (Enchytraeidae sp. B09, Enchytraeidae sp. B12, Enchytraeidae sp. B13). In contrast, Enchytraeidae sp. B07 and Enchytraeidae sp. B10 were both in the low abundance part of the species abundance curve in Figure 7, which shows a log-normal pattern typical of most animal communities (Fisher et al. 1943). More extensive sampling would be required to obtain the multiple records of these species that are required to adequately document their ranges, even when habitat information is used to assist in range predictions. Thus, while Enchytraeidae sp. B07 and Enchytraeidae sp. B10 are each known only from single holes within the northern section of the proposed Yeo Borefield (Figure 8), in both cases the restricted known distributions are probably artefacts of the species having low abundance.

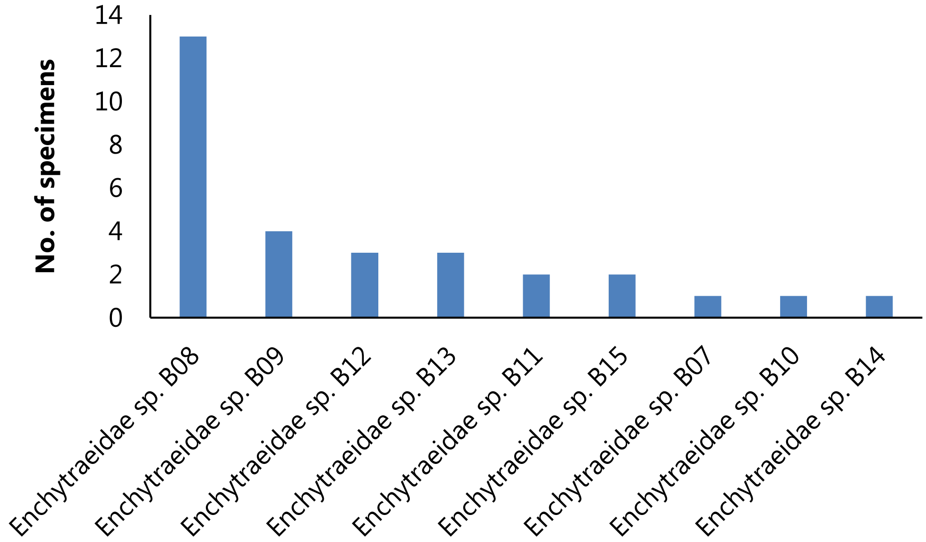


Figure 7. Relative abundance of the nine enchytraeid species in the Yeo Palaeochannel.

Other Worms

Phreodrilid worms are relatively uncommon in groundwater and it is likely a single species was collected in the Yeo palaeochannel as Phreodrilidae with similar ventral chaetae and Phreodrilidae sp. This phreodrilid species has a known linear range in the paleochannel of 12 km, occupying the full length of area between the southern and northern sections of the Yeo Borefield (Figure 9).

One species of tubificid worm is present in the palaeochannel. DNA analysis confirmed that the specimens of Tubificidae sp. B02 in the southern section of the proposed Yeo Borefield and in the palaeochannel to the north of that are the same species with CO1 sequence divergence of only 0.24%. Other morphologically identified specimens of Tubificidae sp. B02 give the species a known linear range of 20 km (Figure 9).

Amphipoda

DNA analysis suggested three species of amphipod occur in the palaeochannel. The species appear to have high intraspecific morphological variability, making morphological determinations difficult, although morphology and DNA indicates they do not belong to any known genera of Amphipoda. The most widespread species is Chiltoniidae sp. B02, which has a linear range of 104 km along the palaeochannel, including both sections of the proposed Yeo Borefield (Figure 10). It showed CO1 sequence divergence of up to 8.6% (4.7% average) from twelve animals. In contrast, Chiltoniidae sp. B03 was found in the eastern part of the palaeochannel, away from the Yeo and Anne Beadell Borefields and two animals sequenced had a CO1 divergence of 1.86% and a range of 22 km. Chiltoniidae sp. B01 was collected through the centre of the Yeo Borefield, with a known linear range of 14.5 km and CO1 divergence of 2.9% from three specimens.

The CO1 divergence between species was about 14% and it is likely that the ranges of all species are larger than shown by the sequenced specimens. Only 17 of the 773 amphipod specimens collected in 59 samples were sequenced.

Syncarida

Four species of syncarid were recorded in the palaeochannel, with two species recorded in the Yeo Borefield, Parabathynellidae gen. nov. 1 sp. B04 extended from the top of the southern Yeo Borefield to beyond the northern borefield, with a linear range of 50 km (Figure 11). Genetic analysis of six specimens (which had CO1 divergence of 5.0%) confirmed the accuracy of morphological identificat-

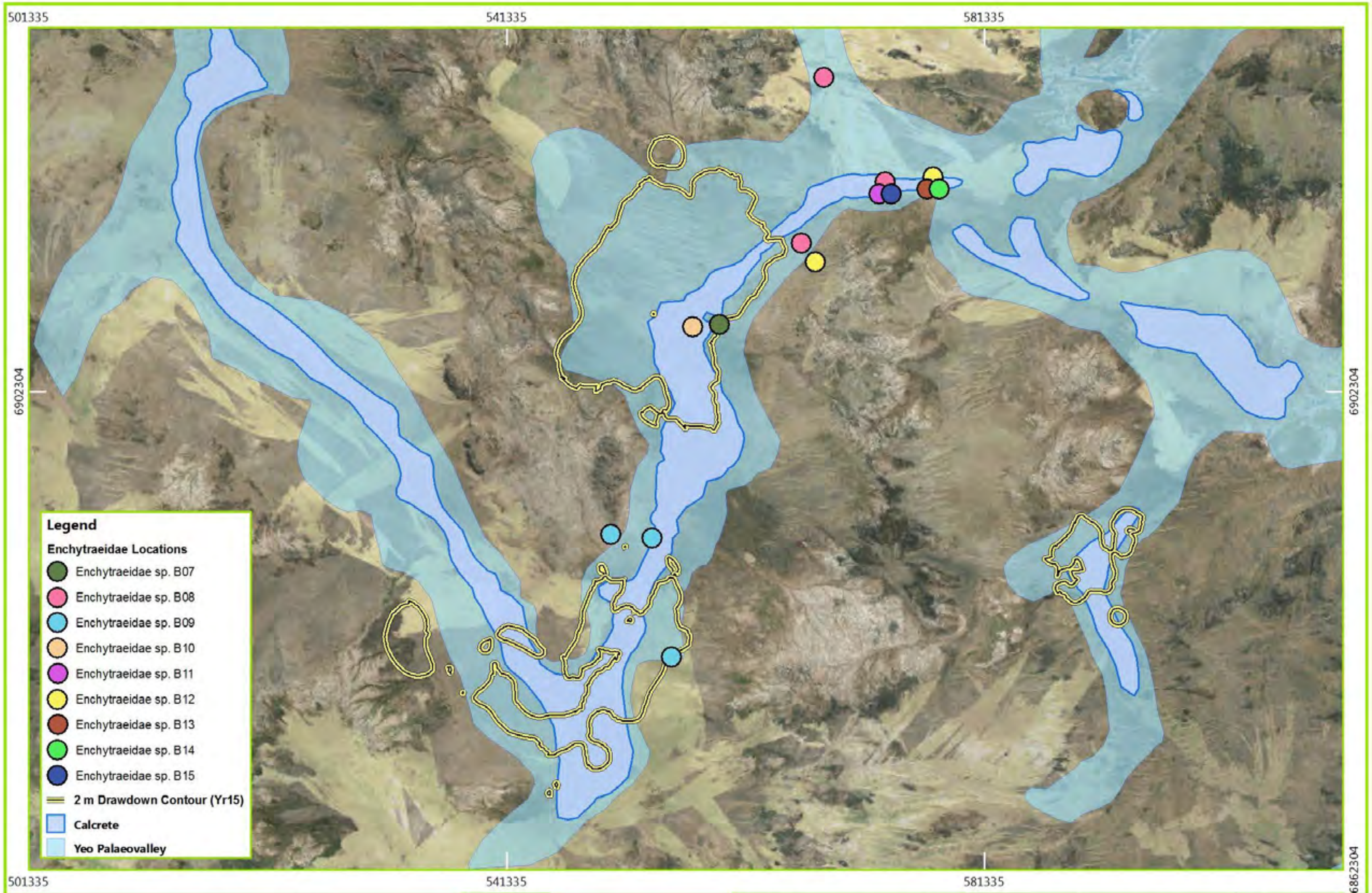
Table 2. Stygofauna species collected from the proposed Yeo and Anne Beadell Borefields.
Number of animals collected in impact and reference sites is shown. N/A, not assessed in EIA and identification is at higher order level. Note that it is inferred that all animals in a sample for which a sequenced was obtained belonged to the sequenced species; if more than one DNA-defined species was present numbers were assigned to the species in the most appropriate way.

Higher Group	Family	Species	Impact	Reference	Distribution
Primitive Worms					
Turbellaria		Turbellaria sp.		20	N/A
Nematoda		Nematoda sp.	26	78	N/A
Rotifers					
Rotifera		Bdelloidea sp. 2:2		3	N/A
	Lecanidae	*Lecane ludwigii*		1	Cosmopolitan
Worms					
	Aeolosomatidae	Aeolosomatidae sp.		5	Yamarna
	Enchytraeidae	Enchytraeidae sp. B07	1		Yeo Borefield
		Enchytraeidae sp. B08		20	Yamarna
		Enchytraeidae sp. B09		11	Yamarna
		Enchytraeidae sp. B10	2		Yeo Borefield
		Enchytraeidae sp. B11		2	Yamarna
		Enchytraeidae sp. B12		3	Yamarna
		Enchytraeidae sp. B13		3	Yamarna
		Enchytraeidae sp. B14		1	Yamarna
		Enchytraeidae sp. B15		2	Yamarna
	Phreodrilidae	*Insulodrilus* sp.		1	Yamarna
	Tubificidae	Tubificidae sp. B02	1	2	Yamarna
Crustaceans					
Calanoida		Calanoida sp.		1	Unknown, outside Yamarna?
Cyclopoida	Cyclopidae	*Dussartcyclops* nr *uniarticulatus*		6	North-west WA
		Dussartcyclops uniarticulatus	1	26	Yilgarn
		Fierscyclops (Fierscyclops) fiersi	3	441	Yilgarn
		Halicyclops eberhardi a	10	7	Yamarna
		Halicyclops eberhardi b		1	Yamarna
		Halicyclops eberhardi c		22	Yamarna
		Halicyclops kieferi		19	North-west WA
Harpacticoida	Ameiridae	Ameiridae gen. nov. 4 sp. B01	10	216	Yamarna
		Nitocrella sp. B06	20	985	Yamarna
		Nitocrella sp. B07		1	Yamarna
		Nitocrella sp. B10	5	1	Yamarna
		Nitocrella sp. B11		2	Yamarna
		Nitocrellopsis sp. B04	8	165	Yamarna
		Nitocrellopsis sp. B05		5	Yamarna
		Nitocrellopsis sp. B06		94	Yamarna
		Nitocrellopsis sp. B07		108	Yamarna
		Nitocrellopsis sp. B08	11	52	Yamarna
		Nitocrellopsis sp. B09	4	10	Yamarna
		Nitocrellopsis sp. B10		14	Yamarna
		Nitokra lacustris sp. B02		4	Yamarna
		Nitokra lacustris sp. B03a	2	2	Yamarna
		Nitokra lacustris sp. B03b		2	Yamarna
		Nitokra lacustris sp. B06		3	Yamarna
		Nitokra sp. B04		6	Yamarna
		Stygonitocrella sp. B05		2	Yamarna
	Canthocamptidae	*Australocamptus* sp. B12		76	Yamarna
	Miraciidae	*Schizopera* sp. B08	1	5	Yamarna
		Schizopera sp. B09	50	58	Yamarna
		Schizopera sp. B11	1	8	Yamarna
	Parastenocarididae	*Kinnecaris* sp.		1	Yamarna
		Parastenocaris sp. B24		44	Yamarna
		Parastenocaris sp. B33		20	Yamarna
Ostracoda	Cyprididae	*Sarscypridopsis* sp. BOS615	92	2	Yilgarn
Syncarida	Parabathynellidae	*Atopobathynella* sp. B13		1	Yamarna
		Kimberleybathynella sp. B07		2	Yamarna

Higher Group	Family	Species	Impact	Reference	Distribution
		Parabathynellidae gen. nov. 1 sp. B04	6	42	Yamarna
		Parabathynellidae gen. nov. 1 sp. B07	2		Yeo Borefield
		Parabathynellidae gen. nov. 1 sp. B08		1	Yamarna
Amphipoda	Chiltoniidae	Chiltoniidae sp. B01	18	131	Yamarna
		Chiltoniidae sp. B02	1	78	Yamarna
		Chiltoniidae sp. B03		5	Yamarna
Insects					
Coleoptera	Dytiscidae	*Limbodessus* sp. B05		35	Yamarna
		Limbodessus sp. B06	3	69	Yamarna
		Nirripirti sp. B01		2	Yamarna

Table 3. Higher level stygofauna identifications from the proposed Yeo and Anne Beadell Borefields. Number of samples containing each taxon is shown.

Higher Group	Family	Identification	Impact	Reference	Likely Species
Primitive Worms					
	Phreodrilidae	Phreodrilidae sp.		5	*Insulodrilus* sp.
		Enchytraeidae sp.	82	77	Any of the other oligochaetes in Table 2
Crustaceans					
Cyclopoida	Cyclopidae	*Halicyclops eberhardi* s.l.	77	202	Any of the *Halicyclops eberhardi* in Table 2
		Cyclopoida sp.	1	3	Any of the cyclopid species in Table 2
Harpacticoida	Ameiridae	Ameiridae sp.	1	3	Any of the ameirids in Table 2
		Nitocrella lacustris sp. B03 s.l.	2	2	Either *Nitocrella lacustris* sp. B03
		Nitocrella sp.	4		Any of the *Nitocrella* species in Table 2
		Nitocrellopsis sp.	2	1	Any of the *Nitocrellopsis* species in Table 2
	Canthocamptidae	Canthocamptidae sp.	1		*Australocamptus* sp. B12
	Parastenocarididae	Parastenocarididae sp.		1	*Parastenocaris* sp. B24 or B33
		Harpacticoida sp.	2	23	Any of the harpacticoid species in Table 2
		Copepoda sp.		1	Any of the the copepod species in Table 2
Syncarida	Parabathynellidae	Parabathynellidae sp.		1	Any of the parabatynellids in Table 2
Amphipoda	Chiltoniidae	Chiltoniidae sp.	6	524	Any of the chiltoniids in Table 2
		Amphipoda sp.	1	9	Any of the chiltoniids in Table 2
Insects					
Coleoptera	Dytiscidae	*Limbodessus* sp.	1	18	*Limbodessus* sp. B05 or B06

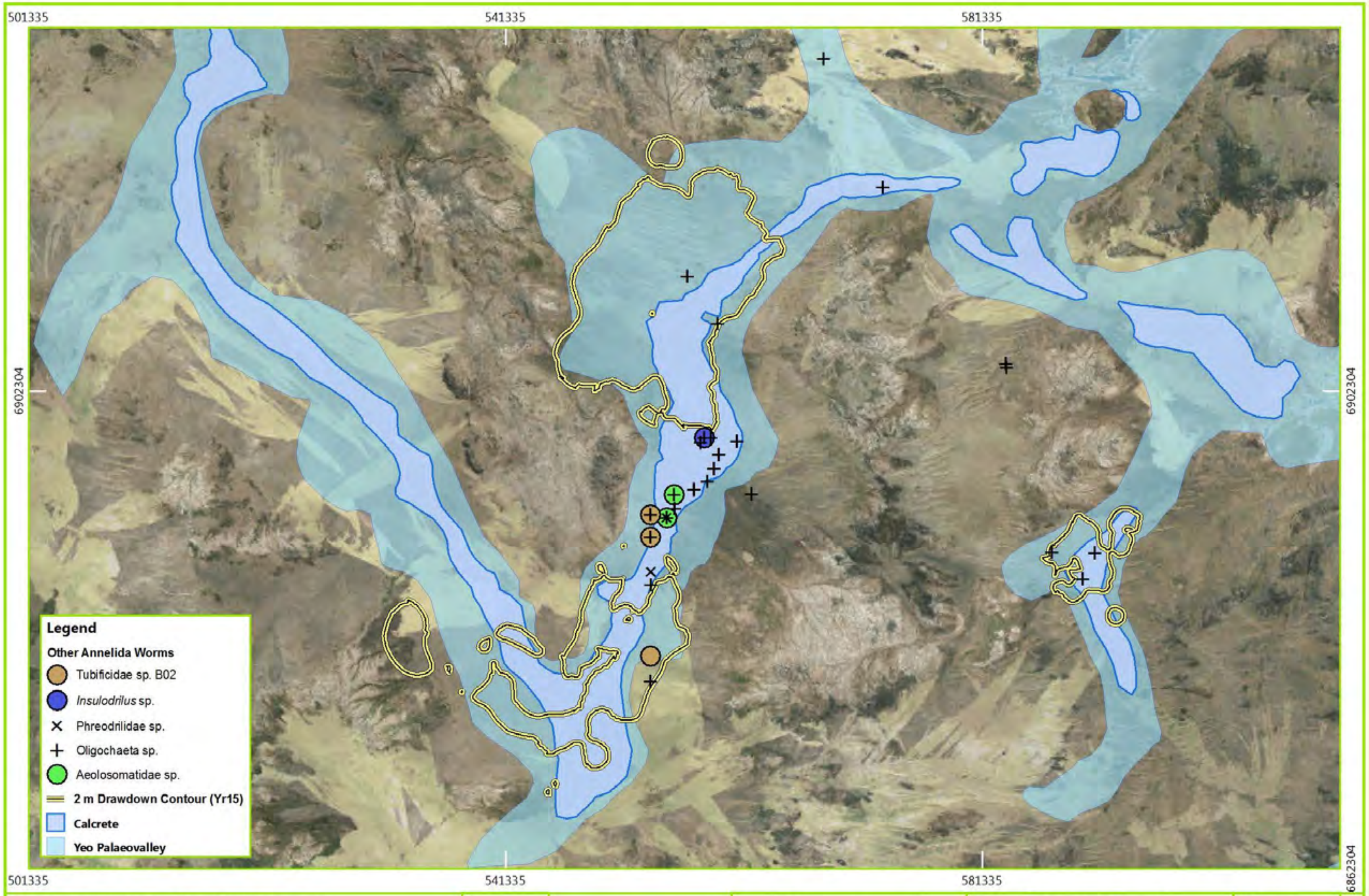


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51) | Author: M. Curran
Date: 6 September 2016 | Rev: A | GRR\GRR_05\04_Report Maps\03_Species

Distribution of Enchytraeidae Oligochaeta

Figure: **8**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.

MGA94 (Zone 51)

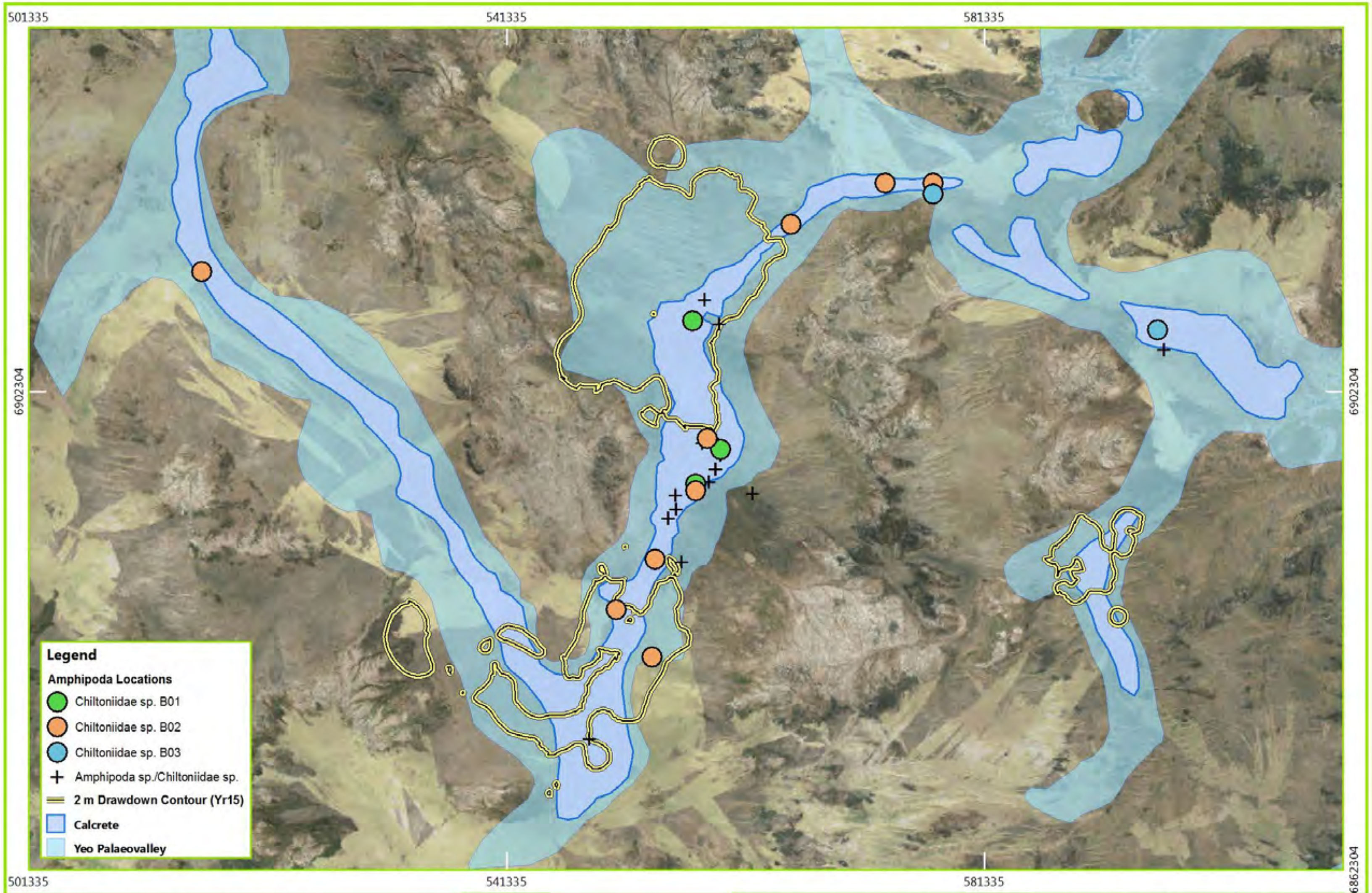
Date: 6 September 2016 Rev: A

Author: M. Curran

GRR\GRR_05\04_Report Maps\03_Species

Distribution of Other Annelida Worms

Figure: **9**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

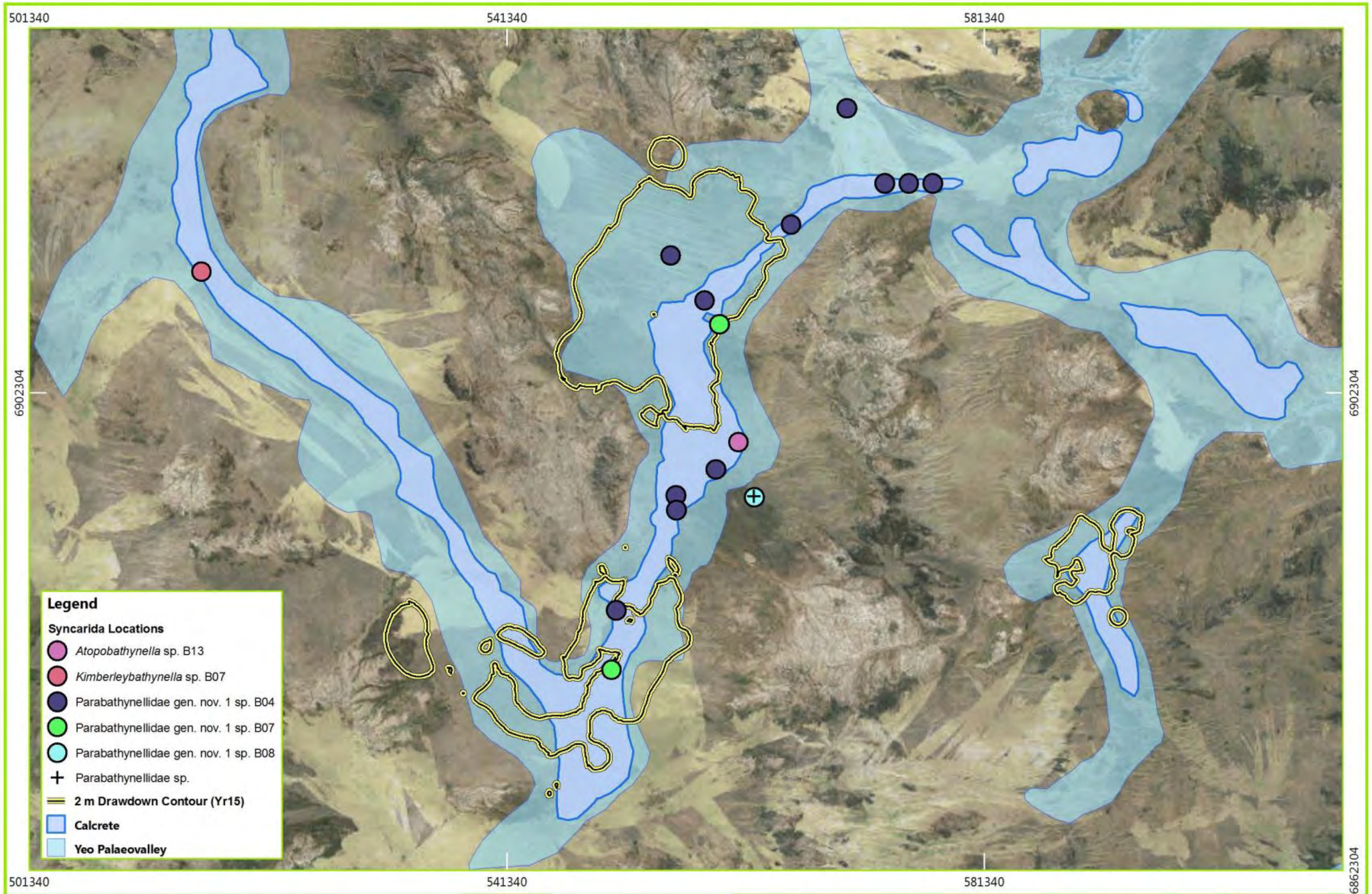
N

0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A

Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Chiltoniidae Amphipoda

Figure: **10**



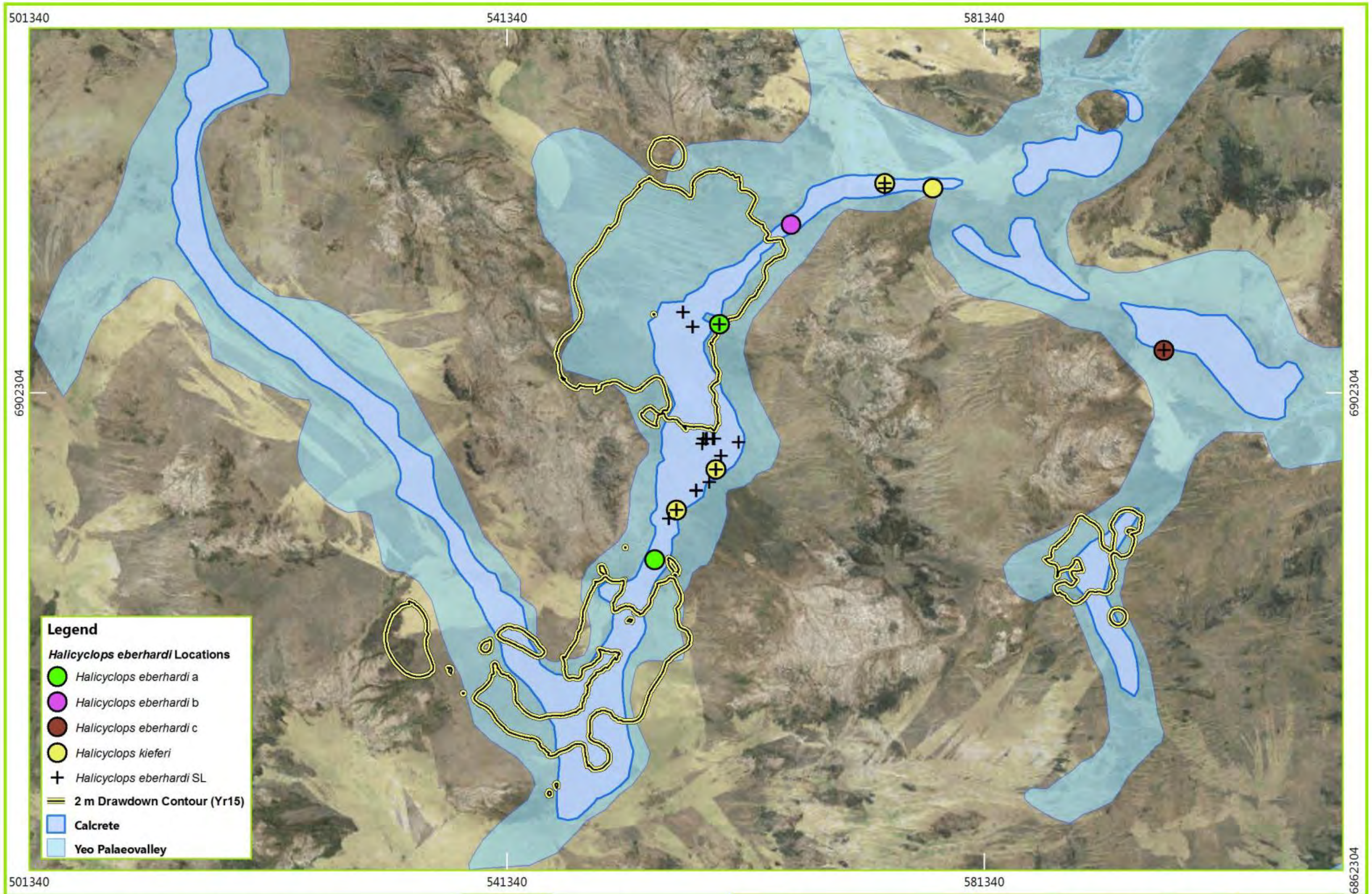
Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

N

0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A
Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Parabathynellidae Syncarida

Figure: **11**

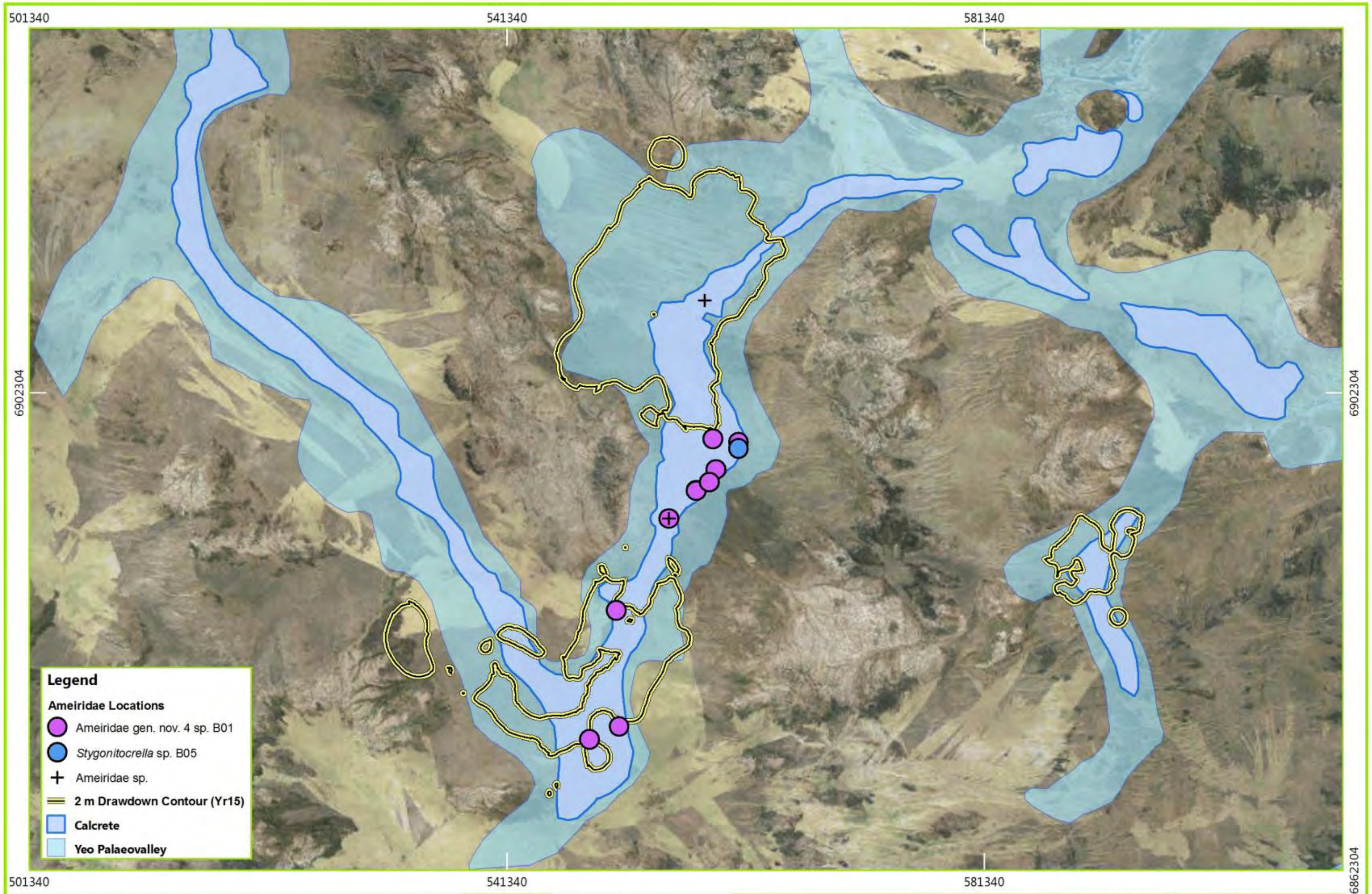


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51) | Author: M. Curran
Date: 6 September 2016 | Rev: A | GRR\GRR_05\04_Report Maps\03_Species

Distribution of *Halicyclops eberhardi* Copepoda

Figure: **12**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

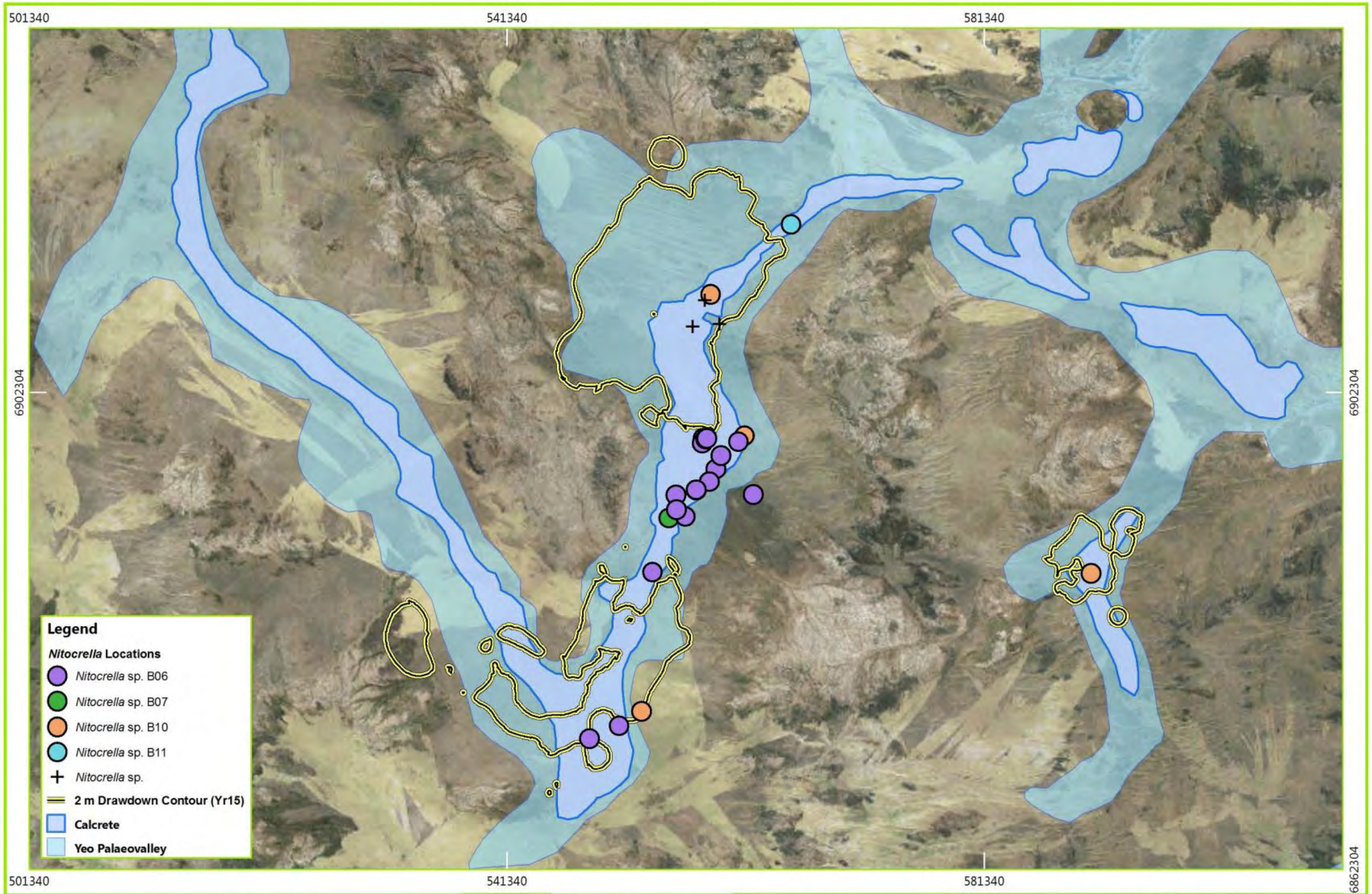
N

0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A

Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Ameiridae Copepoda 1 of 4

Figure: **13**

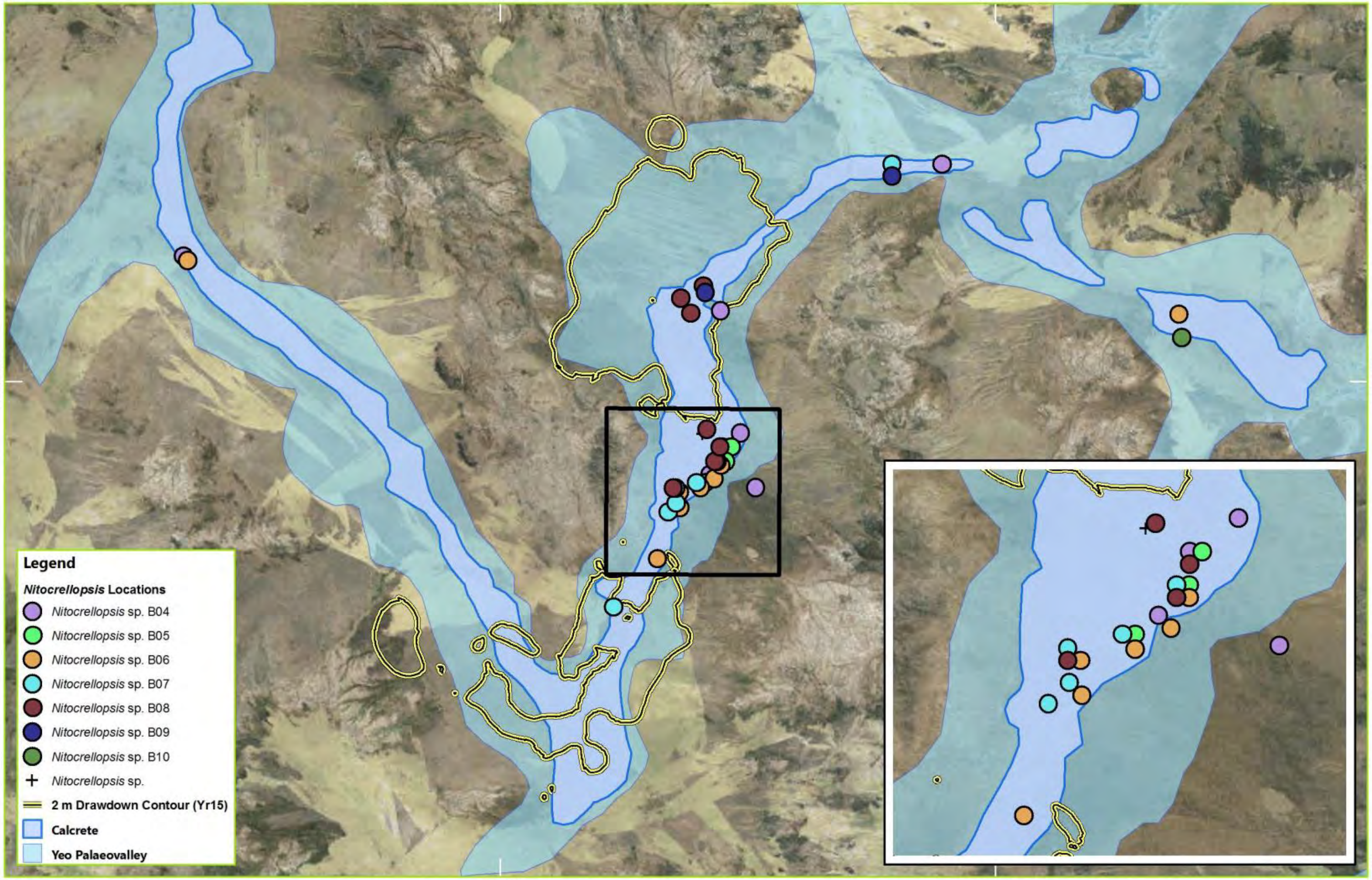


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51) | Author: M. Curran
Date: 6 September 2016 | Rev: A | GRR\GRR_05\04_Report Maps\03_Species

Distribution of Ameiridae Copepoda 2 of 4

Figure: **14**

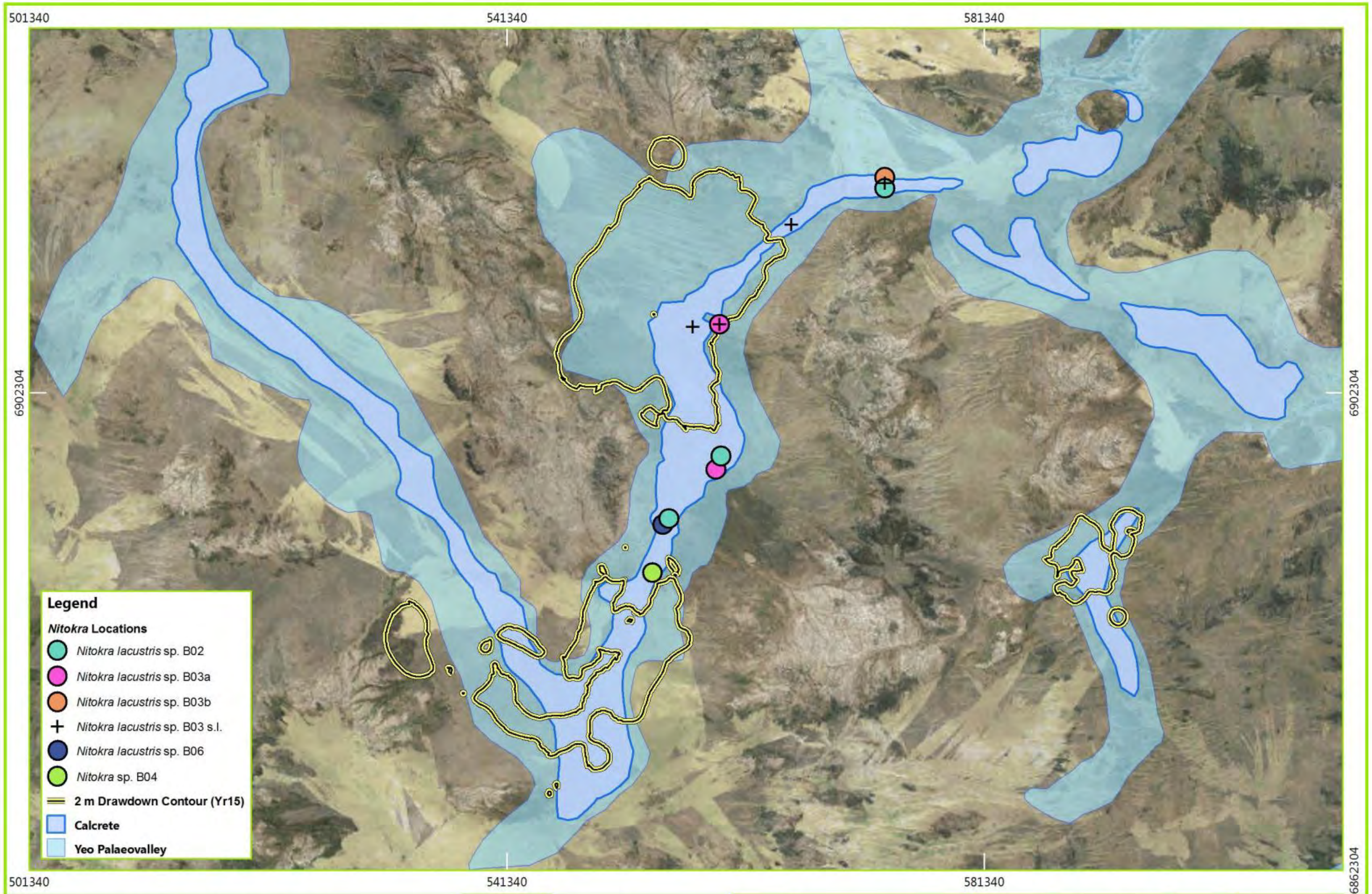


Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

MGA94 (Zone 51)
Author: M. Curran
Date: 6 September 2016 Rev: A GRR\GRR_05\04_Report Maps\03_Species

Distribution of Ameiridae Copepoda 3 of 4

Figure: **15**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

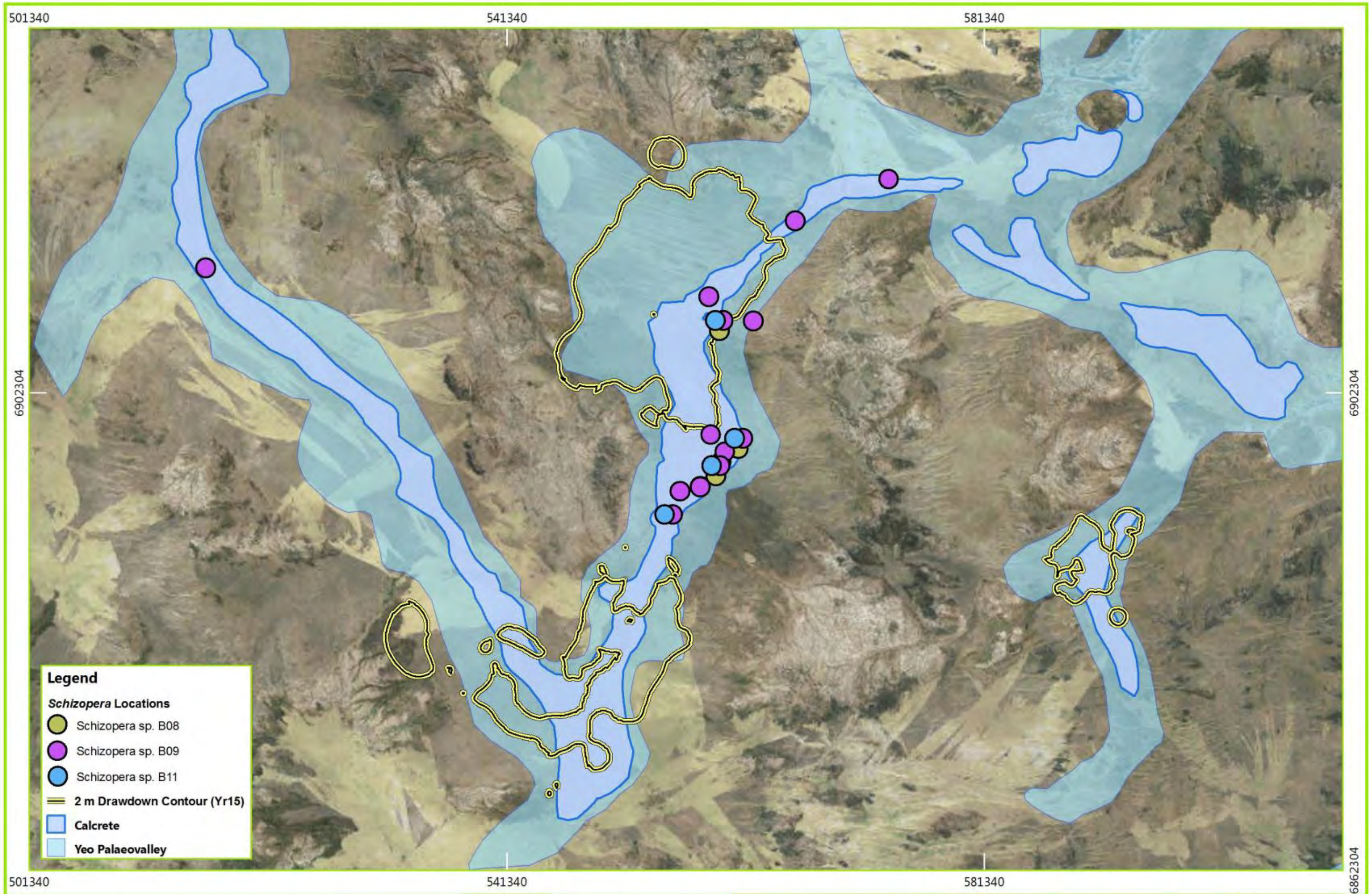
N

0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A

Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Ameiridae Copepoda 4 of 4

Figure: **16**



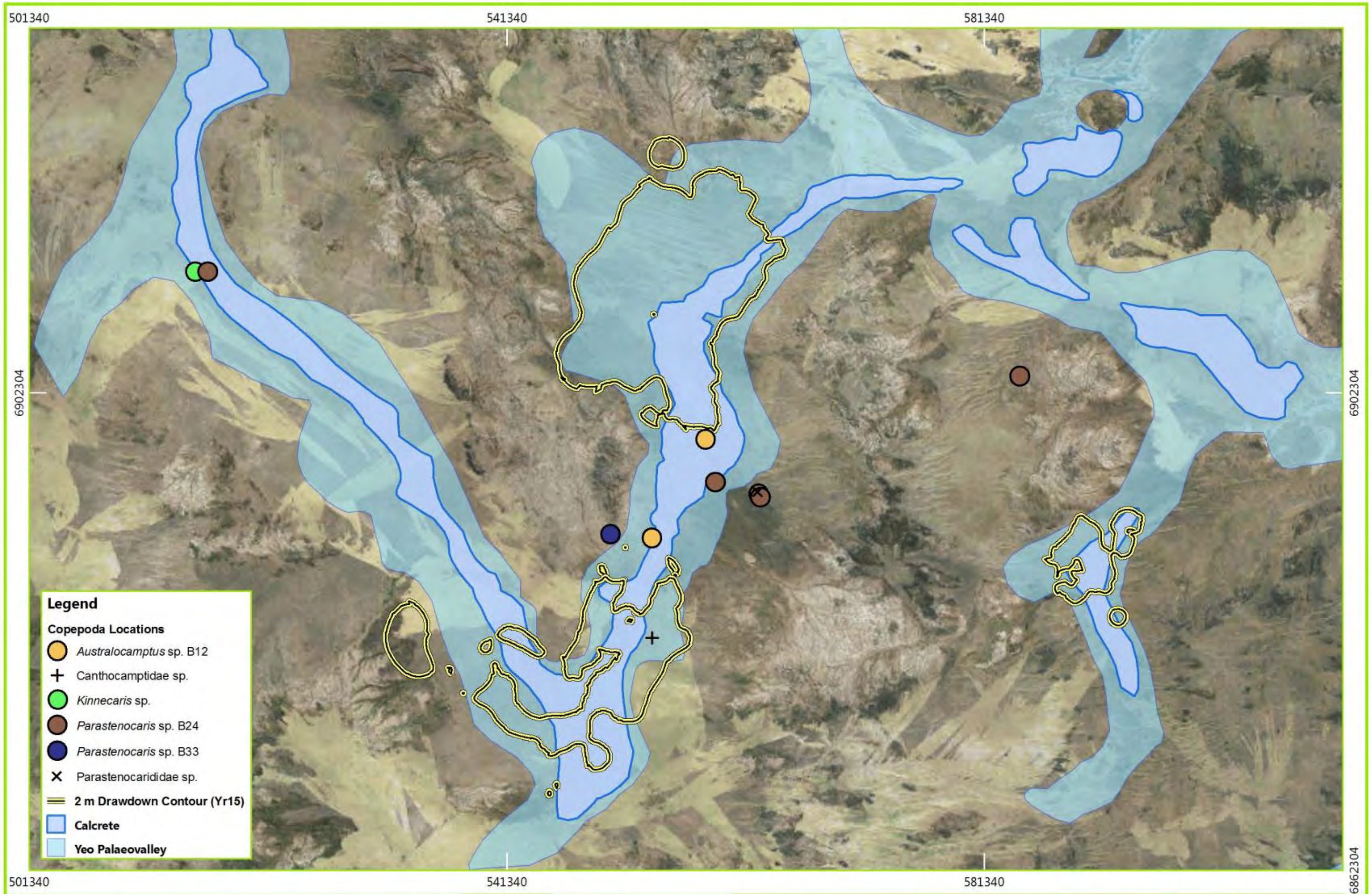
Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

N

0 5 10 km
Scale 1:500000
MGA94 (Zone 51)
Date: 6 September 2016 Rev: A
Author: M. Curran
GRR\GRR_05\04_Report Maps\03_Species

Distribution of Schizopera Copepoda

Figure: **17**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

N

0 5 10 km

Scale 1:500000

MGA94 (Zone 51)

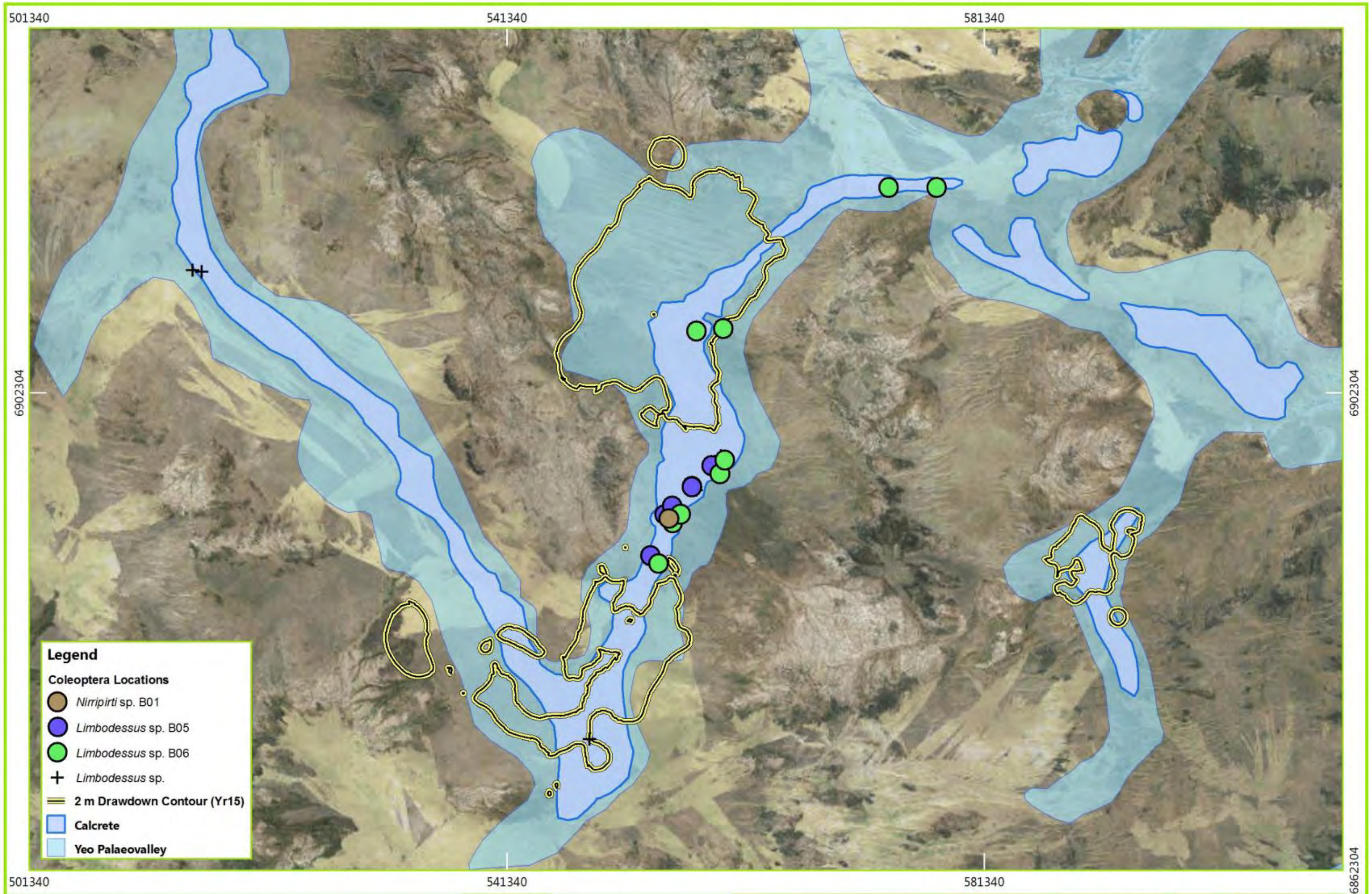
Date: 6 September 2016 Rev: A

Author: M. Curran

GRR\GRR_05\04_Report Maps\03_Species

Distribution of Canthocamptidae & Parastenocarididae

Figure: **18**



Source: Infrastructure supplied by Client (August 2016)
Imagery: World Imagery (ESRI 2016)
Calcrete and palaeovalley supplied by Pennington Scott.
Overlapping points have been offset marginally for display.

N

0 5 10 km

Scale 1:500000

MGA94 (Zone 51)

Date: 6 September 2016 Rev: A

Bennelongia Environmental Consultants

Author: M. Curran

GRR\GRR_05\04_Report Maps\03_Species

Distribution of Dytiscidae Coleoptera

Figure: **19**

ions. Parabathynellidae gen. nov. 1 sp. B07 was collected as single specimens from both of the two proposed Yeo Borefields and is not known from outside these drawdown areas, although it is almost certain to occur in the intervening area (Figure 6). CO1 divergence between the two specimens was 1.0%.

The CO1 divergence between Parabathynellidae gen. nov. 1 sp. B04 and B07 was 14%.

Copepoda

The Yeo Palaeochannel is rich in copepods, with 33 species collected. None of these were recorded only in the proposed borefields (Figures 12 – 18), although the documentation of copepod species in this report is likely to have been affected to a small extent by the limited DNA analysis of copepods because of time constraints and the difficulties encountered extracting DNA from some of these small specimens. However, morphological identifications were correct for species such as *Schizopera* sp. B14 (3 specimens sequenced, 3.5% divergence) and *Nitocrella* sp. B06 (3 specimens, 3.2%). Furthermore, the pattern of occurrence in CO1-sequenced species suggests that copepods are likely to be found only in the borefields.

For example, while CO1 sequencing split the morphologically determined *Halicyclops eberhardi* into three species with 23 – 29% divergence and *Nitocrella* sp.B10 into *Nitocrella* sp. B10 and sp. B11 with 22% divergence, only *Halicyclops eberhardi* sp. 'a' occurred in the Yeo Borefield and it was also found outside as well (Figure 12). *Nitocrella* sp. B10 is widespread in the Yeo Borefield and other parts of the palaeochannel, with a linear range along the channel of 200 km, while *Nitocrella* sp. B11 was found outside the northern section of the Yeo Borefield (Figure 14).

Ostracoda

The single species of ostracod collected (*Sarscypridopsis* sp. BOS615) occurred outside, as well as in, the Yeo Borefield. Cypridopsid ostracods occur commonly in groundwater, usually with large ranges (Halse *et al.* 2014).

Coleoptera

Three species of dytiscid beetles were collected in the Yeo Palaeochannel, with *Limbodessus* sp. B06 occurring in the northern section of the Yeo Borefield and outside (Figure 19). It has a known linear range more than 40 km and the eight specimens sequenced had a divergence of only 0.71%. *Limbodessus* sp. B05 and *Nirripirti* sp. B01 were found only outside the proposed borefields.

6. DISCUSSION

Sixty-one species of stygofauna were recorded during sampling in the Yeo Palaeochannel in the vicinity of the Gruyere Gold Project. This represents a rich stygofauna community with a broad taxonomic composition dominated by copepods, as is typical of Yilgarn calcretes (e.g. MWH 2015; Bennelongia 2015).

Currently, three species are known only from within the Yeo Borefields. These species are:

- Enchytraeidae sp. B07 – known from a single animal in the northern section of the Yeo Borefield as a result of genetic analysis. Altogether, 159 specimens of enchytraeid sp. were collected in surveys and species were widely distributed in the Yeo Palaeochannel. Not all specimens could be sequenced (some were slide-mounted, some were considered unsuitable for DNA extraction and some of the specimens analysed did not yield DNA). It is considered highly likely that Enchytraeidae sp. B07 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.
- Enchytraeidae sp. B10 – known from a single animal in the northern section of the Yeo Borefield through genetic analysis. For the reasons outlined above for Enchytraeidae sp. B07,

it is considered highly likely that Enchytraeidae sp. B10 occurs among the 40 specimens of enchytraeid collected outside the Yeo Borefield but not sequenced. The species appears to be a low abundance species and its range was clearly not fully documented during the surveys.

- Parabathynellidae gen. nov. sp. B07 – known from two animals, one in the southern section and one in the northern section of the Yeo Borefield. The area between the two records is prospective stygofauna habitat and the species is almost certain to occur in this intervening area of highly prospective stygofauna habitat between the two sections of the Yeo Borefield.

In general, stygofauna species in the Yeo Palaeochannel appear to have relatively widespread occurrences for subterranean species in Yilgarn calcretes, with Chiltoniidae sp. B02 having a linear range of >100 km. This suggests that the subterranean habitat within the Yeo Palaeochannel is homogeneous and that, if the ranges of all species were fully documented, most species may occupy moderately large areas.

7. REFERENCES

Bennelongia (2013a) Yamarna Project, subterranean fauna assessment: desktop review and pilot-scale stygofauna survey. Report 2013/174. Bennelongia Pty Ltd, Jolimont, 15 pp.

Bennelongia (2013b) Yamarna Project subterranean fauna assessment. Report 2013/199. Bennelongia Pty Ltd, Jolimont, 37 pp.

Bennelongia (2015) Yeelirrie subterranean fauna assessment. Report 2015/236. Bennelongia Environmental Consultants Pty Ltd, Jolimont, 33pp.

Bennelongia (2016) Gruyere Gold Project: borefields stygofauna assessment. Report 2016/257. Bennelongia Environmental Consultants Pty Ltd, Jolimont, 21pp.

Cooper, S.J.B., Hinze, S., Leys, R., Watts, C.H.S., and Humphreys, W.F. (2002) Islands under the desert: molecular systematics and evolutionary origins of stygobitic water beetles (Coleoptera: Dytiscidae) from central Western Australia. *Invertebrate Systematics* **16**, 589-598.

DPaW (2015) Priority ecological communities and threatened ecological communities endorsed by the Minister of the Environment. Lists from June 2015 are available online at: https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities.

Eberhard, S.M., Halse, S.A., Scanlon, M.D., Cocking, J.S., and Barron, H.J. (2005) Assessment and conservation of aquatic life in the subsurface of the Pilbara region, Western Australia. In: J Gibert (Ed.), World Subterranean Biodiversity. Proceedings of an International Symposium, 8th - 10th December 2004, Villeurbanne, France. University Claude Bernard of Lyon 1, PASCALIS European Research Programme, Lyon, pp. 61-68.

EPA (2007) Sampling methods and survey considerations for subterranean fauna in Western Australia (Technical Appendix to Guidance Statement No. 54). Guidance Statement 54A (Draft). Environmental Protection Authority, Perth, 32 pp.

EPA (2013) Consideration of subterranean fauna in environmental impact assessment in WA. Environmental Assessment Guideline 12, Environmental Protection Authority, Perth, 20 pp.

Fisher, R.A., Corbet, A.S., and Williams, C.B. (1943) The relation between the number of species and the number of individuals in a random sample of an animal population. *Journal of Animal Ecology* **12**, 42-58.

Folmer, O., Black, M., Hoeh, W., Lutz, R., and Vrijenoek, R. (1994). DNA primers for amplification of mitochondrial cytochrome c oxidase subunit 1 from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* **3**, 294–299.

Gibert, J. and Deharveng, L. (2002) Subterranean ecosystems: a truncated functional biodiversity. *BioScience* **52**: 473-481.

Guzik, M.T., Abrams, K.M., Cooper, S.J.B., Humphreys, W.F., Cho, J.-L. and Austin, A.D. (2008) Phylogeography of the ancient Parabathynellidae (Crustacea: Bathynellacea) from the Yilgarn region of Western Australia. *Invertebrate Systematics* **22**, 205–216.

Halse, S.A., Scanlon, M.D., Cocking, J.S., H.J., B., Richardson, J.B., and Eberhard, S.M. (2014) Pilbara stygofauna: deep groundwater of an arid landscape contains globally significant radiation of biodiversity. *Records of the Western Australian Museum Supplement* **78**, 443-483.

Hebert, P.D.N., Ratnasingham, S., and deWaard, J.R. (2003) Barcoding animal life: cytochrome c oxidase subunit 1 divergences among closely related species. *Proceedings of the Royal Society B (Supplement)* **270**, S96–S99.

Karanovic, T. (2004) Subterranean copepods (Crustacea: Copepoda) from arid Western Australia. *Crustacean Monographs*, **3**, 1-366.

Karanovic, T., and Cooper, S.J.B. (2011) Molecular and morphological evidence for short range endemism in the *Kinnecaris solitaria* complex (Copepoda: Parastenocarididae), with descriptions of seven new species. *Zootaxa* **3026**, 1-64.

Karanovic, T., Eberhard, S., Cooper, S.B., and Guzik, M. (2014) Morphological and molecular study of the genus *Nitokra* (Crustacea, Copepoda, Harpacticoida) in a small palaeochannel in Western Australia. *Organisms Diversity & Evolution*, 1-35.

Lefébure, T., Douady, C.J., Gouy, M., and Gibert, J. (2006) Relationship between morphological taxonomy and molecular divergence within Crustacea: Proposal of a molecular threshold to help species delimitation. *Molecular Phylogenetics and Evolution* **40**, 435-447.

MBS (2015) Gruyere Project Level 1 subterranean fauna survey. Martnick Bosch Sell Pty Ltd, West Perth, 21 pp. + appendices.

MWH (2015) Wiluna Uranium Project: Millipede targeted subterranean fauna assessment. MWH, Jolimont, 53 pp + appendices.

Outback Ecology (2012) Lake Maitland Uranium Project, Level 2 troglofauna assessment. Outback Ecology Services, Jolimont, 87 pp.

Novo, M., Almodóvar, A., and Díaz-Cosín, D.J. (2009) High genetic divergence of hormogastrid earthworms (Annelida, Oligochaeta) in the central Iberian Peninsula: evolutionary and demographic implications. *Zoologica Scripta* **38**, 537–552.

Pearson, R.G., Raxworthy, C.J., Nakamura, M., and Peterson, A.T. (2007) Predicting species distributions from small numbers of occurrence records: a test case using cryptic geckos in Madagascar. *Journal of Biogeography* **34**, 102-117.

Pennington Scott (2012) Gold Road Resources H3 Hydrogeological Report, Yeo Palaeochannel Borefield. Pennington Scott, Herdsman, 145 pp.

Pennington Scott (2016) Hydrolgeogy summary: Gruyere Project. Pennington Scott, Herdsman, 26 pp.

Reeves J., De Deckker P., and Halse S.A. (2007) Groundwater ostracods from the arid Pilbara region of northwestern Australia: distribution and water chemistry. *Hydrobiologia* **585**, 99–118.

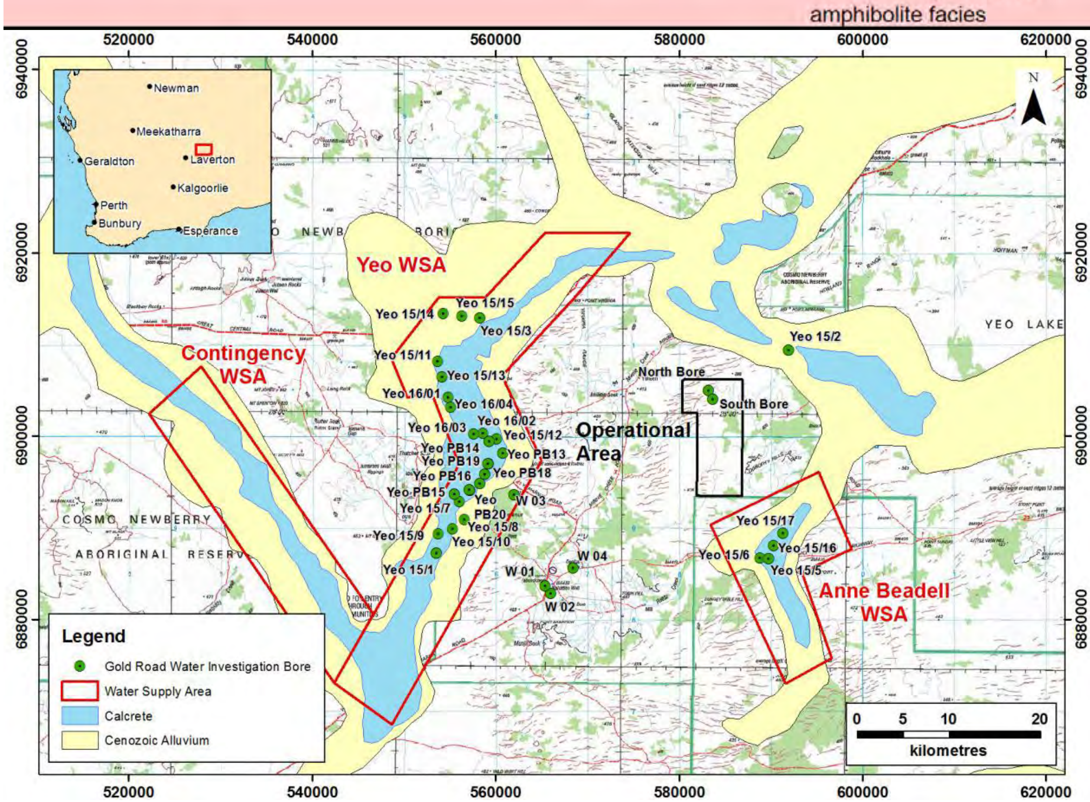
Runyan, C.W., and D'Odorico, P. (2010) Ecohydrological feedbacks between salt accumulation and vegetation dynamics: Role of vegetation-groundwater interactions. *Water Resources Research* **46**, doi 10.1029/2010WR009464.

Watts, C.H.S. and Humphreys, W.F. (2006) Twenty-six new Dytiscidae (Coleoptera) of the genera *Limbodessus* Guignot and *Nirripirti* Watts and Humphreys, from underground waters in Australia. *Transactions of the Royal Society of Australia* **130**, 123-185.

APPENDICES

Appendix 1. Stratigraphy of the Yeo Palaeochannel (Upper Panel); Pre-quaternary geology in the Project Area (Lower Panel)

Era	Period/Epoch	Formation	Unit	Lithology
Cenozoic	Quaternary *Pleistocene–Holocene <2.6 Ma*		Alluvial & lacustrine	Clay, silt & sand; saline, gypsiferous, evaporite deposits
			Eolian sandplain and dune	Sand
	Neogene *Late Oligocene to Miocene (~24-5.3Ma)*	Perkolilli Shale	Palaeochannel deposits	Clay, silt and sand with calcrete
	Paleogene *Late-Middle To Late Eocene (~40-34 Ma)*	Werillup Formation	Palaeochannel deposits	Gravel, sand, silt and clay with lignite
Palaeozoic	Permian *(~300Ma)*	Patterson Formation	Glacio-fluvial	Coarse sand & gravel with basal matrix-supported conglomerate
			Glacio-lacustrine	Clay, silt and minor sand
Archean	Neoarchaen *(2500 – 2800 Ma)*	Yamarna Domain	Granite	Gneissic granitoid
			Yamarna – Mount Gill Greenstone Belt	Felsic – mafic and ultramafic igneous, and sedimentary rocks; greenschist to amphibolite facies



From Pennington Scott (2012, 2016)

Appendix 2. Bores sampled for stygofauna

Bore Codes	Latitude	Longitude
11THAC013	-27.8444167	123.782
11THAC043	-27.8481389	123.741417
11THAC135	-27.94925	123.973833
12ALRC0117	-28.0806111	123.63075
15GYWB0003	-27.9122778	123.152694
15GYWB0004	-28.1330278	123.513944
15GYWB0005	-28.129709	123.547119
15GYWB0006	-28.097494	123.573218
15GYWB0007	-28.113868	123.573479
15GYWB0008	-28.0725278	123.971389
15GYWB0009	-27.96925	123.979778
15GYWB0010	-28.2787222	123.466917
15GYWB0011	-28.2656667	123.492167
15GYWB0012	-28.2494722	123.531028
15MNAC0169	-28.1233889	123.887722
15MNAC0187	-28.1233333	123.924444
15MNAC0206	-28.1378761	123.893015
16GYWB0001	-28.2561467	123.51724
16GYWB0002	-28.2228829	123.545157
16GYWB0003	-28.20371	123.545172
16GYWB0004	-28.2036244	123.561862
16GYWB0005	-28.1888975	123.545026
16GYWB0006	-28.1692643	123.544997
16GYWB0007	-28.1499371	123.545174
16GYWB0008	-28.1337713	123.59061
16GYWB0009	-28.1319525	123.570316
16GYWB0010	-28.0968067	123.544682
16GYWB0011	-28.1135153	123.544736
16GYWB0012	-27.8999482	123.559493
16GYWB0013	-27.9163229	123.574984
16GYWB0014	-27.8947937	123.670733
16GYWB0015	-27.9337592	123.588777
16GYWB0016	-27.9537538	123.578242
16GYWB0017	-27.9519622	123.626632
16GYWB0018	-27.9672435	123.614967
16GYWB0019	-27.9518864	123.601125
16GYWB0020	-27.9089091	123.682364
16GYWB0021	-28.133065	123.488044
16GYWB0022	-28.133254	123.508045
16GYWB0023	-28.1680799	123.514271
16GYWB0024	-28.205813	123.478022
16GYWB0025	-28.2132383	123.510778
16GYWB0026	-28.2116568	123.508977
16GYWB0027	-28.1675731	123.512353
16GYWB0028	-28.096222	123.366028
16GYWB0029	-27.8442972	123.782002
16GYWB0030	-27.8479078	123.782028
16GYWB0031	-27.8444108	123.761692
16GYWB0032	-27.7512141	123.690349
16GYWB0033	-27.7693938	123.688892
16GYWB0034	-27.7881651	123.70866
16GYWB0035	-27.8445214	123.741381
16GYWB0036	-27.848132	123.741406
16GYWB0037	-27.8639854	123.639939
16GYWB0038	-27.8761061	123.661709
16GYWB0041	-28.1659021	123.930323
16GYWB0042	-28.078979	123.914658
16GYWB0043	-28.08027	123.946545
16GYWB0044	-27.952001	123.524577

Bore Codes	Latitude	Longitude
16GYWB0045	-27.952147	123.499966
16GYWB0046	-27.923262	123.511552
16GYWB0047	-27.923226	123.511551
16GYWB0048	-27.892185	123.529765
16GYWB0049	-27.865371	123.528324
16GYWB0052	-27.8787112	123.547598
16GYWB0053	-28.132943	123.528042
AC267	-28.0384444	123.590194
AC268	-28.0383889	123.591056
AC269	-28.0383889	123.592139
AC270	-28.0384167	123.593167
AC271	-28.03825	123.595194
AC272	-28.0382778	123.597139
AC273	-28.0383611	123.596194
AC280	-28.0383889	123.588056
AC283	-28.0420833	123.587194
Bluey	-28.0805556	123.630917
Browns Well	-27.9936882	123.394807
FYRC051	-27.94275	123.570306
LIMESTONE MRD BORE	-27.9131662	123.160514
Near Mt Venn Bore	-28.1108889	123.509472
PB13	-28.0407222	123.618167
PB14	-28.0295556	123.603528
PB15	-28.0813056	123.564833
PB16	-28.0711389	123.593111
PB17	-28.0770833	123.581833
PB18	-28.0616389	123.59875
PB19	-28.0511667	123.602861
PB20	-28.0776667	123.581833
RC0022	-28.0839444	123.633222
RC0025	-28.0831389	123.632528
RC0044	-28.0805278	123.631778
RC0095	-28.0798333	123.630028
RC0096	-28.0798056	123.630139
RC0109	-28.0801111	123.630833
RC0110	-28.0805	123.630361
RC0151	-28.08225	123.631778
Sam Bore	-28.0962222	123.366028
TH01	-28.0094722	123.597944
TH02	-28.0095556	123.597028
TH03	-28.0095278	123.593889
TH04	-28.0095278	123.592944
TH05	-28.0095556	123.591889
TH06	-28.0094722	123.590917
TH07	-28.0095278	123.589833
W03	-28.0814722	123.63125
YE0008A	-28.0987222	123.558722
YEO 15/1	-28.1397715	123.5455
YEO 15/2	-27.9377418	123.934465
YEO 15/3	-27.9073933	123.592577
YEO 15/5	-28.1431947	123.914001
YEO 16/10	-27.957985	123.552472
Yeo 16/5	-28.1245124	123.545824
YUNK02	-27.9404444	123.571917
YUNK03	-28.0921111	123.565222
YUNK04	-28.0798056	123.630139

Appendix 3. Results of DNA analysis

A = number of animals for which DNA analysis was attempted; S = numbers of animals yielding a sequence. Percentage sequence differences within and between species are shown where appropriate.

			Difference (%)	
Species	**A**	**S**	**Intra**	**Inter**
Worms				
Enchytraeidae sp. B07	1	1	-	B10, 11.53
Enchytraeidae sp. B08	13	13	6.20	B09, 11.86
Enchytraeidae sp. B09	4	4	6.52	B12, 18.39
Enchytraeidae sp. B10	1	1	-	B12, 19.79
Enchytraeidae sp. B11	2	2	0.00	B08, 22.52
Enchytraeidae sp. B12	3	3	5.61	B13, 21.85
Enchytraeidae sp. B13	3	3	1.22	B08, 21.23
Enchytraeidae sp. B14	1	1	-	B15, 21.96
Enchytraeidae sp. B15	2	2	0.00	B12, 23.43
Tubificidae sp. B02	3	3	1.44	B07, 22.09; B10, 21.77
Oligochaeta sp.	8	0	-	-
Copepods				
Fierscyclops (Fierscyclops) fiersi	1	1	-	-
Halicyclops eberhardi a	2	2	4.61	b, 27.76; c, 25.45
Halicyclops eberhardi b	1	1	-	c, 23.01
Halicyclops eberhardi c	1	1	-	-
Nitocrella sp. B06	4	3	5.49	B10, 27.15; B11, 19.33
Nitocrella sp. B10	1	1	-	B11, 23.86
Nitocrella sp. B11	1	1	-	-
Nitocrellopsis sp. B04	3	2	10.46	B08, 51.68; B09, 27.02
Nitocrellopsis sp. B06	2	0	-	-
Nitocrellopsis sp. B07	1	0	-	-
Nitocrellopsis sp. B08	2	1	-	*N. lacustris* B06, 38.70
Nitocrellopsis sp. B09	2	1	-	*Nitocrella* B06, 24.10; B10, 20.76; B11, 24.23
Nitocrellopsis sp. B10	1	1	-	*Nitocrella* B06, 27.69; B10, 24.50; B11, 25.47
Ameiridae gen. nov. 4 sp. B01	2	1	-	*Nitocrella* B06, 26.34; B10, 22.81; B11, 23.43
Nitokra lacustris sp. B03a	2	2	0.00	B03b, 14.06; B06, 16.47
Nitokra lacustris sp. B03b	1	1	-	B06, 17.18
Nitokra lacustris sp. B06	1	1	-	-
Nitokra sp. B04	2	0	-	-
Schizopera sp. B08	1	1	-	B09, 24.00
Schizopera sp. B09	7	4	5.90	-
Schizopera sp. B11	3	0	-	-
Ostracods				
Sarscypridopsis sp. BOS615	2	2	-	-
Syncarids				
Parabathynellidae gen. nov. 1 sp. B04	12	11		
Parabathynellidae gen. nov. 1 sp. B07	2	2		
Parabathynellidae gen. nov. 1 sp. B08	1	1	-	
Amphipods				
Chiltoniidae sp. B01	4	4	2.88	B02, 16.26; B03, 12.98
Chiltoniidae sp. B02	11	11	8.62	B03, 15.32
Chiltoniidae sp. B03	2	2	1.86	-
Beetles				
Limbodessus sp. B05	1	1	-	B06, 7.21
Limbodessus sp. B06	8	8	1.34	-

APPENDIX 5: LEVEL 1 FLORA SURVEY AND FAUNA IMPACT ASSESSMENT OF GRUYERE CAMP AND AIRSTRIP (BOTANICA 2016A)

Level 1 Flora Survey & Fauna Assessment

Gruyere Camp and Airstrip

Prepared For
Gold Road Resources Limited

June 2016
FINAL

Prepared by:
Botanica Consulting
PO Box 2027
Boulder WA 6432
90930024

Disclaimer

This document and its contents are to be treated as confidential and are published in accordance with and subject to an agreement between Botanica Consulting (BC) and the client for whom it has been prepared and is restricted to those issues that have been raised by the client in its engagement of BC. Neither this document nor its contents may be referred to or quoted in any manner (report or other document) nor reproduced in part or whole by electronic, mechanical or chemical means, including photocopying, recording or any information storage system, without the express written approval of the client and/or BC.

This document and its contents have been prepared utilising the standard of care and skill ordinarily exercised by Environmental Scientists in the preparation of such documents. All material presented in this document is published in good faith and is believed to be accurate at the time of writing. Any person or organisation who relies on or uses the document and its contents for purposes or reasons other than those agreed by BC and the client without primarily obtaining the prior written consent of BC, does so entirely at their own risk. BC denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be endured as a consequence of relying on this document and its contents for any purpose other than that agreed with the client.

Quality Assurance

An internal quality review process has been implemented to each project task undertaken by BC. Each document and its contents is carefully reviewed by core members of the Consultancy team and signed off at Director Level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

Document Job Number:	2016/27
Prepared by:	Lauren Pick Environmental Consultant Botanica Consulting
Reviewed by:	Andrea Williams Director Botanica Consulting
Approved by:	Jim Williams Director Botanica Consulting

Contents

Tables

Figures

Plates

Appendices

Appendix 1: DPaW's NatureMap Database and DotE Protected matters search tool (DPaW, 2016; DotE, 2016a)
Appendix 2: DPaW Threatened Flora, Nature Map and Protected Matters Database results within 40km
Appendix 3: Muir Life Form/Height Class (Muir, 1977).
Appendix 4: List of species identified within each vegetation community of the Gruyere Camp and Airstrip survey area
Appendix 5: Vegetation map of the Gruyere Camp and Airstrip survey area
Appendix 6: Regional map of the Gruyere Camp and Airstrip survey area including areas of conservation significance
Appendix 7: Vegetation Health Condition Scale adapted from Keighery 1994 and Trudgen 1988 (DPaW/ EPA, 2015)
Appendix 8: Fauna Recorded or Potentially in Region of Survey Area

Glossary

Acronym	Description
BA	Birdlife Australia (Formerly RAOU, Birds Australia).
BAM Act	Biosecurity and Agriculture Management Act 2007, WA Government.
BC	Botanica Consulting.
BC Bill	*Biodiversity Conservation Bill* (2015). WA Government.
BOM	Bureau of Meteorology.
CALM	Department of Conservation and Land Management (now DPaW), WA Government.
CAMBA	China Australia Migratory Bird Agreement 1998.
DAFWA	Department of Agriculture and Food, WA Government.
DEC	Department of Environment and Conservation (now DPaW), WA Government.
DEH	Department of Environment and Heritage (now DoE), Australian Government.
DEP	Department of Environment Protection (now DER), WA Government.
DEWHA	Department of the Environment, Water, Heritage and the Arts (now DotE), Australian Government
DER	Department of Environment Regulation (formerly DEC, DoE), WA Government.
DMP	Department of Mines and Petroleum (formerly DoIR), WA Government.
DoE	Department of Environment (now DER/DPaW), WA Government.
DoIR	Department of Industry and Resources (now DMP), WA Government.
DotE	Department of the Environment (formerly DSEWPaC, DEWHA, and DEH), Australian Government.
DPaW	Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DotE, formerly DEH, DEWHA), Australian Government.
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999, Australian Government.
ESA	Environmentally Sensitive Area.
GRR	Gold Road Resources Limited.
Ha	Hectare (10,000 square metres).
IBRA	Interim Biogeographic Regionalisation for Australia.

Acronym	Description
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
JAMBA	Japan Australia Migratory Bird Agreement 1981.
Km	Kilometre (1,000 metres).
MVG	Major Vegetation Groups.
NVIS	National Vegetation Information System.
OEPA	Office of the Environmental Protection Authority, WA Government.
PEC	Priority Ecological Community.
RAOU	Royal Australia Ornithologist Union.
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement 2007.
SRE	Short Range Endemic.
SSC	Species Survival Commission, International.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.
WAM	Western Australian Museum, WA Government.
WC Act	Wildlife Conservation Act 1950, WA Government.

Executive Summary

Botanica Consulting (BC) was commissioned by Gold Road Resources Limited (GRR) to undertake a Level 1 flora survey and fauna assessment of the proposed Gruyere Camp and Airstrip (referred to as the 'survey area'). The survey covered an area of approximately 569ha encompassing the entire boundary of a pending miscellaneous licence (L38/254). The survey area is located approximately 160km north-east of Laverton WA and approximately 80km east of the Cosmo Newberry Aboriginal Community within GRR's Gruyere Project area. The survey was conducted on the 20th April 2016, within the Autumn survey period.

Six broad vegetation communities were identified within the survey area. These communities comprised of two landform types and two major vegetation groups according to the NVIS definition. The communities were represented by a total 31 Families, 62 Genera and 121 Taxa, (including sub-species and variants). The broad scale terrestrial fauna habitats within the survey area have been identified as sandplains and sand dunes. Results of the literature review identified 28 mammals (including eight bat species), 103 bird, 105 reptile and nine frog species that have previously been recorded in the general area, some of which have the potential to occur in or utilise at times, the survey area.

No Threatened taxa, pursuant to subsection (2) of section 23F of the State WC Act, the Commonwealth EPBC Act and as listed by the DPaW were identified within the survey area. No Priority Flora taxa, as listed by the DPaW, were identified within the survey area. A review of the EPBC Act threatened fauna list, DPAW's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified a number of specially protected, migratory or priority fauna species as having been previously recorded or as being potentially present in the general vicinity of the survey area. However, no fauna of conservation significance is likely to be significantly impacted on by the proposed development. This conclusion is primarily based on the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on fauna and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

None of the vegetation communities within the survey area were found to have National Environmental Significance as defined by the Commonwealth EPBC Act. No TEC pursuant to Commonwealth or State legislation were recorded within the survey area. No PEC listed by the DPaW were recorded within the survey area.

The survey area is not located within an ESA listed under the EP Act or Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the EP Regulations. The survey area is not located within any conservation areas/DPaW managed land. The nearest DPaW managed land is the Yeo Lake Nature Reserve, which is listed as a Class A Nature Reserve, located approximately 16km to the east of the survey area.

Based on the vegetation health condition scale adapted from Keighery, 1994 and Trudgen, 1988 (rating 2 'pristine' to rating 7 'completed degraded'), all six vegetation communities had a '3' health condition rating. No introduced taxa were identified within the survey area.

1 Introduction

1.1 Project Description

BC was commissioned by GRR to undertake a Level 1 flora survey and fauna assessment of the proposed Gruyere Camp and Airstrip survey area. The survey covered an area of approximately 569ha encompassing the entire boundary of a pending miscellaneous licence (L38/254). The survey area is located approximately 160km north-east of Laverton WA and approximately 80km east of the Cosmo Newberry Aboriginal Community within GRR's Gruyere Project area (Figure 1). The survey was conducted on the 20th April 2016. The aim of the survey was to identify fauna habitats, produce a vegetation map and species list as well as to document and map locations of any Threatened Ecological Communities (TEC), Priority Ecological Communities (PEC) and Threatened/ Priority Flora and Fauna species within the survey area.

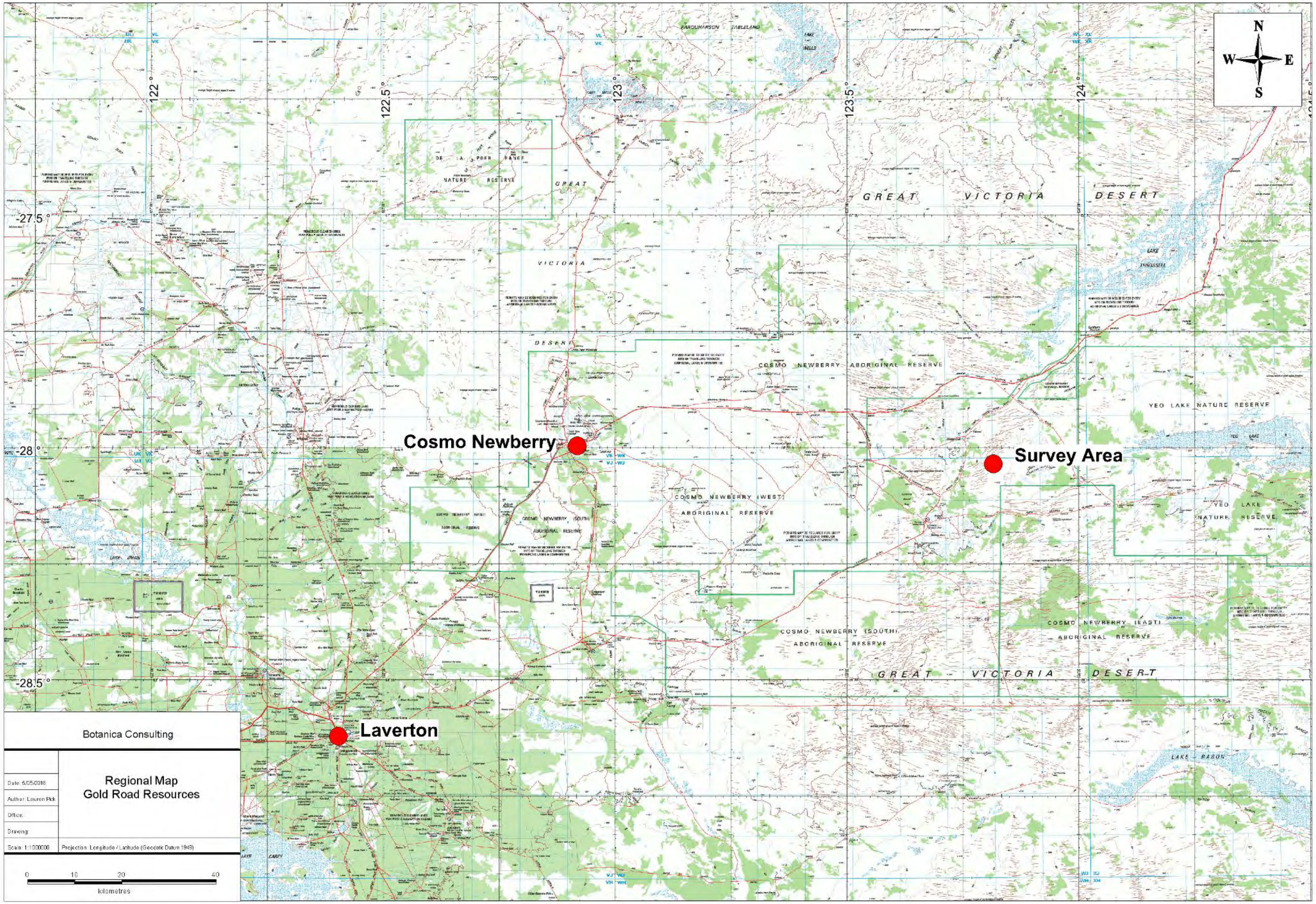


Figure 1: Regional map of the Gruyere Camp and Airstrip survey area

2 Regional Biophysical Environment

2.1 Regional Environment

The survey area lies within the Great Victoria Desert of Western Australia (WA) of the Eremaean Province in a region known as the Helms Botanical District. According to the Interim Biogeographic Regionalisation of Australia (IBRA), the Great Victoria Desert Region is further divided into four subregions; Shield, Central, Maralinga and Kintore, with the survey area located within the Shield (GVD1) subregion (Barton & Cowan, 2001a). A map of the survey area in relation to the IBRA subregions is provided in Figure 2.

Figure 2: Map of IBRA subregions in the vicinity of the Gruyere Camp and Airstrip survey area

2.2 Vegetation

Vegetation of the Great Victoria Desert and the Helms Botanical District (as described by Beard, 1990) comprises a mosaic of tree and shrub steppe between sand hills and on sandplains, consisting of Marble gum, mallee and spinifex (*Eucalyptus gongylocarpa, E. youngiana, Triodia basedowii*). Beard states that dunes in the west, are rather thinner, few and weak. *E. gongylocarpa* is comparatively scarce with *E. youngiana* replaced by *E. kingsmillii* and *Acacia aneura* and *A. linophylla* becoming frequent on the sandplain (Beard, 1990). The Shield subregion contains spinifex (*Triodia* spp.) and mallee (*Eucalyptus kingsmillii*, *E. youngiana*) over hummock grassland dominated by *Triodia basedowii* on aeolian sand plain. Scattered marble gum (*E. gongylocarpa*) and native pine (*Callitris* sp.) occur on the deeper sands of the sand plains. Mulga and acacia woodland occur mainly on the colluvial and residual soils. Halophytes such as salt bush (*Atriplex*), bluebush (*Maireana*) and samphire (*Tecticornia*) occur on the margins of salt lakes and in saline drainage areas (Barton and Cowan, 2001).

The DAFWA GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation association *Great Victoria Desert 84*. The extent of this association as described by the DAFWA is shown in Table 1. Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered “endangered”. Development within the survey area will not significantly reduce the extent of this vegetation association.

Table 1: Pre-European Vegetation within the Gruyere Camp and Airstrip survey area

Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Pre-European extent remaining (%)	% of Current extent within DPaW managed lands	Vegetation Description (Beard, 1990)
Great Victoria Desert 84	876,295.94	876,295.94	100	15.16	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*Eucalyptus youngiana*) over hard spinifex *Triodia basedowii* between Sandhill’s

2.3 Topography & Soils

The Great Victoria Desert bioregion forms the southern part of the anti-clockwise whorl of dune fields of Australia. The dominating landforms are dunes and swales. There are local occurrences of playa lakes, associated lee-sided mounds (lunettes) and rocky prominences (Commonwealth Government, 2008b). Playa lakes are a minor, but locally significant landform in the desert, occurring in topographically low-lying regions and many represent the dried remnants of former drainage channels (Shephard, 1995). It consists of active sand-ridge desert of deep Quaternary (less than 65 million years ago) Aeolian sands overlying Permian (251 – 298 million years ago) and Mesozoic (65 - 251 million years ago) units of the Office Basin (Commonwealth Government, 2008b). The GVD is underlain on its eastern, western and northern margins by an ancient crystalline basement comprising rocks at least 1000 million years old (Shephard, 1995).

The western end of the Shield subregion is underlain by the Yilgarn Craton. Here there is a higher proportion of sandplains in comparison to the entire bioregion. To the east is an arid active sand-ridge desert of deep Quaternary Aeolian sands overlying Permian and Mesozoic strata of the Officer Basin. Landforms consist of salt lakes and major valley floors with lake derived dunes. The sandplains occur with patches of seif dunes running east-west and areas of moderate relief without-cropping and silcrete-capped mesas and plateaus (breakaways). The subregion contains a major paleo channel of Ponton Creek (Cowan, 2001).

Based on geographic information provided by DAFWA (2014), the survey area is located within the Leemans Sandplain Zone (274) of the Murchison Province (27). The Leemans Sandplain Zone is characterised by sandplains (with some gravel plains, mesas and salt lakes) on granitic rocks of the Yilgarn Craton (Eastern Goldfields Superterrane). Soils are comprised of red sandy earths with red loamy earths and some red deep sands, red-brown hardpan shallow loams and Calcareous loamy earths. Vegetation is predominately spinifex grasslands with marble gum, mallee and mulga shrublands (and some halophytic shrublands). The zone is located in the south-western arid interior between Lakes Wells and Minigwal (to the east of Laverton). The Leemans Sandplain Zone is further divided into soil landscape systems with the survey area located within the AB47 and MY99 systems (Table 2 and Figure 3).

Table 2: Soil Landscape Systems within the Gruyere Camp and Airstrip survey area

System	Description
AB47	Plains and Dunes - longitudinal and ring dunes with interdune corridors and plains; occasional salt pans
MY99	Plains with extensive gravel pavements and small tracts of longitudinal dunes

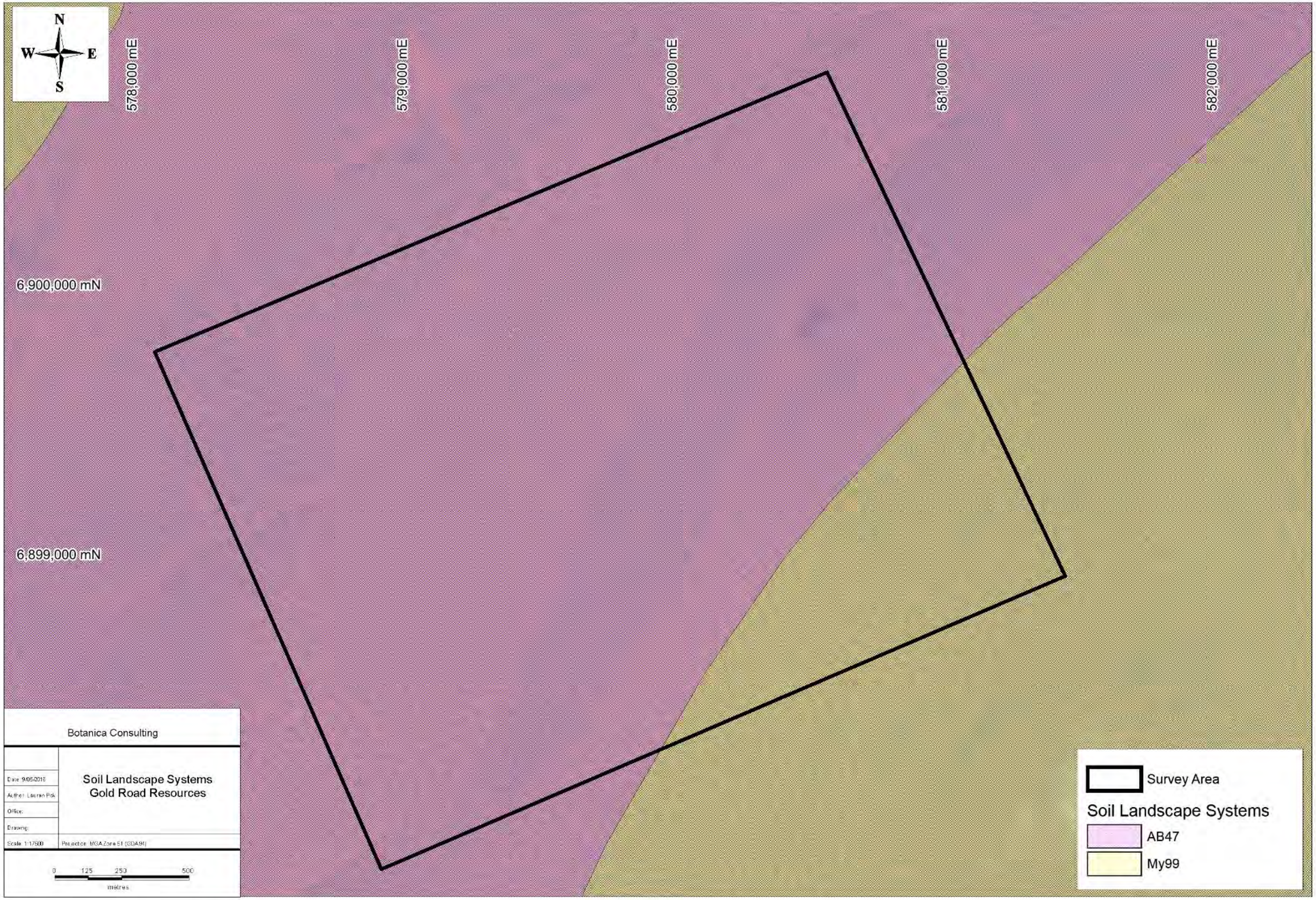


Figure 3: Map of Soil Landscape Systems within the Gruyere Camp and Airstrip survey area

2.4 Climate

The climate of the Great Victoria Desert Region is characterised as arid with summer and winter rain averaging 150 –190mm per annum (Barton & Cowan, 2001). Average weather conditions obtained from the closest Bureau of Meteorology weather station; Laverton Aero weather station (#12305), located approximately 160km south-west of the survey area are shown in Figure 4 and Figure 5 (BOM, 2016).

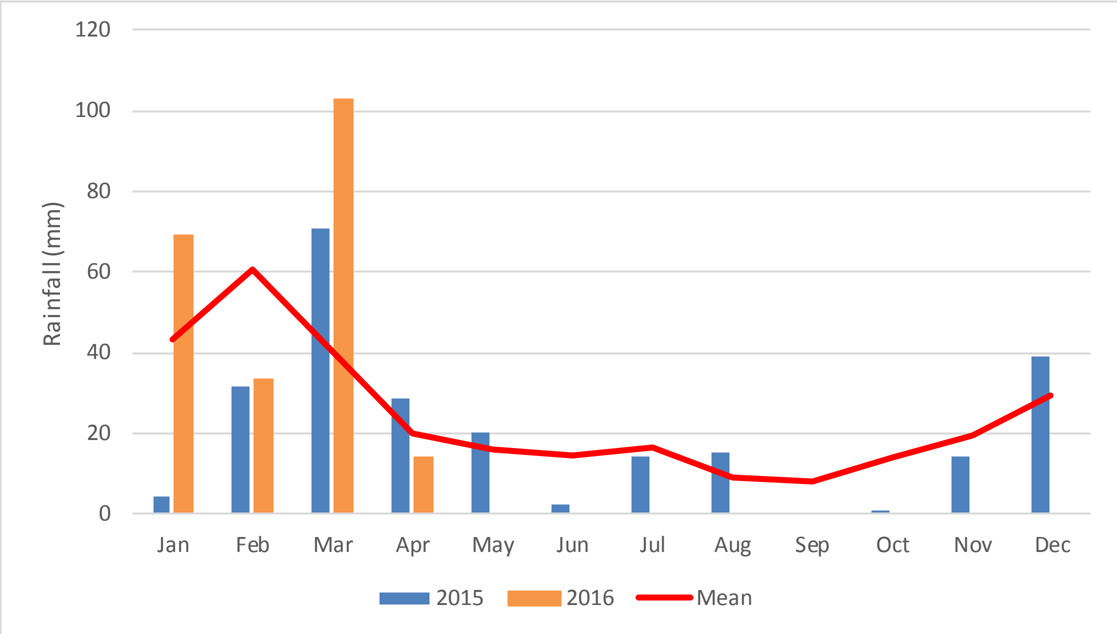


Figure 4: Monthly rainfall from January 2015 to April 2016 and mean monthly rainfall (January 1991 to April 2016) for the Laverton Aero weather station #12305 (BOM, 2016).

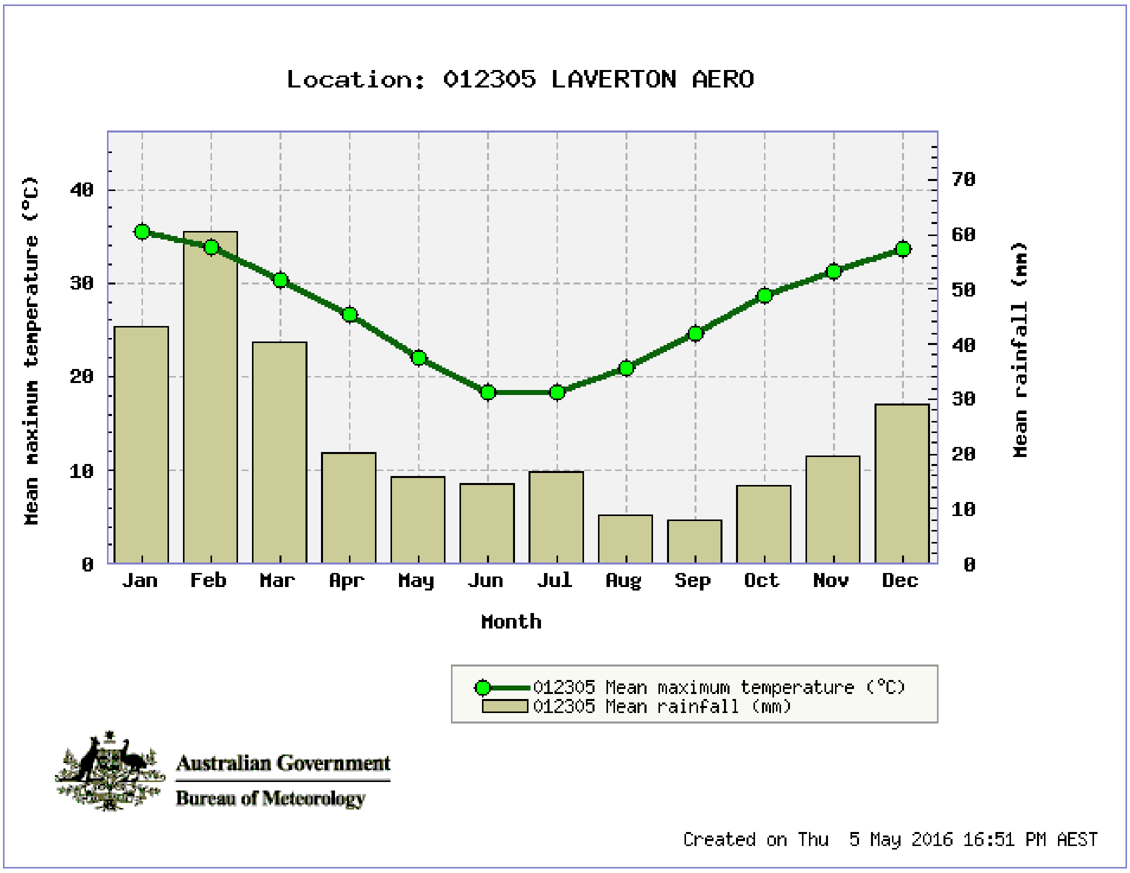


Figure 5: Mean monthly rainfall and maximum temperature for the Laverton Aero weather station #12305 (BOM, 2016).

2.5 Land Use

The dominant land uses of the Shield subregion include; Aboriginal reserves (12.3%), Conservation Reserves (7%), grazing-native pastures (24.8%), UCL and Crown Reserves (55.7%) and other-lake and major watercourse (0.1%). The survey area is located within the Yamarna pastoral lease.

2.6 Survey Objectives

The flora assessment was conducted in accordance with *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015* (DPaW & EPA, 2015). The objectives of the assessment were to:

- Gather background information on flora and vegetation in the target area (literature review, database and map-based searches);
- Compile broad scale vegetation community flora maps and species list of the survey area;
- Document and map locations of any Threatened or Priority listed flora species located;
- Assess the regional and local conservation status of plant species and ecological communities within the survey area; and
- Identify and map occurrences of any "Declared and Environmental" weeds within the survey area.

The fauna assessment was conducted in accordance with the requirements of a Level 1 terrestrial fauna survey as defined in EPA Guidance Statement 56 (EPA 2004). The objectives of the assessment were to:

- Gather background information on fauna in the survey area (literature review, database and map-based searches);
- Delineate and characterise the faunal assemblages and fauna habitats present in the survey area;
- Document and map locations of any Threatened or Priority listed fauna species located;
- Assess the regional and local conservation status of fauna species and fauna habitats within the survey area.

3 Survey Methodology

3.1 Desktop Assessment

Searches of the following databases were undertaken to obtain background information on the flora and fauna taxa within the survey area:

- DPaW's NatureMap Database (DPaW, 2016);
- DotE Protected Matters search tool (DotE, 2016a).

The searches were conducted for an area encompassing a 40km radius of the centre coordinates – 28.028S, 123.808E (Appendix 1). It should be noted that these lists are based on observations from a broader area than the survey area (40km radius) and therefore may include taxon not present. The databases also often included very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

Prior to the field survey, a combined search of the DPaW's Flora of Conservation Significance databases (DPaW, 2013a) was undertaken, the results of which are provided in Appendix 2. These significant flora species were examined on the Western Australian Herbarium's (WAHERB) web page prior to the survey, to familiarise staff with their appearance. Locations of Threatened Flora and Priority Flora were overlaid on aerial photography of the area. Vegetation descriptions and available images of the Priority Flora were also obtained from Florabase.

The conservation significance of flora and fauna was assessed using data from the following sources:

- EPBC Act. Administered by the Australian Government (DotE);
- WC Act. Administered by the WA Government (DPaW);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- DPaW Priority Flora/ Fauna list. A non-legislative list maintained by DPaW for management purposes.

The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)[1];
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (NES) under the EPBC Act.

Table 3 and Table 4 below provide the definitions of conservation significant flora and fauna.

---

[1] Species listed under JAMBA are also specially protected under Schedule 5 of the WC Act.

Table 3: Definitions of conservation significant Flora

Code	Category
State categories of threatened and priority species	
R	Declared Rare Flora – Extant Taxa "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such."
P1	Priority One – Poorly Known Taxa "Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey."
P2	Priority Two – Poorly Known Taxa "Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey."
P3	Priority Three – Poorly Known Taxa "Taxa which are known from several populations and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey."
P4	Priority Four – Rare Taxa "Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years."
P5	Priority Five-Conservation Dependent Taxa Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered	Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation dependent	Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Table 4: Definitions of Conservation Significant Fauna

Code	Category
State categories of threatened and priority species	
Schedule 1	Critically Endangered – Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2	Endangered – Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3	Vulnerable – Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7	Fauna otherwise in need of special protection to ensure their conservation.
P1	Priority One – Poorly Known Taxa Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority Two – Poorly Known Taxa Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority Three – Poorly Known Taxa Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	Priority Four – Rare, Near Threatened and other species in need of monitoring (a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or

Code	Category
	expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Near Threatened	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A search of the DPaW PEC and TEC database was also conducted within a 40km radius of the survey area (DPaW, 2013b). Table 5 describes definitions of conservation significant communities.

Table 5: Definition of conservation significant communities

Category Code	Category
Threatened Ecological Communities (TEC)	
PTD	**Presumed Totally Destroyed** An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; all occurrences recorded within the last 50 years have since been destroyed.
CE	**Critically Endangered** An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	**Endangered** An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;

Category Code	Category
	The ecological community is highly modified with potential of being rehabilitated in the short term future.
V	**Vulnerable** An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.
Priority Ecological Communities (PEC)	
P1	**Poorly-known ecological communities** Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities** Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Ecological communities that are adequately known, rare but not threatened** or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

3.2 Field Assessment

BC was commissioned by GRR to undertake a Level 1 flora survey and fauna assessment of the proposed Gruyere Camp and Airstrip survey area. The survey covered an area of approximately 569ha encompassing the entire boundary of a pending miscellaneous licence (L38/254). The survey was conducted on the 20th April 2016 with the area traversed on foot by two staff members.

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between vegetation communities. At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant species;
- Landform classification;
- Health Rating;
- Fauna habitat;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of fauna of conservation significance if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and WAHERB. Structural vegetation classification (based on Muir Life Form/ Height Classifications provided in Appendix 3) was used to determine different vegetation communities based on the vegetation structure and dominant species. Similar vegetation communities were recognised visually in the field. Vegetation communities were classified in accordance with the NVIS to a minimum Level 5 classification which includes recording Dominant growth form, height, cover and species for the three traditional strata (i.e. Upper, Middle and Ground).

Vegetation and landform units identified during the flora and vegetation survey have been used to define broad fauna habitat types across the site. The main aim of the habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that may be impacted as a consequence of the proposal proceeding. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

3.2.1 Personnel involved

Jim Williams - Environmental Consultant/Botanist (Diploma of Horticulture)
Aidan Williams - Environmental Assistant (Undergraduate-Bachelor of Science)
Greg Harewood - Zoologist (Bachelor of Science)

3.2.2 Scientific licences

Table 6: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL011451	21-05-2016

3.3 Survey limitations and constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 7.

The conclusions presented in this report are based upon field data and 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 the field assessments. Also it should be recognised that site conditions can change with time. Information not available at the time of this assessment which may subsequently become available may alter the conclusions presented.

Some fauna species are reported as potentially occurring based on there being suitable habitat (quality and extent) within the survey area or immediately adjacent. The habitat requirements and ecology of many of the species known to occur in the wider area are however often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitats or microhabitats within the survey area. As a consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that actually utilise the survey area for some purpose. Some species may be present in the general area but may only use the survey area itself on rare occasions or as vagrants.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any vertebrate fauna species that would possibly occur within the survey area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author, has been listed as having the potential to occur.

Table 7: Limitations and constraints associated with the survey.

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD and on foot.
Experience levels	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Botanist:** Jim Williams **Field Staff:** Jim Williams & Aidan Williams **Data Interpretation:** Jim Williams, Greg Harewood & Lauren Pick
Timing of survey, weather & season	Not a constraint	Fieldwork was conducted in April within the recommended DPaW/ EPA guidelines primary survey period (Eremaean Province-6-8 weeks post wet season (March – June). The survey was conducted following above average rainfall received in March and as a result annual species were present.
Sources of information	Not a constraint	BC was able to obtain information about the area from previous research conducted within the area which enabled adequate background information about the region.
Mapping reliability	Not a constraint	BC were able to obtain high quality ortho aerial images of the area which was sufficient to reliably determine changes in vegetation within the survey area.
Area disturbance	Not a constraint	Slight signs of disturbance caused by repeated fire or occasional vehicle tracks.
Survey Intensity	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a Level 1 survey completed to identify vegetation communities, fauna habitat and any Flora/Fauna of Conservation Significance.
Resources	Not a constraint	Threatened flora database search provided by the DPaW was used to identify any potential locations of Threatened/Priority Flora species. DAFWA, DPaW and DotE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region.
Completeness	Not a constraint	In the opinion of BC the survey area was covered sufficiently in order to identify vegetation assemblages. Due to the extensive experience and familiarity of the BC staff with flora within the region, it is estimated that approximately 90% of the flora within the survey area was able to be fully identified. The vegetation communities for this study were based on visual descriptions of

Variable	Potential Impact on Survey	Details
		locations in the field. The distribution of these vegetation communities outside the study area is not known, however vegetation communities identified were categorised via comparison to vegetation distributions throughout WA specified in the NVIS obtained from the Australian Government (DotE, 2016b).

4 Results

4.1 Desktop Assessment

4.1.1 Flora of Conservation Significance

The results of the combined search of the DPaW's Flora of Conservation Significance databases (Appendix 3), NatureMap Database and Protected Matters search tool (Appendix 1), recorded no Threatened Flora and no Priority Flora taxon within the survey area. Six Priority Flora taxa and one Threatened Flora were listed within a 40km radius of the survey area; However, there appears to be an error with NatureMap database listing as two taxa identified in the NatureMap database search, *Ptychosema pusillum* (T) and *Triodia bromoides* (P4), are not listed within a 40km radius of the survey area. These taxa are located in the Dandaragan Plateau, Lesueur Sandplain, Perth IBRA subregions and Edel, Geraldton Hills subregions respectively. As such these taxa have been excluded from the desktop assessment. The remaining taxa were assessed and ranked for their likelihood of occurrence within the survey area (Table 8). The rankings and criteria used were:

- Unlikely: Area is outside of the currently documented distribution for the species/no suitable habitat (type, quality and extent) was identified as being present during the field/desktop assessment.

- Possible: Area is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field/desktop assessment, supported in some cases by recent records being documented from within or near the area.

- Known to Occur: The species in question was positively identified as being present during the field survey.

Table 8: Likelihood of occurrence for Flora of Conservation Significance within the Gruyere Camp and Airstrip survey area

Taxon	Conservation Code	Description (WAHERB, 2016)	Likelihood of Occurrence
Calytrix warburtonensis	P2	Shrub, 0.3-0.6 m high. Fl. white, Mar or Sep to Oct. Rocky hills, breakaways.	Unlikely
Comesperma viscidulum	P4	Shrub, to ca 0.7 m high.	Possible
Conospermum toddii	P4	Spreading shrub, 1.2-2 m high. Fl. white/white-yellow, Jul to Oct. Yellow sand. Sand dunes.	Possible
Grevillea secunda	P4	Low spreading shrub, 0.3-0.8 m high. Fl. red, Sep to Oct. Yellow or red sand. Sand dunes, sandplains.	Possible
Sauropus sp. Woolgorong ((M. Officer s.n. 10/8/94)	P3	Slender, much-branched shrub, to 0.3 m high.	Unlikely

4.1.2 Vertebrate Fauna of Conservation Significance

For vertebrate fauna of conservation significance identified during the literature review as previously being recorded in the general area, each was assessed and ranked for their likelihood of occurrence within the survey area itself (Table 9). The rankings and criteria used were:

- Unlikely: Survey area is outside of the currently documented distribution for the species in question or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records), or no suitable habitat (type, quality and extent) was identified as being likely to be present during the field survey and literature review. Individuals of some species may occur very occasionally as vagrants/transients especially if suitable habitat is located nearby but the survey area itself would not support a population or part population of the species.

    - Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20km of the survey area. Populations do however persist outside of this area.

    - Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the Goldfields region, Populations do however persist outside of this area.

- Possible: Survey area is within the known distribution of the species in question and habitat of at least marginal quality was identified as likely to be present during the field survey and literature review, supported in some cases by recent records being documented in literature from within or near the survey area. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- Known to Occur: The species in question has been positively identified as being present (for sedentary species) or as using the survey area as habitat for some other purpose (for non-sedentary/mobile species) during field surveys within or near the survey area. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. tracks, foraging debris, scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

Table 9: Likelihood of Occurrence – Vertebrate Fauna Species of Conservation Significance

Species	Conservation Status (see Appendix A for codes)			Potential Habitats Within Survey Area		Likelihood of Occurrence
	EPBC Act	*WC Act*	DPAW Priority	Foraging Habitat	Breeding Habitat	
Buff-snouted Blind Snake *Anilios margaretae*	-	-	P2	Sand plains and sand dunes.		Possible.
Great Desert Skink *Liopholis kintorei*	VU	S3	-	Sand plains and sand dunes.		Unlikely. Outside current documented range/locally extinct.
Woma *Aspidites ramsayi*	-	-	P1	Sand plains and sand dunes.		Unlikely. Outside current documented range/locally extinct.
Malleefowl *Leipoa ocellata*	VU	S3	-	Vegetated sand plains.	None.	Possible transient individuals only. Breeding unlikely.
Great Egret *Ardea alba*	Mig	S5	-	None.		Unlikely. No suitable habitat and outside normal range.
Peregrine Falcon *Falco peregrinus*	-	S7	-	Air space over sand plains and sand dunes.	Large trees with open spouts suitable for nesting or abandoned bird of prey nests.	Possible. No potential nest sites identified.
Grey Falcon *Falco hypoleucos*	-	S3	-	Air space over sand plains and sand dunes.	None.	Unlikely. Outside normal range.
Oriental Plover *Charadis veredus*	Mig	S5	-	None.		Unlikely. No suitable habitat and outside normal range.
Princess Parrot *Polytelis alexandrae*	VU	-	P4	Vegetated sand plains and sand dunes.	Large trees with hollows suitable for nesting.	Possible. No suitable tree hollows identified.
Night Parrot *Pezoporus occidentalis*	EN	S1	-	Vegetated sand plains.		Unlikely. Outside current documented range/locally extinct.
Fork-tailed Swift *Apus pacificus*	Mig	S5	-	Air space over entre area.	None	Unlikely. Rarely recorded in this area.
Striated Grasswren (sandplain) *Amytornis striatus striatus*	-	-	P4	Densely vegetated sand plains and sand dunes.		Possible.
Thick-billed Grass-wren (western ssp) *Amytornis textilis textilis*	-	-	P4	Densely vegetated sand plains and sand dunes		Unlikely. Outside current documented range/locally extinct.

Species	**Conservation Status (see Appendix A for codes)**			**Potential Habitats Within Survey Area**		**Likelihood of Occurrence**
	EPBC Act	***WC Act***	**DPAW Priority**	**Foraging Habitat**	**Breeding Habitat**	
Rainbow Bee-eater *Merops ornatus*	Mig	S5	-	Sand plains and sand dunes.	Sand plains and sand dunes.	Possible.
Grey Wagtail *Motacilla cinerea*	Mig	S5	-	None.		Unlikely.
Yellow Wagtail *Motacilla flava*	Mig	S5	-	None.		Unlikely.
Brush-tailed Mulgara *Dasycercus blythi*	-	-	P4	Sand plains and sand dunes.		Possible.
Southern Marsupial Mole *Notoryctes typhlops*	-	-	P4	Sand dunes.		Unlikely. Outside current documented range/locally extinct.
Sandhill Dunnart *Sminthopsis psammophila*	EN	S2	-	None.		Unlikely. Habitat Appears unsuitable.
Bilby *Macrotis lagotis*	VU	S3	-	Sand plains and sand dunes.		Unlikely. Outside current documented range/locally extinct.
Central Long-eared Bat *Nyctophilus major tor*	-	-	P4	Sand plains and sand dunes.		Unlikely. Outside current documented range

The current status on site and/or in the general area of some species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, the following species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times:

Buff-snouted Blind Snake *Anilios margaretae* – P2 (DPaW Priority Species)
The status of this species in the survey area is difficult to determine. Given suitable habitat (i.e. sand dunes and sand plains) occurs its presence cannot be discounted despite not being recorded during previously fauna surveys nearby and in the wider area (ecologia 2009, KLA 2012, KEC 2014 and Rapallo 2015). While there are limited records for this species, it appears to have a wide distribution across the Great Victoria Desert. The lack of records could be attributed to the areas remoteness and the secretive habits of blind snakes and it may in fact be more common than records indicate.

Extent of potential habitat within the survey area: Sand plains and sand dunes (569 ha - 100% of total area).

Malleefowl *Leipoa ocellata* – S3 (*WC Act*), Vulnerable (*EPBC Act*)
No evidence of this species (individuals, foot prints, feathers or recent/old nest mounds) was observed during the survey period. Habitat appears unsuitable or at best marginal within much of the area surveyed primarily due to the generally sparse nature of the vegetation, recent fires and/or a lack of leaf litter.

Individual malleefowl have very occasionally been observed in the general vicinity of Yamarna (pers. comms. “Driller” and TOs) but no recent active or inactive mounds have ever been recorded despite several fauna and flora surveys over significant areas of land associated with the proposed mining operations. This would suggest that the habitats present are unsuitable for breeding and that the observations made are of transient individuals. For these reasons malleefowl have been listed as a potential species due to the possibility for occasional transient individuals to occur, but they are considered very unlikely to breed within the area itself.

Extent of potential habitat within the survey area: Sand plains (560 ha - ~98.3% of total area). Most habitat does however appear marginal in quality at best.

Princess Parrot *Polytelis alexandrae* – Vulnerable (*EPBC Act*), P4 (DPaW Priority Species)
The species may frequent the survey area at times, but given it is highly nomadic, its frequency of occurrence would be very low and generally temporary. Areas containing *Eucalyptus gongylocarpa* woodland are of most significance as they have the potential to contain larger trees with hollows that may represent potential breeding habitat.

Extent of potential habitat within the survey area: Foraging habitat – Vegetated sand plains and sand dunes (569 ha – 100% of total area). Breeding habitat - Large trees with hollows suitable for nesting – total number, if any, unknown.

Peregrine Falcon *Falco peregrinus* – S7 (*WC Act*)
The species potentially utilises some sections of the survey area as part of a much larger home range for foraging purposes only. Would only be represented by a very small number of individuals for limited periods. Previously recorded at Tropicana (ecologia 2009).

Extent of potential habitat within the survey area: Foraging habitat - sand plains and sand dunes (569 ha – 100% of total area). Breeding habitat - Large trees with open spouts suitable for nesting or abandoned bird of prey nests – total number unknown, but none observed during field survey.

Rainbow Bee-eater *Merops ornatus* – Migratory (*EPBC Act*), S5 (*WC Act*)
The rainbow bee-eater is a very common and widespread seasonal visitor to the southern half of WA but would not be specifically attracted to the survey area itself. Some potential for the species to breed in some sections of the survey area where ground conditions are suitable. Population levels would however not be significant as it usually breeds in pairs and rarely in small colonies (Johnstone and Storr, 1998).

Extent of potential habitat within the survey area: Foraging habitat - sand plains and sand dunes (569 ha – 100% of total area). Breeding habitat - sand plains and sand dunes (569 ha – 100% of total area).

Striated Grasswren (sand plain) *Amytornis striatus striatus* - P4 (DPaW Priority Species)
Not observed during any recent surveys at Yamarna however there is a NatureMap record along the Anne Beadell Highway just east of the borefield survey area made in the year 2000 (DPaW 2016) and therefore it is considered to be a potential species where suitable habitat occurs. This species has also been recorded recently much further south at several locations along the Tropicana to Sunrise Dam pipeline route (KEC 2014).

Extent of potential habitat within the survey area: Sand plains and sand dunes (569 ha – 100% of total area).

Brush-tailed Mulgara *Dasycercus blythi* - P4 (DPaW Priority Species)
There is a paucity of records of this species in the area and no evidence of its presence was observed during the field survey or any previous survey at Yamarna including those where trapping has been employed (KLA 2012 and Rapallo 2015). The current status in the survey area is therefore difficult to determine. The most recent nearby records are just south west of Yamarna from 1990 (DPaW 2016) and it was also recorded at several locations along the Tropicana to Sunrise Dam pipeline route (KEC 2014). This information coupled with the fact that habitat in some sections of the survey area appears suitable (e.g. sand plains and sand ridges) suggests that the species may be present in some areas.

Extent of potential habitat within the survey area: Sand plains and sand dunes (569 ha – 100% of total area).

It should be recognised that habitat within the survey area for some of the species listed above, while considered possibly suitable, may be marginal in extent/quality and the species listed may therefore only visit the area for short periods or as rare/uncommon vagrants.

A number of other species of conservation significance, while possibly present in the general area and/or the Goldfields region are not listed as potential species due to the Project area being outside of their currently recognised range, a lack of suitable habitat or known/very likely local or regional extinction (and no subsequent recruitment from adjoining areas).

4.1.3 Invertebrate Fauna of Conservation Significance

It can be difficult to identify what may be significant invertebrate species (e.g. Short Range Endemics - SREs) as there are uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

The review of potential terrestrial invertebrate species of conservation significance has included a search of the DPaW NatureMap database (DPaW, 2016) and the DotE protected matters database (DotE, 2016) with the aim of identifying previously recorded threatened and endemic species.

These sources do however have limitations and therefore the results and conclusions of several terrestrial short range endemic studies carried out previously within GRR's Yamarna tenements/Project areas have also been used as a reference in determining the likelihood of terrestrial invertebrate species of conservation significance being impacted on by the installation and operation of the borefield itself. The reports have included:

- 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.

- Judd, S. (2015). Terrestrial Isopod Identification for Dorothy Hills, Yamarna Station. Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

- 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.

- Phoenix Environmental Sciences (2015a). Identification and assessment of short-range endemism of invertebrates from Yamarna Station, Western Australia. Unpublished report prepared for Rapallo Ltd.

- Phoenix Environmental Sciences (2015b). Identification and assessment of short-range endemism of trapdoor spiders from Gruyere Project (Yamarna Station), Western Australia. Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

- Volschenk, E. (Scorpion ID) (2012). Yamarna Scorpion Identification Report. Unpublished report for Keith Linbeck and Associates.

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

- Volschenk, E. (Scorpion ID) (2015b). Taxonomic and Short-Range Endemism Assessment of Invertebrates Surveyed from Yamarna Station (November 2015). Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

The NatureMap database search of the survey area returned 63 invertebrate species records (DPaW 2016) none of which are listed as threatened or as priority species. One species (*Wandella stuartensis* - a spider) is shown as being "Endemic to Query Area" (i.e. those DPaW species records that are wholly contained within the database search area) but this species is also known from several locations in the eastern states (ALA 2016) and therefore it is not likely to be an SRE.

No other invertebrate species listed in the NatureMap search were flagged as being endemic to the query area which indicates that there are other records of each of these species, within the NatureMap database, outside the 40km (~5,000 km^2) search area, suggesting none would be classified as SREs though this assessment has limitations.

A search of the federal *EPBC Act* database using the Protected Matters Search Tool (DotE 2016) returned no reference to invertebrates.

A search of the WAM databases for invertebrates was undertaken by MBS as part of their initial desktop review for the Gruyere Project (MBS 2014). The database search was based on a 20 km area and buffer respectively around a central coordinate, (-27.98669 S and 123.85007 E). The search results were limited to one potential SRE species being reported, a scorpion (*Urodacus* sp. 'Point Sunday') which was recovered from a borrow pit on Point Sunday Road in July 2007, approximately 11 km north of the central coordinate (MBS 2014). The individual record was a new and previously undescribed species.

During a Level 2 Fauna survey carried out at Yamarna in 2011 and 2012 (KLA 2012), 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 the WAM were often inconclusive depending on the families or genera. Of the invertebrates identified, results indicated that seven species were not SREs or unlikely to be SREs, for three it was, at the time, not possible to say if the species represented an SRE and the remaining two required further taxonomic research in order to determine or confirm their SRE status. This highlights the lack of knowledge currently available in relation to the conservation status of many invertebrate species (KLA 2012).
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.

Two myglamorph spiders were collected within the Gruyere Project area during a Level 1 fauna survey carried out in May 2014 (Harewood 2014) and submitted to specialists for identification. The specimens included a male “trapdoor spider” identified as the widespread *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).

During a Level 2 Fauna Survey within the Gruyere Project area carried out in late 2014 (Rapallo 2015) a total of 37 invertebrate specimens were collected. These comprised 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 pseudoscorpions were identified as being unlikely to represent SREs.
More recently, a targeted invertebrate survey has been completed within the Gruyere Project area between August and October 2015 (Harewood 2016). The survey included the deployment of 120 wet pit traps left in place for about two months and the collection and examination of 12 leaf litter

samples. The survey yielded 249 specimens of SRE target groups (scorpions (59), isopods (59), pseudoscorpions (61), Mygalomorph spiders (10) and centipedes (60)).

The Mygalomorph spiders were identified as including four potential SREs and a widespread species (Phoenix 2015b). However, until a comparative analysis of material at the WA Museum (which at the time was closed due to a major re-organisation of specimen storage) is carried out, it will remain unclear if some of the specimens collected are conspecific with those previously collected in the area by KLA (2012) or Rapallo (2015) (i.e. if *Synothele* 'gruyere' is conspecific with *Synothele* sp. indet. (as reported in Burger *et al.* 2012) 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).

Other specimens collected included five species of scorpions, three species of pseudoscorpions, four species of scolopendromorph centipedes, one species of stone centipede and one species of earth centipede. Of these 14 species, two scorpions (*Lychas* 'annulatus complex' and *Urodacus* sp. indet), and the earth centipede (*Mecistocephalus* sp. indet.) were determined to be potential SRE's. The remaining 11 species were considered to have widespread ranges (Volschenk 2015b) and therefore not SREs.

The isopod specimens collected were determined to represent a single species that is considered to be a potential SRE primarily because there are knowledge gaps for the taxon and insufficient geographic information to determine its full distribution (Judd 2015).

To date no confirmed terrestrial SREs have been identified within the Yamarna area.

The results of the abovementioned surveys indicate that it is possible that potential SREs could occur within the survey area, given the proximity of the records acquired to date and the presence of similar habitat types. Based on available information it is however concluded that terrestrial SRE invertebrates, even if present, are unlikely to be significantly impacted on by development with the survey area given the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. As a consequence there is a very low likelihood of any significant impact/change occurring to local invertebrate communities or to the conservation status of individual species given that populations will persist in adjoining unaffected locations.

4.1.4 Previous Surveys

Flora and fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publically available and could not be referenced. The most significant of those available listed below have been used as the primary reference material for compiling the potential flora and vegetation communities and fauna habitats for the general area.

- BC (2011), *Level 1 Yamarna Proposed Haul Road Flora and Vegetation Survey,* Botanica Consulting
- BC (2012), *Level 2 Flora and Vegetation Survey, Yamarna Project,* Botanica Consulting
- BC (2014a), *Level 1 Flora and Vegetation Survey, Gruyere Project,* Botanica Consulting
- BC (2014b), *Level 1 Flora and Vegetation Survey, Sunrise Dam Gold Mine to Tropicana Gold Mine Gas Pipeline,* Botanica Consulting
- BC (2014c), *Level 1 Flora and Vegetation Survey, Miningwal Borefields,* Botanica Consulting

- BC (2015a), *Level 2 Flora and Vegetation Survey of the Gruyere Project.* Botanica Consulting
- BC (2015b), *Level 1 Flora and Vegetation Survey Proposed Gas Pipeline Routes,* Botanica Consulting
- DAFWA (1994) *Technical Bulletin: An inventory and condition survey of the north-eastern Goldfields Western Australia (No. 87),* Department of Agriculture WA, 1994.
- Ecologia (2009a). Tropicana Gold Project. Operational Area Vertebrate Fauna Assessment. Unpublished report for Tropicana Joint Venture. February 2009.
- Ecologia (2009b). Tropicana Gold Project. Tropicana-Transline Infrastructure Corridor, Level 1 Fauna Assessment. Unpublished report for Tropicana Joint Venture. July 2009.
- Hall, N. J., McKenzie, N. L. and Keighery, G. J. (eds) (1994). The Biological Survey of the Eastern Goldfields of WA - Pt 10: Sandstone-Sir Samuel and Laverton-Leonora Survey Areas. Records of the WAM, Supplement 47: 1 – 166.
- Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) of Yamarna Gold Project (Central Bore, Attila, Alaric, Haul Road and Khan North). Unpublished report for Gold Road Resources. September 2011.
- Harewood G. (2014). Fauna Assessment (Level 1) Gruyere Project. Unpublished report for Gold Road Resources Ltd. July 2014.
- Harewood G. (2015a). Southern Marsupial Mole (*Notoryctes typhlops*) – Additional Information on Presence/Absence - Gruyere Project Area. Unpublished letter report for Gold Road Resources Ltd. June 2015.
- Harewood G. (2015b). Southern Marsupial Mole (*Notoryctes typhlops*) – Northern Borefield Area. Unpublished letter report for Gold Road Resources Ltd. November 2015.
- Harewood G. (2015c). Fauna Assessment (Level 1) Gruyere Borefield Project. Unpublished report for Gold Road Resources Ltd. December 2015.
- Harewood G. (2016). Terrestrial Invertebrate Survey – Gruyere Project Area. Unpublished report for Gold Road Resources Ltd. January 2016.
- Kingfisher Environmental Consulting (2014a). Murrin Murrin – Sunrise Dam Infrastructure Corridor Level 1 Fauna Survey. Unpublished report for AngloGold.
- Kingfisher Environmental Consulting (2014b). Sunrise Dam – Tropicana Infrastructure Corridor Level 1 Fauna Survey. Unpublished report for AngloGold.
- KLA (2012). Fauna Assessment (Level 2) Yamarna Project. Unpublished report for Gold Road Resources. October 2012.
- Martnick and Associates Pty Ltd (1996). Environmental Appraisal – Yamarna Gold Project Area. Unpublished report for Zanex NL. January 1996.
- MBS Environmental (2014). Gruyere Project - Desktop Environmental Review and Work Program. Unpublished report for Gold Road Resources. February 2014.
- Ninox Wildlife Consulting (2009). A Level One Survey of the Vertebrate Fauna, Infrastructure Corridor – Pinjin Option. L 31/57, L 39/185, Pinjin – Tropicana Gold Project. Unpublished report for Tropicana Joint Venture. January 2009.
- Rapallo Environmental (2015). Fauna Survey of the Gruyere Project Area. Unpublished report for Gold Road Resources Limited. May 2015.
- Terrestrial Ecosystems (2011). Level 2 Fauna Risk Assessment for the Granny Deeps Project Area. Unpublished report. February 2011.

Some of the abovementioned reports refer to flora and fauna surveys carried a considerable distance from the survey area being assessed and therefore, as with the databases searches, some refer to species that would not occur in the survey area due it being out of their normal range or due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential flora and fauna species list for the survey area.

4.2 Field Assessment

4.2.1 Flora of Conservation Significance

Flora of conservation significance identified in the desktop assessment as potentially occurring within the survey area were targeted during the field assessment. No Threatened Flora taxa pursuant to subsection (2) of section 23F of the WC Act and the EPBC Act were identified within the survey area. No Priority Flora taxa were identified within the survey area.

4.2.2 Fauna of Conservation Significance

Fauna of conservation significance identified in the desktop assessment as potentially occurring within the survey area were targeted during the field assessment. No Threatened Fauna/ Schedule Fauna taxa pursuant to the WC Act and the EPBC Act were identified within the survey area. No Priority Fauna taxa were identified within the survey area.

4.3 Vegetation Communities

A total of six vegetation communities were identified within the survey area. These communities comprised of two landform types and two NVIS major vegetation groups as listed in Table 10 below. These communities were represented by a total of 31 Families, 62 Genera and 121 Taxa, (including sub-species and variants) as listed in Appendix 4. A map showing the vegetation communities present in the survey area is provided in Appendix 5.

Table 10: Vegetation Communities identified within the Gruyere Camp and Airstrip survey area

<table>
<tr><th>Landform</th><th>NVIS Vegetation Group</th><th>Vegetation Community</th><th>Code</th><th>Area (ha)</th><th>Area (%)</th></tr>
<tr><td>Sand Dune</td><td>Eucalypt Woodlands/Mallee Woodlands and Shrublands</td><td>Open low woodland of Eucalyptus gongylocarpa over open shrub mallee of Eucalyptus youngiana and mid-dense hummock grass of Triodia basedowii on sand dune</td><td>SD-EW/MWS1</td><td>9.5</td><td>1.7</td></tr>
<tr><td rowspan="5">Sandplain</td><td>Eucalypt Woodlands</td><td>Low woodland of Eucalyptus gongylocarpa over heath of Acacia ligulata and dense hummock grass of Triodia basedowii in sandplain</td><td>S-EW1</td><td>25</td><td>4.4</td></tr>
<tr><td>Eucalypt Woodlands/Mallee Woodlands and Shrublands</td><td>Low woodland of Eucalyptus gongylocarpa over shrub mallee of Eucalyptus youngiana and mid-dense hummock grass of Triodia basedowii in sandplain</td><td>S-EW/MWS1</td><td>206</td><td>36.2</td></tr>
<tr><td rowspan="3">Mallee Woodlands and Shrublands</td><td>Open tree mallee of Eucalyptus youngiana over dense hummock grass of Triodia basedowii in sandplain</td><td>S-MWS1</td><td>288</td><td>50.6</td></tr>
<tr><td>Open tree mallee of Eucalyptus youngiana over heath of Acacia caesaneura and mid-dense hummock grass of Triodia basedowii in sandplain</td><td>S-MWS2</td><td>25.5</td><td>4.5</td></tr>
<tr><td>Open tree mallee of Eucalyptus concinna/ Eucalyptus mannensis over heath of mixed shrubs and hummock grass of Triodia basedowii in sandplain</td><td>S-MWS5</td><td>15</td><td>2.6</td></tr>
<tr><td colspan="4">TOTAL</td><td>569</td><td>100</td></tr>
</table>

Sand Dune: Eucalypt Woodlands/ Mallee Woodlands and Shrublands

4.3.1 Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune (SD-EW/MWS1)

The total flora recorded within this vegetation community (Plate 1) was represented by a total of 24 Families, 38 Genera and 55 Taxa (Appendix 4). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation community are shown in Table 11. According to NVIS this vegetation community is best represented by the MVG5-Eucalypt Woodlands/ MVG 14-Mallee Woodlands and Shrublands (DotE, 2016b).

Table 11: Vegetation assemblage for Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Eucalyptus gongylocarpa*
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 1: Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune

Sandplain: Eucalypt Woodlands

4.3.2 Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain (S-EW1)

The total flora recorded within this vegetation community (Plate 2) was represented by a total of 19 Families, 30 Genera and 46 Taxa (Appendix 4). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation community are shown in Table 12. According to NVIS this vegetation community is best represented by the MVG5-Eucalypt Woodlands (DotE, 2016b).

Table 12: Vegetation assemblage for Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus gongylocarpa*
Shrub 1.5-2m	30-70%	*Acacia ligulata*
Hummock Grass	70-100%	*Triodia basedowii*

Plate 2: Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain

Sandplain: Eucalypt Woodlands/ Mallee Woodlands and Shrublands

4.3.3 Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-EW/MWS1)

The total flora recorded within this vegetation community (Plate 3) was represented by a total of 22 Families, 35 Genera and 55 Taxa (Appendix 4). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation community are shown in Table 13. According to NVIS this vegetation community is best represented by the MVG5-Eucalypt Woodlands/MVG 14-Mallee Woodlands and Shrublands (DotE, 2016b).

Table 13: Vegetation assemblage Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Eucalyptus gongylocarpa*
Mallee Tree Form	30-70%	*Eucalyptus youngiana*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 3: Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Sandplain: Mallee Woodlands and Shrublands

4.3.4 Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain (S-MWS1)

The total flora recorded within this vegetation community (Plate 4) was represented by a total of 12 Families, 23 Genera and 40 Taxa (Appendix 4). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation community are shown in Table 14. According to NVIS this vegetation community is best represented by the MVG 14-Mallee Woodlands and Shrublands (DotE, 2016b).

Table 14: Vegetation assemblage for Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
Hummock Grass	70-100%	*Triodia basedowii*

Plate 4: Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain

4.3.5 Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-MWS2)

The total flora recorded within this vegetation community (Plate 5) was represented by a total of 17 Families, 26 Genera and 37 Taxa (Appendix 4). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation community are shown in Table 15. According to NVIS this vegetation community is best represented by the MVG 14-Mallee Woodlands and Shrublands (DotE, 2016b).

Table 15: Vegetation assemblage for Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
Shrub 1.5-2m	30-70%	*Acacia caesaneura*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 5: Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain

4.3.6 Open tree mallee of *Eucalyptus concinna/ Eucalyptus mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain (S-MWS5)

The total flora recorded within this vegetation community (Plate 6) was represented by a total of 15 Families, 21 Genera and 38 Taxa (Appendix 4). No Threatened or Priority Flora taxa were identified within this vegetation community. Dominant taxa from the vegetation community are shown in Table 16. According to NVIS this vegetation community is best represented by the MVG 14-Mallee Woodlands and Shrublands (DotE, 2016b).

Table 16: Vegetation assemblage for Open tree mallee of *Eucalyptus concinna/ Eucalyptus mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna* *Eucalyptus mannensis*
Shrub 1-1.5m	30-70%	*Acacia ligulata* *Senna artemisioides* subsp. *filifolia* *Senna artemisioides* subsp. x *artemisioides* *Scaevola spinescens*
Hummock Grass	10-30%	*Triodia basedowii*

Plate 6: Open tree mallee of *Eucalyptus concinna/ Eucalyptus mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain

4.4 Fauna Habitat

The broad scale terrestrial fauna habitats within the survey area presented below are based on vegetation and associated landforms identified during the flora and vegetation assessment. The extent of the identified fauna habtiats and a summary description of each are provided in Table 17 below.

Table 17: Main Terrestrial Fauna Habitats within the Survey Area.

No.	Fauna Habitat Description	Example Image
1	Sand Dunes Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dunes. Total Area = 9.5 ha (~1.7%)	
2	Sandplains Low Eucalypt Woodlands or Open Tree Mallees over heath of *Acacia* or mixed shrubs over *Triodea* hummock grass on sandplains. Total Area = 560 ha (~98.3%)	

A list of expected vertebrate fauna species likely to occur in the survey area was compiled from information obtained during the literature review and is presented in Appendix 8. The results of some previous fauna surveys carried out in the general area are also summarised in this species listing as are the DPaW NatureMap database search results. The raw database search results from NatureMap (DPaW 2016) and the Protected Matters Search Tool (DotE 2016) are contained within Appendix 1.

Table 18 summarises the numbers of potential species based on vertebrate class considered likely to be present in the general vicinity of the survey area based on the complete list held Appendix 8.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. *EPBC Act's* Threatened Fauna and Migratory species lists, DPAW's NatureMap Fauna Database and various publications) are considered likely to be present within the survey area. The list of potential fauna takes into consideration that firstly the species in question is not known to be locally/regionally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the survey area, though compiling an accurate list has limitations (see **Section 3.3 Survey limitations and constraints**).

Table 18: Summary of Potential Vertebrate Fauna Species

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species
Amphibians	9	0	0	0
Reptiles	105	0	0	1
Birds	103	3	1	1
Non-Volant Mammals	29[9]	0	0	2
Volant Mammals (Bats)	8	0	0	0
Total	**254[9]**	**1**	**1**	**6**

Superscript = number of introduced species included in the total. Note: Where a species state and federal conservation status is different, the highest category is used.

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the survey area (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time only a subset of the listed potential species are likely to be present within the bounds of the study area.

4.5 Vegetation of Conservation Significance

None of the vegetation communities within the survey area were found to have National Environmental Significance as defined by the Commonwealth EPBC Act. No TEC pursuant to Commonwealth or State legislation were recorded within the survey area. No PEC listed by the DPaW were recorded within the survey area.

The survey area is not located within an ESA listed under the EP Act or Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the EP Regulations. The survey area is not located within any conservation areas/DPaW managed land. The nearest DPaW managed land is the Yeo Lake Nature Reserve, which is listed as a Class A Nature Reserve, located approximately 16km to the east of the survey area. The Yeo Lake Nature Reserve is also listed as an ESA and a Schedule 1 Area.

A map showing the survey area in relation to areas of conservation significance is provided in Appendix 6.

4.6 Vegetation Condition

Based on the vegetation health condition rating scale (Appendix 7) adapted from Keighery, 1994 and Trudgen, 1988 specified in the *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015* (DPaW & EPA, 2015), all six vegetation communities had a ‘3’ health condition rating. This depicts that vegetation structure exhibits some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire or occasional vehicle tracks.

4.7 Introduced Plant Taxa

No introduced taxa were recorded within the survey area.

5 Relevant Legislation and Compliance with Recognised Standards

5.1 Commonwealth Legislation

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The aim of this Act is to protect matters of national environmental significance, and is used by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) to list threatened taxa and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance.

The survey area does not have national environmental significance under the EPBC Act. There are no TEC or Threatened Flora or Fauna as listed under the EPBC Act identified within the survey area.

5.2 State Legislation

5.2.1 Clearing of Native Vegetation

Under Section 51C of the EP Act and the EP Regulations any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the EP Act or under the EP Regulations requires a clearing permit from the DER or DMP. Under Section 51A of the EP Act native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the EP Act defines clearing as "*the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above*".

Exemptions under Schedule 6 of the EP Act and the EP Regulations do not apply for clearing an area exceeding 10ha per tenement; clearing in ESA's as declared under Section 51B of the EP Act or within Schedule 1 Areas as described in Regulation 6 and Schedule 1, clause 4 of the EP Regulations.

The survey area is not located within an ESA or Schedule 1 Area. If development of the camp and airstrip will require >10ha of clearing within the pending miscellaneous licence (L38/254), a clearing permit is required.

5.2.2 Environmental Protection Act WA 1986

This Act pertains to the assessment of applications for clearing permits and aims to protect Declared Rare Flora/Fauna and Threatened Ecological Communities from clearing. Threatened Ecological Communities are protected even where exemptions for a clearing permit may apply. The act enforces both financial and/or imprisonment penalties on those who unlawfully damage a TEC.

The survey area does not contain any TEC or Threatened Flora or Fauna.

5.2.3 Wildlife Conservation Act WA 1950

This Act is used by the Western Australian DPaW to list flora taxa as being protected and the level of protection needed for such flora. Flora taxa are classified as 'Declared Rare Flora' when their populations are geographically restricted or are threatened by local processes. Under this Act all native flora (spermatophytes, Pteridophyta, bryophytes and thallophytes) are protected throughout the State. Financial penalties are enforced under this Act if threatened plant taxa are collected without an appropriate licence.

5.2.4 DPaW Priority lists

The DPaW lists 'Priority' flora and fauna taxa which are under consideration for declaration as Rare Flora or Fauna. Taxa classed as Priority 1-3 are in urgent need of further survey, whereas Priority 4 taxa are considered to have been adequately surveyed but may become vulnerable or rare in future years. Priority 4 taxa are also taxa that have been removed from the threatened taxa list in the past 5 years. Priority 5 taxa are those taxa which are not currently threatened but are subject to a specific conservation program, the cessation of which would result in the taxon likely to become threatened within 5 years The DPaW also lists PECs, which identifies those communities that may need monitoring before possible nomination for TEC status. These priority taxa and communities have no formal legal protection until they are endorsed by the Minister as being Declared Rare Flora and TEC's respectively.

Results of the database searches revealed five Priority Flora within a 40km radius of the survey area, of which three had the potential to occur within the survey area. No Priority Flora/ Fauna or Threatened Flora/ Fauna taxa were identified within the survey area.

5.3 EPA Position Statements

The EPA develops Position Statements to inform the public about environmental issues facing Western Australia, and the plans for the future to ensure protection and ecological sustainability of environmentally important ecosystems. It provides a set of principles to assist the public and decision-makers on their responsibilities for managing land with care. These principles also provide the basis for the Environmental Protection Authority to evaluate and report upon achieving environmental and ecological sustainability, and the protection of natural resources.

5.3.1 Position Statement No. 2

Environmental Protection of Native Vegetation in Western Australia (EPA 2000) outlines EPA policy on the protection of native vegetation in Western Australia, particularly in the agricultural area. It identifies basic elements that the EPA should consider when assessing proposals that impact on biological diversity. These include comparison of all proposal options; avoidance of taxa and community extinctions; an expectation that implementing the proposal will not take a vegetation type below the "threshold level" of 30%; and that proponents should demonstrate that on- and off-site impacts can be managed.

The survey area does not contain any Threatened Flora or TEC suggesting that clearing within the area will meet the EPA standards outlined in Position Statement No. 2. According to DAFWA (2011) the survey area occurs within the pre-European Beard vegetation association *Great Victoria 84* which retains approximately 100% of the original pre-European vegetation extent.

5.3.2 Position Statement No. 3

Terrestrial Biological Surveys as an Element of Biodiversity Protection establishes that the EPA has adopted the definition and principles of biological diversity as defined in the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996), and has stipulated the following requirements:

- The quality of information and scope of field surveys should meet standards, requirements and protocols as determined and published by the EPA; and
- The IBRA regionalisations should be used as the largest unit for Environmental Impact Assessment (EIA) decision-making in relation to the conservation of biodiversity.

Pursuant to the IBRA regionalisation's, 26 bioregions in WA, which are affected by a range of different threatening processes and have varying levels of sensitivity to impact, have been identified. Terrestrial biological surveys should provide sufficient information to address both biodiversity conservation and ecological functional values within the context of proposals and the results of surveys should be publicly available.

The flora survey was planned and implemented as far as practicable according to the *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015* (DPaW & EPA, 2015). Also, the IBRA regionalisations have been used in preparing the report to identify the conservation status of the area and identify the main threats to the biodiversity of plant taxa in the region.

5.4 Native Vegetation Clearing Principles

Based on the outcomes from the survey undertaken, as presented in this report, BC provides the following comments regarding the native vegetation clearing principles (relevant to flora and fauna only) listed under Schedule 5 of the EP Act (Table 19).

Table 19: Assessment of development within the Gruyere Camp and Airstrip survey area against native vegetation clearing principles

Letter	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	Vegetation identified within the survey area is not considered to be of high biological diversity, and is well represented outside of the proposed impact area.	Development within the survey area is unlikely to be at variance to this principle
(b)	Native vegetation should not be cleared it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	No significant fauna habitat identified within the project area. Fauna habitats are well represented outside of the project area.	Development within the survey area is unlikely to be at variance to this principle
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the WC Act 1950 and the EPBC Act 1999 were identified within the survey area	Development within the survey area is unlikely to be at variance to this principle
(d)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of a threatened ecological community (TEC).	No TEC listed under the EPBC Act 1999 or by the DPaW occur within the survey area.	Development within the survey area is unlikely to be at variance to this principle
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	According to DAFWA (2011), the survey area occurs in pre-European Beard vegetation association Great Victoria Desert 84 which retains approximately 100% of the original pre-European vegetation extent.	Development within the survey area is unlikely to be at variance to this principle
(f)	Native vegetation should not be cleared if it is growing, in, or in association with, an environment associated with a watercourse or wetland.	According to the Geoscience Australia GIS database there are no watercourses or wetlands within the survey area. No vegetation associated with a watercourse or wetland were identified within the survey area.	Development within the survey area is unlikely to be at variance to this principle
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	According to DAFWA (2011), the survey area occurs in pre-European Beard vegetation association Great Victoria Desert 84 which retains approximately 100% of the original pre-European vegetation extent. Clearing within this	Development within the survey area is unlikely to be at variance to this principle

Letter	Principle	Assessment	Outcome
		vegetation association is not likely to lead to land degradation issues such as salinity, water logging or acidic soils.	
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The survey area is not located within a conservation area. No PEC as listed by DPaW is located within the survey area. The closest conservation area is the Yeo Lake Nature Reserve (Class A) located approximately 16km east of the survey area.	Development within the survey area is unlikely to be at variance to this principle

6 Conclusions

Six broad vegetation communities were identified within the survey area. These communities comprised of two landform types and two major vegetation groups according to the NVIS definition. The communities were represented by a total 31 Families, 62 Genera and 121 Taxa, (including sub-species and variants).

No Threatened taxa, pursuant to subsection (2) of section 23F of the State WC Act, the Commonwealth EPBC Act and as listed by the DPaW were identified within the survey area. No Priority Flora taxa, as listed by the DPaW, were identified within the survey area.

None of the vegetation communities within the survey area were found to have National Environmental Significance as defined by the Commonwealth EPBC Act. No TEC pursuant to Commonwealth or State legislation were recorded within the survey area. No PEC listed by the DPaW were recorded within the survey area.

The survey area is not located within an ESA listed under the EP Act or Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the EP Regulations. The survey area is not located within any conservation areas/DPaW managed land. The nearest DPaW managed land is the Yeo Lake Nature Reserve, which is listed as a Class A Nature Reserve, located approximately 16km to the east of the survey area.

According to the vegetation health condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (rating 2 'pristine' to rating 7 'completed degraded'), all six vegetation communities had a '3' health condition rating. No introduced taxa were identified within the survey area.

Based on available information and despite the potential presence of some vertebrate and invertebrate species of conservation significance and it has been concluded that none are likely to be significantly impacted on by the proposed camp and airstrip development. This conclusion is primarily based on the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on fauna and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

7 Bibliography

Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishers, Sydney.

Aplin, K. P. and Smith, L.A. (2001). Checklist of the frogs and reptiles of Western Australia, Records of the Western Australian Museum Supplement No. 63, 51-74.

ASRIS (2014), *Atlas of Australian Soils Database,* Australian Soil Resource Information System

Atlas of Living Australia (ALA) (2016). www.ala.org.au Accessed May 2016.

Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.

Barton & Cowan, (2001a), *A Biodiversity Audit of Western Australia's 53 Biogeographical Region in 2001- Great Victoria Desert (GVD1 - Shield Subregion)*, Department of Conservation and Land Management.

BC (2011), *Level 1 Yamarna Proposed Haul Road Flora and Vegetation Survey,* Botanica Consulting

BC (2012), *Level 2 Flora and Vegetation Survey, Yamarna Project,* Botanica Consulting

BC (2014a), *Level 1 Flora and Vegetation Survey, Gruyere Project,* Botanica Consulting

BC (2014b), *Level 1 Flora and Vegetation Survey, Sunrise Dam Gold Mine to Tropicana Gold Mine Gas Pipeline,* Botanica Consulting

BC (2014c), *Level 1 Flora and Vegetation Survey, Miningwal Borefields,* Botanica Consulting

BC (2015a), *Level 2 Flora and Vegetation Survey of the Gruyere Project.* Botanica Consulting

BC (2015b), *Level 1 Flora and Vegetation Survey Proposed Gas Pipeline Routes,* Botanica Consulting

Beard, J.S., (1990), *Plant Life of Western Australia*, Kangaroo Press Pty Ltd, NSW.

Benshemesh, J. (2004). Recovery Plan for Marsupial Moles *Notoryctes typhlops* and *N. caurinus*, 2005-2010. [Online]. Northern Territory Department of Natural Resources, Environment and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/marsupial-moles.html.

BOM, (2016), *Laverton Aero Weather Station (#12305) Rainfall Data 1991-2016*, Bureau of Meteorology

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 8 May 2012. Western Australian Museum.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.

Christidis, L. and Boles, W.E. (2008) Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Melbourne

Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin.

Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.

Corbett, L.K. (1975). Geographical distribution and habitat of the Marsupial Mole, *Notoryctes typhlops*. Australian Mammalogy. 1:375-378.

DAFWA (1994) *Technical Bulletin: An inventory and condition survey of the north-eastern Goldfields Western Australia (No. 87),* Department of Agriculture and Food WA, 1994.

DAFWA (2014), *Soil Landscape System of Western Australia,* Department of Agriculture and Food Western Australia

DAFWA, (2011), *Pre-European Vegetation - Western Australia (NVIS Compliant Version GIS file),* Department of Agriculture and Food Western Australia

DAFWA, (2016), *Declared Organism-database search,* Department of Agriculture and Food Western Australia

Department of Parks and Wildlife (DPaW) (2015). Threatened and Priority Fauna Rankings. 3 November 2015.

Department of the Environment (DotE) (2015). Threatened Species & Ecological Communities Species Profile and Threats Database: *Liopholis kintorei* — Great Desert Skink. Available online: http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=83160. Accessed November 2015.

DotE, (2016a), *Protected Matters Search Tool, Environment Protection and Biodiversity Conservation Act 1999,* Department of the Environment

DotE, (2016b), *National Vegetation Information System (NVIS) Version 4.2*, Department of the Environment

DPaW (2016), *Nature Map Database search*, Department of Parks and Wildlife

DPaW, (2013a), *TEC and PEC search*, Department of Parks and Wildlife

DPaW, (2013b), *Threatened Flora Database search results*, Department of Parks and Wildlife

DPaW/ EPA, (2015), *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015.* Department of Parks and Wildlife & Environmental Protection Authority

Duncan, Anne. & Baker, G. B. & Montgomery, Narelle. & Natural Heritage Trust (Australia) (1999). The action plan for Australian bats / edited by Anne Duncan, G. Barry Baker and Narelle Montgomery; with assistance from Lindy Lumsden *et al*. Natural Heritage Trust, Canberra.

Ecologia (2009a). Tropicana Gold Project. Operational Area Vertebrate Fauna Assessment. Unpublished report for Tropicana Joint Venture. February 2009.

Ecologia (2009b). Tropicana Gold Project. Tropicana-Transline Infrastructure Corridor, Level 1 Fauna Assessment. Unpublished report for Tropicana Joint Venture. July 2009.

Ecologia (2009c). Neale Junction Reserve Fauna Assessment in collaboration with DEC. Unpublished report for Tropicana Joint Venture.

Environmental Protection Authority (EPA) (2004). Guidance for the Assessment of Environmental Factors - Terrestrial fauna surveys for environmental impact assessment in Western Australia. Guidance Statement No 56 EPA, Perth.

EPA, (2000), Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia,* Environmental Protection Authority.

EPA, (2002), Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection,* Environmental Protection Authority.

EPA, (2004), Guidance for the Assessment of Environmental Factors (in accordance with the *Environmental Protection Act 1986*), *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia,* Environmental Protection Authority.

Glauret, L. (1961). A Handbook of the Lizards of Western Australia. Handbook 6, Western Australian Naturalists Club, Perth.

Government of Western Australia (2015). *Wildlife Conservation Act 1950*. Wildlife Conservation (Specially Protected Fauna) Notice 2014. Government Gazette, WA. 9 November 2015.

Hall, N.J., Newbey, K.R., McKenzie, N.L., Keighery, G.J., Rolfe, J.K & Youngson, W. K., (1993), *The Biological survey of the Eastern Goldfields of Western Australia Part 7: Sandstone-Sir Samuel. Laverton-Leonora study area,* West. Aust. Mus. Suppl. **47.**

Harewood G. (2014). Fauna Assessment (Level 1) Gruyere Project. Unpublished report for Gold Road Resources Ltd. July 2014.

Harewood G. (2015a). Southern Marsupial Mole (*Notoryctes typhlops*) – Additional Information on Presence/Absence - Gruyere Project Area. Unpublished letter report for Gold Road Resources Ltd. June 2015.

Harewood G. (2015b). Southern Marsupial Mole (*Notoryctes typhlops*) – Northern Borefield Area. Unpublished letter report for Gold Road Resources Ltd. November 2015.

Harewood G. (2015c). Fauna Assessment (Level 1) Gruyere Borefield Project. Unpublished report for Gold Road Resources Ltd. December 2015.

Harewood G. (2016). Terrestrial Invertebrate Survey – Gruyere Project Area. Unpublished report for Gold Road Resources Ltd. January 2016.

Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) of Yamarna Gold Project (Central Bore, Attila, Alaric, Haul Road and Khan North). Unpublished report for Gold Road Resources. September 2011.

Hart, R.P. and Kitchener, D.J., (1986). First Record of *Sminthopsis psammophila* (Marsupialia: Dasyuridae) from Western Australia. Records of the Western Australian Museum 13(1): 139-144.

Harvey, M. S. (2002). Short-range endemism among the Australian fauna: some examples from non-marine environments. Invertebrate Systematics 16: 555-570.

How, R., Cooper, N.K. and Bannister, J.L. (2001). Checklist of the mammals of Western Australia, Records of the Western Australian Museum Supplement No. 63, 91-98.

Jackson, S. & Groves, C. (2015). Taxonomy of Australian mammals. CSIRO Publishing.

Jacob, A (2014), *Declared Rare and Priority Flora List for Western Australia,* Minister for Environment.

Johnstone, R.E. (2001). Checklist of the birds of Western Australia, Records of the Western Australian Museum Supplement No. 63, 75-90.

Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.

Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.

Judd, S. (2015). Terrestrial Isopod Identification for Dorothy Hills, Yamarna Station. Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

Keighery, B. J., (1994), *Bushland Plant Survey: A guide to plant community survey for the community.* Wildflower Society of Western Australia (Inc.), Nedlands

Keith Lindbeck and Associates (KLA) (2012). Fauna Assessment (Level 2) Yamarna Project. Unpublished report for Gold Road Resources. October 2012.

Kingfisher Environmental Consulting (2014a). Murrin Murrin – Sunrise Dam Infrastructure Corridor Level 1 Fauna Survey. Unpublished report for AngloGold.

Kingfisher Environmental Consulting (2014b). Sunrise Dam – Tropicana Infrastructure Corridor Level 1 Fauna Survey. Unpublished report for AngloGold.

Martnick and Associates Pty Ltd (1996). Environmental Appraisal – Yamarna Gold Project Area. Unpublished report for Zanex NL. January 1996.

Masters, P., Dickman, C. R., and Crowther, M. (2003). Effects of cover reduction on mulgara *Dasycercus cristi*cauda (Marsupialia: Dasyuridae), rodent and invertebrate populations in central Australia: implications for land management. Austral Ecology 28, 658-665.

MBS Environmental (2014). Gruyere Project Desktop Environmental Review and Work Program. Unpublished report for Gold Road Resources. February 2014.

Mc Donald, R.C, Isbell, R.F & Speight, J.G (1998), *Australian Soil and Land Survey Field Handbook* (3rd edn). CSIRO Publishing: Melbourne.

McAlpin, S. (2001). A recovery plan for the Great Desert Skink (*Egernia kintorei*) 2001-2011. Page(s) Jan-24. [Online]. Arid Lands Environment Centre. Arid Lands Environment Centre, Alice Springs. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/recovery/great-desert-skink/index.html.

Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Third Edition, Oxford University Press, Melbourne.

Mitchell, A. & Wilcox, D. G. (1988), *Arid Shrubland Plants of Western Australia,* University of Western Australia Press, Nedlands, WA.

Morcombe, M. (2004). Field Guide to Australian Birds. Steve Parish Publishing, Archerfiled, Queensland.

Muir, B. G., (1977), Biological Survey of the Western Australian Wheatbelt. Pt 2. Vegetation and habitat of the Bendering Reserve. *Rec. West. Aust. Mus*. Suppl. **3**.

Ninox Wildlife Consulting (2009). A Level One Survey of the Vertebrate Fauna, Infrastructure Corridor – Pinjin Option. L 31/57, L 39/185, Pinjin – Tropicana Gold Project. Unpublished report for Tropicana Joint Venture. January 2009.

Pearson, D., P. Davies, N. Carnegie & J. Ward (2001). The Great Desert Skink (*Egernia kintorei*) in western Australia: distribution, reproduction and ethno-zoological observations.:64-68.

Pearson, D.J. and Robinson, A.C. (1990). New records of the Sandhill Dunnart, *Sminthopsis psammophila* (Marsupialia: Dasyuridae) in south and Western Australia. Journal of Australian Mammalogy 13: 57-59.

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.

Phoenix Environmental Sciences (2015a). Identification and assessment of short-range endemism of invertebrates from Yamarna Station, Western Australia. Unpublished report prepared for Rapallo Ltd.

Phoenix Environmental Sciences (2015b). Identification and assessment of short-range endemism of trapdoor spiders from Gruyere Project (Yamarna Station), Western Australia. Unpublished report prepared for Greg Harewood (on behalf of GRRs).

Pizzey, G & Knight, F. (2012). The Field Guide to the Birds of Australia. 9th Edition. Harper Collins, Sydney.

Rapallo Environmental (2015). Fauna Survey of the Gruyere Project Area. Unpublished report for Gold Road Resources Limited. May 2015.

Simpson, K. and Day, N. (2010). Field Guide to the Birds of Australia. Penguin Books, Ringwood.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.

Terrestrial Ecosystems (2011). Level 2 Fauna Risk Assessment for the Granny Deeps Project Area. Unpublished report. February 2011.

Thompson, S & Thompson, G (2006). Reptiles of the Western Australian Goldfields. Published by the Goldfields Environmental Management Group.

Tille, P. (2006) *Soil Landscapes of Western Australia's Rangelands and Arid Interior*, Department of
TJV (2009), *Tropicana Gold Project Public Environmental Review.* Tropicana Joint Venture (Anglo Gold Ashanti Australia and Independence Group NL).

Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.

Van Dyck, S. & Strahan, R. Eds (2008). The Mammals of Australia. Third edition Queensland Museum.

Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.

Volschenk, E. (Scorpion ID) (2012). Yamarna Scorpion Identification Report. Unpublished report for Keith Linbeck and Associates.

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

Volschenk, E. (Scorpion ID) (2015b). Taxonomic and Short-Range Endemism Assessment of Invertebrates Surveyed from Yamarna Station (November 2015). Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

WAHERB, (2016), *Florabase – Information on the Western Australian Flora,* Department of Parks and Wildlife

Wilson, S. and Swan, G. (2013). A Complete Guide to Reptiles of Australia. Third Edition, Reed, New Holland, Sydney.

Appendix 1: DPaW's NatureMap Database and DotE Protected matters search tool (DPaW, 2016; DotE, 2016a)

NatureMap Species Report

Created By Guest user on 05/05/2016

Current Names Only
Core Datasets Only
Method
Centre
Buffer
Group By
Yes
Yes
'By Circle'
123° 48' 27'' E,28° 01' 41'' S
40km
Kingdom
Kingdom Species Records
Animalia 234 8026
Plantae 207 332
TOTAL 441 8358

Animalia

1. 24559 *Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*
2. 24260 *Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*
3. 24261 *Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*
4. 24264 *Acanthiza robustirostris (Slaty-backed Thornbill)*
5. 24265 *Acanthiza uropygialis (Chestnut-rumped Thornbill)*
6. *Acariformes sp.*
7. 25535 *Accipiter cirrocephalus (Collared Sparrowhawk)*
8. 25536 *Accipiter fasciatus (Brown Goshawk)*
9. *Acrophylla nubilosa*
10. 25544 *Aegotheles cristatus (Australian Owlet-nightjar)*
11. 30833 *Amphibolurus longirostris (Long-nosed Dragon)*
12. 25647 *Amytornis striatus (Striated Grasswren)*
13. 25319 *Antaresia stimsoni subsp. orientalis (Stimson's Python)*
14. 24561 *Anthochaera carunculata (Red Wattlebird)*
15. 25528 *Aphelocephala leucopsis (Southern Whiteface)*
16. 24285 *Aquila audax (Wedge-tailed Eagle)*
17. 24610 *Ardeotis australis (Australian Bustard)*
18. *Argiope protensa*
19. 25566 *Artamus cinereus (Black-faced Woodswallow)*
20. 24356 *Artamus personatus (Masked Woodswallow)*
21. *Asadipus auld*
22. *Austracantha minax*
23. *Austrogymnocnemia bipunctata*
24. *Backobourkia collina*
25. *Backobourkia heroine*
26. *Barnardius zonarius*
27. 42374 *Brachyurophis fasciolatus subsp. fasciatus (Narrow-banded Shovel-nosed Snake)*
28. 42381 *Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*
29. 42307 *Cacomantis pallidus (Pallid Cuckoo)*
30. *Calomyrmex sp.*
31. *Camponotus perjurus*
32. *Camponotus sp.*
33. *Cardiocondyla nuda*
34. *Cavasteron crassicalcar*
35. *Cerapachys sp.*
36. 24086 *Cercartetus concinnus (Western Pygmy-possum, Mundarda)*
37. *Cheramoeca leucosterna*
38. 25580 *Cinclosoma castaneothorax (Chestnut-breasted Quail-thrush)*
39. 42311 *Cinclosoma marginatum (Western Quail-thrush)*
40. 25675 *Colluricincla harmonica (Grey Shrike-thrush)*
41. 24361 *Coracina maxima (Ground Cuckoo-shrike)*
42. 25568 *Coracina novaehollandiae (Black-faced Cuckoo-shrike)*
43. 24416 *Corvus bennetti (Little Crow)*
44. 25593 *Corvus orru (Torresian Crow)*
45. *Corvus sp.*
46. 24420 *Cracticus nigrogularis (Pied Butcherbird)*
47. 25595 *Cracticus tibicen (Australian Magpie)*
48. 25596 *Cracticus torquatus (Grey Butcherbird)*
49. 25458 *Ctenophorus caudicinctus (Ring-tailed Dragon)*
50. 24867 *Ctenophorus caudicinctus subsp. infans (Ring-tailed Dragon)*
51. 24868 *Ctenophorus clayi (Collared Dragon)*
52. 24873 *Ctenophorus fordi (Mallee Sand Dragon)*
53. 25459 *Ctenophorus isolepis (Crested Dragon, Military Dragon)*
54. 24875 *Ctenophorus isolepis subsp. gularis (Central Military Dragon)*
55. 24882 *Ctenophorus nuchalis (Central Netted Dragon)*
56. 24884 *Ctenophorus pictus (Painted Dragon)*
57. 24886 *Ctenophorus reticulatus (Western Netted Dragon)*
58. 24889 *Ctenophorus scutulatus (Lozenge-marked Dragon)*
59. *Ctenophorus sp.*
60. 25025 *Ctenotus ariadnae*
61. 25461 *Ctenotus brooksi*
62. 25032 *Ctenotus calurus*
63. 25037 *Ctenotus dux*
64. 25041 *Ctenotus grandis subsp. grandis*
65. 25042 *Ctenotus greeri*
66. 25044 *Ctenotus hanloni*
67. 25045 *Ctenotus helenae*
68. 25050 *Ctenotus leae*
69. 25052 *Ctenotus leonhardii*
70. 25057 *Ctenotus nasutus*
71. 25463 *Ctenotus pantherinus (Leopard Ctenotus)*
72. 25064 *Ctenotus pantherinus subsp. ocellifer (Leopard Ctenotus)*
73. 25062 *Ctenotus piankai*
74. 25066 *Ctenotus quattuordecimlineatus*
75. 25074 *Ctenotus schomburgkii*
76. 25090 *Cyclodomorphus melanops subsp. melanops (Slender Blue-tongue)*
77. 25375 *Cyclorana maini (Sheep Frog)*
78. *Cyclorana sp.*
79. 30903 *Dasycercus blythi (Brush-tailed Mulgara, Ampurta)* P4
80. 24997 *Delma butleri*
81. 25001 *Delma nasuta*
82. 25247 *Demansia psammophis subsp. psammophis (Yellow-faced Whipsnake)*
83. *Dingosa humphreysi*
84. 24926 *Diplodactylus conspicillatus (Fat-tailed Gecko)*

85. 24940 *Diplodactylus pulcher*
86. 42401 *Diporiphora paraconvergens (Grey-striped Western Desert Dragon)*
87. *Drepanotermes columellaris*
88. *Drepanotermes diversicolor*
89. *Drepanotermes gayi*
90. 24470 *Dromaius novaehollandiae (Emu)*
91. *Eolophus roseicapillus*
92. 24570 *Epthianura tricolor (Crimson Chat)*
93. 24258 *Equus caballus (Horse)* Y
94. 25109 *Eremiascincus richardsonii (Broad-banded Sand Swimmer)*
95. *Eretes australis*
96. *Ethmostigmus curtipes*
97. 25621 *Falco berigora (Brown Falcon)*
98. 25622 *Falco cenchroides (Australian Kestrel)*
99. 25623 *Falco longipennis (Australian Hobby)*
100. 25624 *Falco peregrinus (Peregrine Falcon)* S
101. 24957 *Gehyra purpurascens*
102. 24959 *Gehyra variegata*
103. 24401 *Geopelia cuneata (Diamond Dove)*
104. 24443 *Grallina cyanoleuca (Magpie-lark)*
105. 24961 *Heteronotia binoei (Bynoe's Gecko)*
106. 24491 *Hirundo neoxena (Welcome Swallow)*
107. *Hoggicosa alfi*
108. *Hoggicosa bicolor*
109. *Hoggicosa forresti*
110. *Holconia nigrigularis*
111. *Iridomyrmex chasei*
112. *Iridomyrmex difficilis*
113. *Iridomyrmex discors*
114. *Iridomyrmex hartmeyeri*
115. *Iridomyrmex purpureus*
116. *Iridomyrmex roseatus*
117. *Iridomyrmex sp.*
118. *Isopedella saundersi*
119. *Isopedella tindalei*
120. *Lamponina elongata*
121. *Lamponina scutata*
122. 25125 *Lerista bipes*
123. 25130 *Lerista desertorum*
124. *Lerista sp.*
125. 25005 *Lialis burtonis*
126. 41411 *Liopholis inornata (Desert Skink)*
127. 41417 *Liopholis striata (Night Skink)*
128. 41420 *Lucasium bungabinna (Southern Sand Plain Gecko)*
129. 30938 *Lucasium damaeum*
130. 30933 *Lucasium stenodactylum*
131. *Lycosa australicola*
132. *Lycosa woonda*
133. 25651 *Malurus lamberti (Variegated Fairy-wren)*
134. 25652 *Malurus leucopterus (White-winged Fairy-wren)*
135. *Manorina (Myzantha) flavigula*
136. 24583 *Manorina flavigula (Yellow-throated Miner)*
137. *Masasteron piankai*
138. *Melophorus sp.*
139. 24736 *Melopsittacus undulatus (Budgerigar)*
140. 25184 *Menetia greyii*
141. *Meranoplus sp.*
142. *Merimma atrata*
143. 25693 *Microeca fascinans (Jacky Winter)*
144. *Minasteron minusculum*
145. 24904 *Moloch horridus (Thorny Devil)*
146. *Molycria vokes*
147. *Monomorium sp.*
148. 25190 *Morethia butleri*
149. 25495 *Morethia ruficauda*
150. 24223 *Mus musculus (House Mouse)* Y
151. 25248 *Neelaps bimaculatus (Black-naped Snake)*
152. 25422 *Neobatrachus aquilonius (Northern Burrowing Frog)*
153. 25425 *Neobatrachus kunapalari (Kunapalari Frog)*
154. 42303 *Neobatrachus sudellae (Desert Trilling Frog)*
155. 25427 *Neobatrachus sutor (Shoemaker Frog)*
156. 24740 *Neophema splendida (Scarlet-chested Parrot)*
157. *Neostenus sp.*
158. *Nephila edulis*
159. 24966 *Nephrurus laevissimus*
160. 24971 *Nephrurus vertebralis*
161. 24094 *Ningaui ridei (Wongai Ningaui)*
162. 25748 *Ninox novaeseelandiae (Boobook Owl)*
163. 25430 *Notaden nichollsi (Desert Spadefoot)*
164. 24224 *Notomys alexis (Spinifex Hopping-mouse)*
165. 24229 *Notomys mitchellii (Mitchell's Hopping-mouse)*
166. 24407 *Ocyphaps lophotes (Crested Pigeon)*
167. *Odontomachus ruficeps*
168. *Odontomachus sp.*
169. 24618 *Oreoica gutturalis (Crested Bellbird)*
170. 24085 *Oryctolagus cuniculus (Rabbit)* Y
171. 25680 *Pachycephala rufiventris (Rufous Whistler)*
172. 25254 *Parasuta monachus*
173. 24627 *Pardalotus rubricatus (Red-browed Pardalote)*
174. 25682 *Pardalotus striatus (Striated Pardalote)*
175. 24630 *Pardalotus striatus subsp. westraliensis (Striated Pardalote)*
176. *Pediana horni*
177. 24659 *Petroica goodenovii (Red-capped Robin)*
178. 24409 *Phaps chalcoptera (Common Bronzewing)*
179. 25703 *Podargus strigoides (Tawny Frogmouth)*
180. *Podomyrma sp.*
181. 25510 *Pogona minor (Dwarf Bearded Dragon)*
182. 24907 *Pogona minor subsp. minor (Dwarf Bearded Dragon)*
183. *Polyrhachis sp.*
184. 24683 *Pomatostomus superciliosus (White-browed Babbler)*
185. 24103 *Pseudantechinus macdonnellensis (Fat-tailed Pseudantechinus)*
186. 25261 *Pseudechis australis (Mulga Snake)*
187. 24235 *Pseudomys desertor (Desert Mouse)*
188. 24237 *Pseudomys hermannsburgensis (Sandy Inland Mouse)*
189. 42416 *Pseudonaja mengdeni (Western Brown Snake)*
190. 25263 *Pseudonaja modesta (Ringed Brown Snake)*
191. 42342 *Ptilotula plumulus (Grey-fronted Honeyeater)*
192. 42344 *Purnella albifrons (White-fronted Honeyeater)*
193. 25009 *Pygopus nigriceps*
194. 24278 *Pyrrholaemus brunneus (Redthroat)*
195. 24243 *Rattus fuscipes (Western Bush Rat)*
196. 25614 *Rhipidura leucophrys (Willie Wagtail)*
197. 24982 *Rhynchoedura ornata (Western Beaked Gecko)*
198. *Rhytidoponera sp.*

199. 25305 *Simoselaps anomalus (Desert Banded Snake)*
200. 25266 *Simoselaps bertholdi (Jan's Banded Snake)*
201. 30948 *Smicrornis brevirostris (Weebill)*
202. 24109 *Sminthopsis dolichura (Little long-tailed Dunnart)*
203. 24114 *Sminthopsis hirtipes (Hairy-footed Dunnart)*
204. 24116 *Sminthopsis macroura (Stripe-faced Dunnart)*
205. 24117 *Sminthopsis ooldea (Ooldea Dunnart)*
206. *Storena sinuosa*
207. 25597 *Strepera versicolor (Grey Currawong)*
208. 24924 *Strophurus ciliaris subsp. aberrans*
209. 24927 *Strophurus elderi*
210. 24931 *Strophurus intermedius*
211. 24946 *Strophurus strophurus*
212. 25269 *Suta fasciata (Rosen's Snake)*
213. *Synothele meadhunteri*
214. 30870 *Taeniopygia guttata (Zebra Finch)*
215. *Tamopsis marri*
216. *Thereuopoda lesueurii*
217. 25202 *Tiliqua multifasciata (Central Blue-tongue)*
218. 25203 *Tiliqua occipitalis (Western Bluetongue)*
219. *Trichocyclus arabana*
220. *Tumulitermes tumuli*
221. 24851 *Turnix velox (Little Button-quail)*
222. 30814 *Tympanocryptis cephalus (Pebble Dragon)*
223. *Urodacus hoplurus*
224. 25210 *Varanus brevicauda (Short-tailed Pygmy Monitor)*
225. 25211 *Varanus caudolineatus*
226. 25212 *Varanus eremius (Pygmy Desert Monitor)*
227. 25216 *Varanus giganteus (Perentie)*
228. 25215 *Varanus gilleni (Pygmy Mulga Monitor)*
229. 25218 *Varanus gouldii (Bungarra or Sand Monitor)*
230. 25526 *Varanus tristis (Racehorse Monitor)*
231. *Venator yalkara*
232. *Wandella stuartensis* Y
233. *Wydundra kennedy*
234. *Wydundra uluru*

Plantae

235. *Abutilon sp.*
236. 3194 *Acacia abrupta*
237. 3217 *Acacia aneura (Mulga, Wanari)*
238. 3248 *Acacia burkittii (Sandhill Wattle)*
239. 3264 *Acacia colletioides (Wait-a-while)*
240. 3330 *Acacia exocarpoides*
241. 3393 *Acacia jennerae*
242. 3399 *Acacia kempeana (Witchetty Bush, Ilykuwara)*
243. 3475 *Acacia pachyacra*
244. 36800 *Acacia pteraneura*
245. 3507 *Acacia quadrimarginea*
246. 19483 *Acacia ramulosa var. linophylla*
247. 19499 *Acacia ramulosa var. ramulosa*
248. 3522 *Acacia rigens (Nealie)*
249. 3544 *Acacia sibilans*
250. 3545 *Acacia sibina*
251. 3577 *Acacia tetragonophylla (Kurara, Wakalpuka)*
252. 19901 *Actinobole oldfieldianum*
253. 11730 *Alectryon oleifolius subsp. canescens*
254. 1730 *Allocasuarina helmsii*
255. *Allocasuarina sp.*
256. 4907 *Alyogyne pinoniana (Sand Hibiscus)*
257. 13702 *Alyogyne pinoniana var. pinoniana*
258. 2383 *Amyema preissii (Wireleaf Mistletoe)*
259. 2333 *Anthobolus leptomerioides*
260. 2468 *Atriplex nana*
261. 2481 *Atriplex vesicaria (Bladder Saltbush)*
262. 17246 *Austrostipa nitida*
263. 2770 *Boerhavia coccinea (Tar Vine, Wituka)*
264. *Bryum dichotomum*
265. 8466 *Callitris columellaris (White Cypress Pine)*
266. 7895 *Calocephalus multiflorus (Yellow-top)*
267. 7905 *Calotis multicaulis (Many-stemmed Burr-daisy)*
268. 5488 *Calytrix warburtonensis* P2
269. 1742 *Casuarina obesa (Swamp Sheoak, Kuli)*
270. 12658 *Casuarina pauper (Black Oak)*
271. 7922 *Cephalipterum drummondii (Pompom Head)*
272. 32 *Cheilanthes brownii*
273. 12815 *Cheilanthes sieberi subsp. pseudovellea*
274. 7933 *Chthonocephalus pseudevax (Woolly Groundheads)*
275. 4565 *Comesperma viscidulum (Viscid Milkwort)* P4
276. 1884 *Conospermum toddii (Victoria Desert Smokebush)* P4
277. 11709 *Crassula colorata var. acuminata*
278. 3010 *Cuphonotus andraeanus*
279. 290 *Dactyloctenium radulans (Button Grass)*
280. 6218 *Daucus glochidiatus (Australian Carrot)*
281. 17733 *Daviesia ulicifolia subsp. aridicola*
282. 6758 *Dicrastylis exsuccosa*
283. 310 *Digitaria brownii (Cotton Panic Grass)*
284. 4779 *Dodonaea rigida*
285. 2501 *Dysphania glomulifera*
286. 33479 *Dysphania melanocarpa (Black Crumbweed)*
287. 2507 *Dysphania simulans*
288. 378 *Eragrostis dielsii (Mallee Lovegrass)*
289. 380 *Eragrostis eriopoda (Woollybutt Grass, Wangurnu)*
290. 381 *Eragrostis falcata (Sickle Lovegrass)*
291. 386 *Eragrostis laniflora (Hairy-flowered Woollybutt)*
292. *Eragrostis sp.*
293. 7178 *Eremophila abietina (Spotted Poverty Bush)* Y
294. 17584 *Eremophila abietina subsp. ciliata*
295. 7205 *Eremophila exilifolia*
296. 15052 *Eremophila forrestii subsp. forrestii*
297. 29532 *Eremophila galeata*
298. 7211 *Eremophila georgei*
299. 16732 *Eremophila gilesii subsp. gilesii*
300. 14340 *Eremophila glabra subsp. glabra*
301. 7221 *Eremophila homoplastica*
302. 7234 *Eremophila longifolia (Berrigan, Tulypurpa)*
303. 15003 *Eremophila oldfieldii subsp. angustifolia*
304. 18570 *Eremophila oppositifolia subsp. angustifolia*
305. 15054 *Eremophila platythamnos subsp. exotrachys*
306. 7267 *Eremophila scoparia (Broom Bush ()*
307. 7269 *Eremophila serrulata (Serrate-leaved Eremophila)*
308. 408 *Eriachne flaccida (Claypan Grass)*
309. 2514 *Eriochiton sclerolaenoides (Woolly Bindii)*
310. 35345 *Eucalyptus camaldulensis subsp. obtusa (Blunt-budded River Red Gum)*

311. 5583 *Eucalyptus carnei (Carne's Blackbutt)*
312. 5592 *Eucalyptus clelandii (Cleland's Blackbutt)*
313. 5595 *Eucalyptus comitae-vallis (Comet Vale Mallee)*
314. 5596 *Eucalyptus concinna (Victoria Desert Mallee)*
315. 5636 *Eucalyptus eremicola*
316. 20300 *Eucalyptus eremicola subsp. peeneri*
317. 5641 *Eucalyptus ewartiana (Ewart's Mallee)*
318. 13533 *Eucalyptus glomerosa (Jinjulu)*
319. 5660 *Eucalyptus gongylocarpa (Marble Gum, Baarla)*
320. 13058 *Eucalyptus leptopoda subsp. elevata*
321. 5703 *Eucalyptus lucasii (Barlee Box)*
322. 5761 *Eucalyptus rigidula (Stiff-leaved Mallee)*
323. 5773 *Eucalyptus socialis (Red Mallee, Altarpa)*
324. *Eucalyptus sp.*
325. 15595 *Eucalyptus sublucida*
326. 29733 *Eucalyptus trivalva (Victoria Spring Mallee)*
327. 11011 *Eulalia aurea*
328. 851 *Fimbristylis dichotoma (Eight Day Grass)*
329. *Frankenia sp.*
330. 6143 *Glischrocaryon aureum (Common Popflower)*
331. 8002 *Gnephosis tenuissima*
332. 32472 *Goniomitrium acuminatum subsp. enerve*
333. 12530 *Goodenia macroplectra*
334. 1946 *Grevillea acacioides*
335. 19543 *Grevillea nematophylla subsp. planicosta*
336. 2077 *Grevillea pterosperma*
337. 2092 *Grevillea secunda* P4
338. 19137 *Hakea lorea subsp. lorea*
339. 6687 *Halgania cyanea (Rough Halgania)*
340. 29840 *Halgania cyanea var. Allambi Stn (B.W. Strong 676)*
341. 31117 *Halgania cyanea var. Charleville (R.W. Purdie +111)*
342. *Halgania cyanea var. Charleville (R.W.Purdie+ 111)*
343. 17491 *Halgania cyanea var. cyanea*
344. 6180 *Haloragis trigonocarpa*
345. 6712 *Heliotropium heteranthum*
346. 8045 *Helipterum craspedioides (Yellow Billy Buttons)*
347. 5815 *Homalocalyx thryptomenoides*
348. 459 *Iseilema eremaeum*
349. 7397 *Isotoma petraea (Rock Isotome, Tundiwari)*
350. 14779 *Jacksonia arida*
351. 12059 *Jasminum didymum subsp. lineare (Desert Jasmine)*
352. 19636 *Keraudrenia velutina subsp. elliptica*
353. *Lachnostachys sp.*
354. 5846 *Lamarchea sulcata*
355. 13289 *Lawrencella davenportii*
356. 4955 *Lawrencia glomerata*
357. 19727 *Leiocarpa semicalva subsp. semicalva*
358. 3037 *Lepidium phlebopetalum (Veined Peppercress)*
359. 19126 *Leptochloa fusca subsp. muelleri*
360. 4055 *Leptosema chambersii*
361. 14541 *Lomandra leucocephala subsp. robusta (Woolly Mat-rush)*
362. 12051 *Lysiana exocarpi subsp. exocarpi (Harlequin Mistletoe)*
363. 2398 *Lysiana murrayi (Mistletoe, Parka-Parka)*
364. *Lysiana sp.*
365. 2533 *Maireana amoena*
366. 2538 *Maireana carnosa (Cottony Bluebush)*
367. 2555 *Maireana pentatropis*
368. 2557 *Maireana platycarpa (Shy Bluebush)*
369. 2560 *Maireana pyramidata (Sago Bush)*
370. 11662 *Maireana tomentosa subsp. tomentosa*
371. 2568 *Maireana trichoptera (Downy Bluebush)*
372. 5908 *Melaleuca eleuterostachya*
373. 3053 *Menkea sphaerocarpa*
374. 5997 *Micromyrtus hymenonema*
375. 2842 *Mollugo cerviana*
376. 4110 *Muelleranthus stipularis*
377. 6791 *Newcastelia hexarrhena (Lambs' Tails)*
378. 11734 *Nicotiana rosulata subsp. rosulata*
379. 17 *Ophioglossum lusitanicum (Adders Tongue)*
380. 514 *Paractaenum refractum*
381. 518 *Paspalidium clementii (Clements Paspalidium)*
382. 19744 *Pittosporum angustifolium*
383. 8167 *Pluchea dentex*
384. 8173 *Podolepis capillaris (Wiry Podolepis)*
385. *Podolepis jaceoides*
386. 29098 *Poranthera leiosperma*
387. 12702 *Prostanthera sericea*
388. 2690 *Ptilotus aervoides*
389. 2708 *Ptilotus chamaecladus*
390. 2730 *Ptilotus helichrysoides*
391. 41001 *Ptilotus nobilis subsp. nobilis (Yellow Tails)*
392. 2747 *Ptilotus obovatus (Cotton Bush)*
393. 41000 *Ptilotus sp. Goldfields (R. Davis 10796)*
394. 4161 *Ptychosema pusillum (Dwarf Pea)* T
395. 13308 *Rhodanthe charsleyae*
396. 13241 *Rhodanthe chlorocephala subsp. rosea*
397. 13242 *Rhodanthe chlorocephala subsp. splendida*
398. 13300 *Rhodanthe citrina*
399. 13301 *Rhodanthe floribunda*
400. 13246 *Rhodanthe humboldtiana*
401. 13251 *Rhodanthe propinqua*
402. 13252 *Rhodanthe pygmaea*
403. 45178 *Roebuckiella similis*
404. 8198 *Rutidosis helichrysoides (Grey Wrinklewort)*
405. 13006 *Sarcostemma viminale subsp. australe*
406. *Scaevola sp.*
407. 2602 *Sclerolaena convexula*
408. 2612 *Sclerolaena eurotioides (Fluffy Bindii)*
409. 2613 *Sclerolaena fimbriolata*
410. 2626 *Sclerolaena parviflora (Small-flower Saltbush)*
411. 2627 *Sclerolaena patenticuspis (Spear-fruit Saltbush)*
412. 29941 *Sclerolaena x georgei* Y
413. 8207 *Senecio glossanthus (Slender Groundsel)*
414. 8217 *Senecio quadridentatus*
415. 17558 *Senna artemisioides subsp. x artemisioides*
416. 4732 *Stackhousia megaloptera*
417. *Stackhousia muricata subsp. Annual (W.R.Barker 2172)*
418. 3074 *Stenopetalum anfractum*
419. 3082 *Stenopetalum velutinum (Velvet Thread Petal)*
420. 12355 *Swainsona affinis*
421. 12356 *Swainsona formosa*
422. 4231 *Swainsona kingii*
423. 13585 *Swainsona tenuis*
424. 33319 *Tecticornia indica subsp. bidens*

425. 31618 *Tecticornia pruinosa*
426. 1338 *Thysanotus manglesianus (Fringed Lily)*
427. 29457 *Thysanotus sp. Eremaean (S. van Leeuwen 1067)*
428. 6279 *Trachymene ornata (Spongefruit)*
429. 678 *Tragus australianus (Small Burrgrass)*
430. 17885 *Triodia bromoides* P4
431. 17873 *Triodia schinzii*
432. 705 *Tripogon loliiformis (Five Minute Grass)*
433. 7661 *Velleia hispida (Hispid Velleia)*
434. 7664 *Velleia rosea (Pink Velleia)*
435. *Wahlenbergia sp.*
436. 8275 *Waitzia acuminata (Orange Immortelle)*
437. 9247 *Westringia rigida (Stiff Westringia)*
438. 20183 *Zygophyllum aurantiacum subsp. aurantiacum*
439. 4388 *Zygophyllum compressum*
440. 18140 *Zygophyllum eichleri*
441. 4389 *Zygophyllum eremaeum*

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines,
forms and application process details.

Other Matters Protected by the EPBC Act

Acknowledgements

Buffer: 40.0Km

Matters of NES

Report created: 05/05/16 17:23:08

Coordinates

Caveat

Extra Information

Details

Summary

Summary

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

Matters of National Environmental Significance

World Heritage Properties: None

National Heritage Places: None

Wetlands of International Importance: None

Great Barrier Reef Marine Park: None

Commonwealth Marine Area: None

Listed Threatened Ecological Communities: None
Listed Threatened Species: 5
Listed Migratory Species: 6

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at
http://www.environment.gov.au/heritage
This part of the report summarises other matters protected under the Act that may relate to the area you nominated.
Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.
A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Other Matters Protected by the EPBC Act

Commonwealth Land: None
Commonwealth Heritage Places: None
Listed Marine Species: 6
Whales and Other Cetaceans: None
Critical Habitats: None
Commonwealth Reserves Terrestrial: None
Commonwealth Reserves Marine: None

Extra Information

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

State and Territory Reserves: 1
Regional Forest Agreements: None
Invasive Species: 6
Nationally Important Wetlands: 1
Key Ecological Features (Marine) None

Details

Listed Threatened Species

Name Status Type of Presence
Birds

Malleefowl [934] Vulnerable Species or species habitat likely to occur within area
Leipoa ocellata

Night Parrot [59350] Endangered Species or species habitat may occur within area
Pezoporus occidentalis

Princess Parrot, Alexandra's Parrot [758] Vulnerable Species or species habitat may occur within area
Polytelis alexandrae

Mammals
Sandhill Dunnart [291] Endangered Species or species habitat likely to occur within area
Sminthopsis psammophila

Reptiles
Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160] Vulnerable Species or species habitat may occur within area
Liopholis kintorei

Listed Migratory Species

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.
Name Threatened Type of Presence
Migratory Marine Birds
Fork-tailed Swift [678] Species or species habitat likely to occur within area
Apus pacificus

Migratory Terrestrial Species
Rainbow Bee-eater [670] Species or species habitat may occur within area
Merops ornatus

Grey Wagtail [642] Species or species habitat may occur within area
Motacilla cinerea

Yellow Wagtail [644] Species or species habitat may occur within area
Motacilla flava

Migratory Wetlands Species
Great Egret, White Egret [59541] Species or species habitat likely to occur within area
Ardea alba

Matters of National Environmental Significance

Name Threatened Type of Presence
Oriental Plover, Oriental Dotterel [882] Species or species habitat may occur within area
Charadrius veredus

Listed Marine Species

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

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

Great Egret, White Egret [59541] Species or species habitat likely to occur within area
Ardea alba

Oriental Plover, Oriental Dotterel [882] Species or species habitat may occur within area
Charadrius veredus

Rainbow Bee-eater [670] Species or species habitat may occur within area
Merops ornatus

Grey Wagtail [642] Species or species habitat may occur within area
Motacilla cinerea

Yellow Wagtail [644] Species or species habitat may occur within area
Motacilla flava

Other Matters Protected by the EPBC Act

State and Territory Reserves

Name State
Yeo Lake WA

Nationally Important Wetlands

Name State
Yeo Lake/Lake Throssell WA

Extra Information

Invasive Species

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

Name Status Type of Presence
Mammals
Dromedary, Camel [7] Species or species habitat
likely to occur within area
Camelus dromedarius
Goat [2] Species or species habitat
likely to occur within area
Capra hircus
Cat, House Cat, Domestic Cat [19] Species or species habitat
likely to occur within area
Felis catus
House Mouse [120] Species or species habitat
likely to occur within area
Mus musculus
Rabbit, European Rabbit [128] Species or species habitat
likely to occur within area
Oryctolagus cuniculus
Red Fox, Fox [18] Species or species habitat
likely to occur within area
Vulpes vulpes

- non-threatened seabirds which have only been mapped for recorded breeding sites
- migratory species that are very widespread, vagrant, or only occur in small numbers
- some species and ecological communities that have only recently been listed

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only.

Where available data supports mapping, the type of presence that can be determined from the data is indicated in general
terms. People using this information in making a referral may need to consider the qualifications below and may need to seek
and consider other information sources.

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

- seals which have only been mapped for breeding sites near the Australian continent

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed
habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For
species whose distributions are less well known, point locations are collated from government wildlife authorities, museums,
and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some
cases, the distribution maps are based solely on expert knowledge.

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

Caveat

- migratory and

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

- marine

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

- threatened species listed as extinct or considered as vagrants
- some terrestrial species that overfly the Commonwealth marine area

The following groups have been mapped, but may not cover the complete distribution of the species:
Only selected species covered by the following provisions of the EPBC Act have been mapped:
-28.02847 123.80793

Coordinates

-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Department of Parks and Wildlife, Western Australia

Acknowledgements

-Office of Environment and Heritage, New South Wales
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Environment and Primary Industries, Victoria
-Australian National Wildlife Collection
-Department of Environment, Water and Natural Resources, South Australia
This database has been compiled from a range of data sources. The department acknowledges the following
custodians who have contributed valuable data and advice:
-Australian Museum
-National Herbarium of NSW
Forestry Corporation, NSW
-Australian Government, Department of Defence
-State Herbarium of South Australia
The Department is extremely grateful to the many organisations and individuals who provided expert advice
and information on numerous draft distributions.
-Natural history museums of Australia
-Queensland Museum
-Australian National Herbarium, Atherton and Canberra
-Royal Botanic Gardens and National Herbarium of Victoria
-Geoscience Australia
-Ocean Biogeographic Information System
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-Western Australian Herbarium
-Tasmanian Herbarium
-Northern Territory Herbarium
-South Australian Museum
-Museum Victoria

-University of New England
-CSIRO

Appendix 2: DPaW Threatened Flora, Nature Map and Protected Matters Database results within 40km

Taxon	Conservation Code	Description (WAHERB, 2016)
Calytrix warburtonensis	P2	Shrub, 0.3-0.6 m high. Fl. white, Mar or Sep to Oct. Rocky hills, breakaways.
Comesperma viscidulum	P4	Shrub, to ca 0.7 m high.
Conospermum toddii	P4	Spreading shrub, 1.2-2 m high. Fl. white/white-yellow, Jul to Oct. Yellow sand. Sand dunes.
Grevillea secunda	P4	Low spreading shrub, 0.3-0.8 m high. Fl. red, Sep to Oct. Yellow or red sand. Sand dunes, sandplains.
Sauropus sp. Woolgorong ((M. Officer s.n. 10/8/94)	P3	Slender, much-branched shrub, to 0.3 m high.

Appendix 3: Muir Life Form/Height Class (Muir, 1977).

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70% -100%	**MID-DENSE 30% -70%**	**SPARSE 10% -30%**	**VERY SPARSE 2% -10%**
Trees > 30m Trees 15 – 30m Trees 5 – 15m Trees < 5m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
Mallee Tree Form Mallee Shrub Form	Dense Tree Mallee Dense Shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
Shrubs > 2m Shrubs 1.5 – 2m Shrubs 1 – 1.5m Shrubs 0.5 – 1m Shrubs 0 – 0.5m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath B Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
Mat Plants Hummock Grass Bunch grass >0.5m Bunch grass < 0.5m Herbaceous spp.	Dense Mat Plants Dense Hummock Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants Mid-dense Hummock Grass Tall Grass Low Grass Herbs	Open Mat Plants Hummock Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hummock Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
Sedges > 0.5m Sedges < 0.5m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low Sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
Ferns Mosses, liverworts	Dense ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

Appendix 4: List of species identified within each vegetation community of the Gruyere Camp and Airstrip survey area

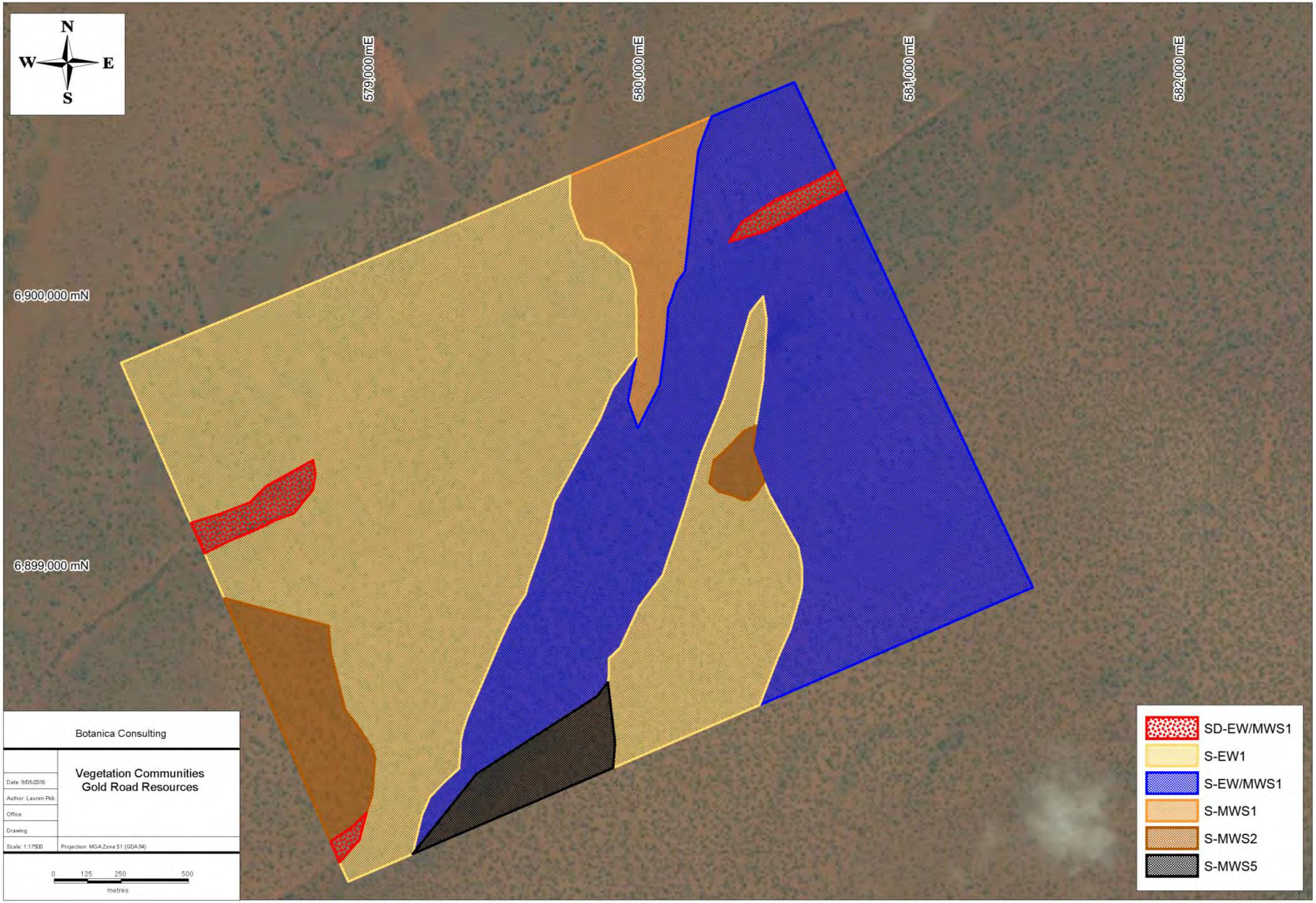
(A) Denotes Annual species as listed on Florabase (WAHERB, 2016)

			Sand Dune	Sandplain				
Family	**Genus**	**Taxon**	**SD-EW/MWS1**	**S-EW1**	**S-EW/MWS1**	**S-MWS1**	**S-MWS2**	**S-MWS5**
Amaranthaceae	*Ptilotus*	*aervoides* (A)						*
Amaranthaceae	*Ptilotus*	*nobilis*						*
Amaranthaceae	*Ptilotus*	*obovatus*	*			*		*
Amaranthaceae	*Ptilotus*	*polystachyus* (A)			*			*
Amaranthaceae	*Ptilotus*	sp. (sterile)				*		
Apocynaceae	*Marsdenia*	*australis* (A)					*	*
Asparagaceae	*Lomandra*	*leucocephala* subsp. *robusta*	*					
Asteraceae	*Chrysocephalum*	*puteale*	*					
Asteraceae	*Rhodanthe*	*chlorocephala* subsp. *splendida* (A)	*				*	
Boraginaceae	*Halgania*	*cyanea* var. Allambi Stn (B.W. Strong 676)		*	*			
Boraginaceae	*Halgania*	*cyanea* var. *charleville*				*	*	
Boraginaceae	*Halgania*	*integerrima*		*	*			
Boraginaceae	*Trichodesma*	*zeylanicum* (A)	*					
Boraginaceae	*Trichodesma*	*zeylanicum* (A)	*					
Celastraceae	*Stackhousia*	*muricata* subsp. annual (W.R. Barker 2172) (A)	*					
Chenopodiaceae	*Dysphania*	*kalpari* (A)			*			
Chenopodiaceae	*Enchylaena*	*tomentosa*						*
Chenopodiaceae	*Maireana*	*thesioides*					*	
Chenopodiaceae	*Rhagodia*	*eremaeum*						*
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *preissii*		*	*			
Chenopodiaceae	*Sclerolaena*	*diacantha*	*					
Colchicaceae	*Wurmbea*	*deserticola*		*	*	*		
Convolvulaceae	*Bonamia*	*erecta*		*	*			
Cupressaceae	*Callitris*	*preissii*	*	*	*			
Ericaceae	*Leucopogon*	*?cuneifolius*		*	*			
Euphorbiaceae	*Euphorbia*	*drummondii* (A)	*					
Euphorbiaceae	*Euphorbia*	*tannensis* (A)	*					
Fabaceae	*Acacia*	*abrupta*		*	*	*	*	
Fabaceae	*Acacia*	*aptaneura*		*			*	
Fabaceae	*Acacia*	*caesaneura*		*	*	*	*	*
Fabaceae	*Acacia*	*craspedocarpa*			*			
Fabaceae	*Acacia*	*cuthbertsonii*						*
Fabaceae	*Acacia*	*desertorum*		*	*	*		
Fabaceae	*Acacia*	*incurvaneura*		*	*	*	*	*
Fabaceae	*Acacia*	*jennerae*		*	*			
Fabaceae	*Acacia*	*ligulata*	*	*	*	*	*	*
Fabaceae	*Acacia*	*murrayana*	*		*			
Fabaceae	*Acacia*	*pachyacra*			*	*		*
Fabaceae	*Acacia*	*quadrimarginea*	*					
Fabaceae	*Acacia*	*ramulosa* var. *ramulosa*						*
Fabaceae	*Acacia*	*tetragonophylla*				*	*	*
Fabaceae	*Daviesia*	*purpurascens*	*					
Fabaceae	*Daviesia*	*ulicifolia*	*					
Fabaceae	*Leptosema*	*chambersii*		*	*	*	*	
Fabaceae	*Senna*	*artemisioides* subsp. *filifolia*	*	*	*	*	*	*
Fabaceae	*Senna*	*artemisioides* subsp. x *artemisioides*				*		*
Fabaceae	*Senna*	*cardiosperma*						*

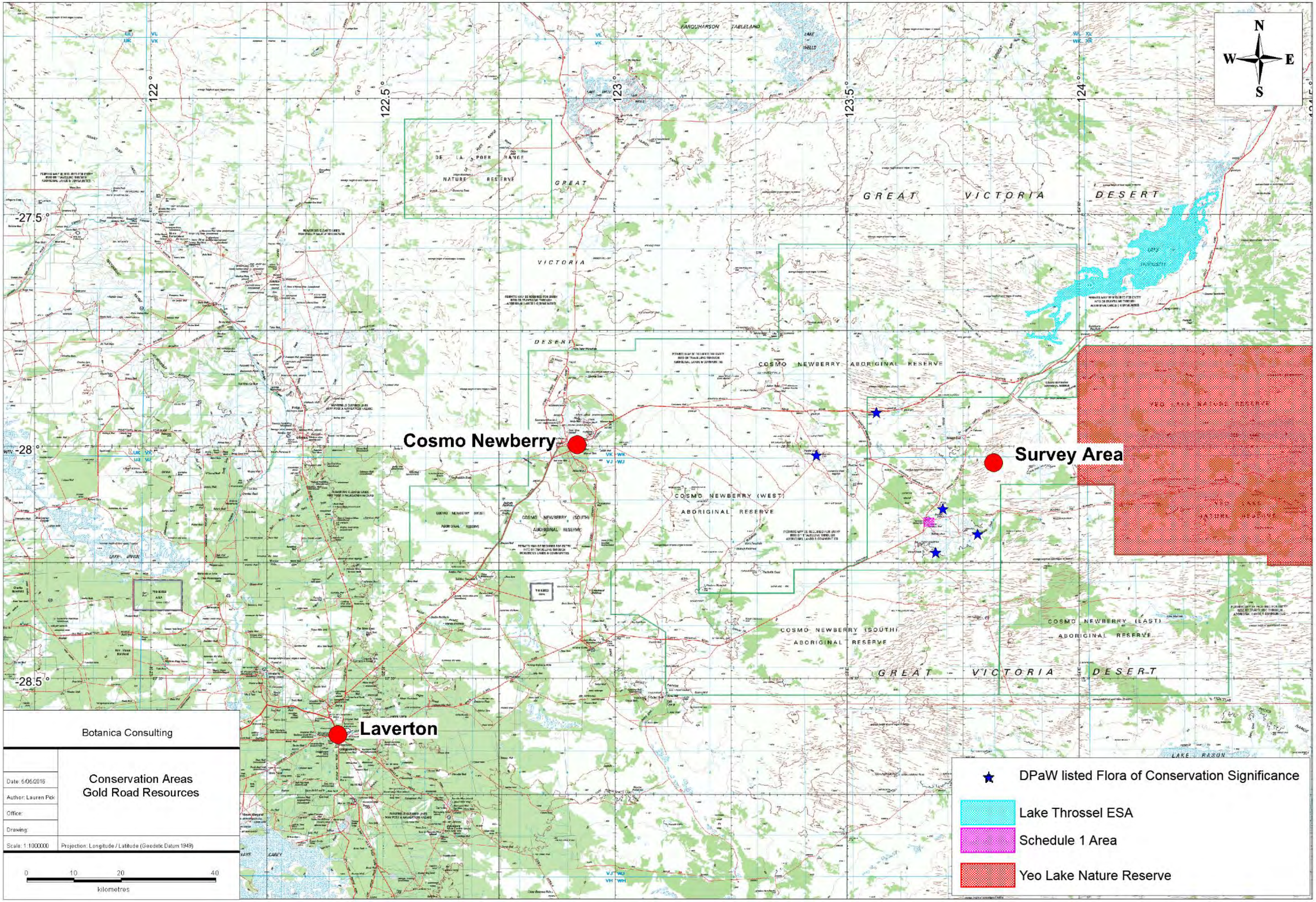
			Sand Dune	Sandplain				
Family	**Genus**	**Taxon**	**SD-EW/MWS1**	**S-EW1**	**S-EW/MWS1**	**S-MWS1**	**S-MWS2**	**S-MWS5**
Goodeniaceae	*Brunonia*	*australis* (A)				*	*	
Goodeniaceae	*Goodenia*	*centralis (A)*				*	*	
Goodeniaceae	*Goodenia*	*ramelii*	*					
Goodeniaceae	*Goodenia*	*xanthosperma*		*	*			
Goodeniaceae	*Scaevola*	*basedowii*	*		*			
Goodeniaceae	*Scaevola*	*parvifolia*		*	*			
Goodeniaceae	*Scaevola*	*spinescens*		*				*
Gyrostemonaceae	*Gyrostemon*	*ramulosus*	*		*			
Haloragaceae	*Glischrocaryon*	*aureum*		*	*			
Haloragaceae	*Haloragis*	*odontocarpa*(A)	*				*	*
Hemerocallidaceae	*Corynotheca*	*micrantha* var. *divaricata*	*					
Lamiaceae	*Dicrastylis*	*doranii*		*	*			
Lamiaceae	*Dicrastylis*	*sessilifolia*		*	*			
Lamiaceae	*Microcorys*	*macrediana*			*			
Lamiaceae	*Prostanthera*	*wilkieana*						*
Lamiaceae	*Spartothamnella*	*teucriiflora*		*			*	*
Loranthaceae	*Amyema*	*miquelii*		*	*			
Malvaceae	*Abutilon*	*otocarpum*	*					
Malvaceae	*Alyogyne*	*pinoniana*	*	*	*			*
Malvaceae	*Androcalva*	*loxophylla*				*		
Malvaceae	*Androcalva*	*luteiflora*				*		
Malvaceae	*Commersonia*	*craurophylla*				*		
Malvaceae	*Hibiscus*	*burtonii*		*	*			
Malvaceae	*Keraudrenia*	*prorepens*				*	*	
Malvaceae	*Keraudrenia*	*velutina*	*		*	*	*	
Malvaceae	*Sida*	*calyxhymenia*		*	*			
Malvaceae	*Sida*	sp. Excedentifolia (J.L. Egan 1925)				*	*	*
Myrtaceae	*Aluta*	*maisonneuvei* subsp. *auriculata*	*	*	*	*	*	
Myrtaceae	*Eucalyptus*	*concinna*						*
Myrtaceae	*Eucalyptus*	*eremicola*						*
Myrtaceae	*Eucalyptus*	*glomerosa*	*	*	*			
Myrtaceae	*Eucalyptus*	*gongylocarpa*	*	*	*	*		
Myrtaceae	*Eucalyptus*	*leptopoda* subsp. *elevata*	*					
Myrtaceae	*Eucalyptus*	*mannensis*						*
Myrtaceae	*Eucalyptus*	*rigidula*	*					
Myrtaceae	*Eucalyptus*	*trivalva*		*	*			
Myrtaceae	*Eucalyptus*	*youngiana*	*	*	*	*	*	
Myrtaceae	*Micromyrtus*	*flaviflora*		*	*	*	*	
Oleaceae	*Jasminum*	*didymum* subsp. *lineare*	*	*	*		*	
Pittosporaceae	*Pittosporum*	*angustifolium*	*		*			*
Poaceae	*Aristida*	*contorta* (A)	*					*
Poaceae	*Aristida*	*holathera* (A)	*		*			
Poaceae	*Enneapogon*	*caerulescens*	*					
Poaceae	*Eragrostis*	*eriopoda*	*	*		*	*	*
Poaceae	*Monachather*	*paradoxus*	*					
Poaceae	*Triodia*	*basedowii*	*	*	*	*	*	*
Poaceae	*Triodia*	*irritans*	*	*	*	*	*	*
Proteaceae	*Grevillea*	*acacioides*	*			*	*	
Proteaceae	*Grevillea*	*juncifolia* subsp. *juncifolia*	*		*			*
Proteaceae	*Grevillea*	*pterosperma*	*	*	*			
Proteaceae	*Hakea*	*francisiana*	*	*	*			
Proteaceae	*Hakea*	*lorea*				*	*	
Pteridaceae	*Cheilanthes*	*sieberi* subsp. *sieberi*					*	
Santalaceae	*Exocarpos*	*aphyllus*			*			
Santalaceae	*Exocarpos*	*sparteus*	*	*	*	*	*	
Sapindaceae	*Dodonaea*	*lobulata*						*

			Sand Dune	Sandplain				
Family	Genus	Taxon	SD-EW/MWS1	S-EW1	S-EW/MWS1	S-MWS1	S-MWS2	S-MWS5
Sapindaceae	*Dodonaea*	*viscosa* subsp. *angustissima*	*					
Scrophulariaceae	*Eremophila*	*clarkei*	*					*
Scrophulariaceae	*Eremophila*	*exilifolia*	*					
Scrophulariaceae	*Eremophila*	*forrestii* subsp. *forrestii*	*	*	*	*		*
Scrophulariaceae	*Eremophila*	*gilesii*					*	
Scrophulariaceae	*Eremophila*	*glabra*			*	*		*
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *glabra*	*			*	*	
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *latrobei*		*				
Scrophulariaceae	*Eremophila*	*longifolia*				*		
Scrophulariaceae	*Eremophila*	*platythamnos* subsp. *platythamnos*	*	*	*			*
Solanaceae	*Anthotroche*	*pannosa*	*	*	*			
Solanaceae	*Duboisia*	*hopwoodii*	*					
Solanaceae	*Nicotiana*	*rosulata* subsp. *rosulata* (A)					*	
Solanaceae	*Solanum*	*centrale*		*	*	*	*	
Solanaceae	*Solanum*	*lasiophyllum*	*	*	*	*	*	*
Solanaceae	*Solanum*	*orbiculatum*				*	*	
Solanaceae	*Solanum*	*plicatile*				*		
Zygophyllaceae	*Zygophyllum*	*eremaeum* (A)	*					

Appendix 5: Vegetation map of the Gruyere Camp and Airstrip survey area



Appendix 6: Regional map of the Gruyere Camp and Airstrip survey area including areas of conservation significance



Appendix 7: Vegetation Health Condition Scale adapted from Keighery 1994 and Trudgen 1988 (DPaW/ EPA, 2015)

Vegetation Condition Rating	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
1	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	N/A
2	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
3	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
5	N/A	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
6	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
7	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Appendix 8: Fauna Recorded or Potentially in Region of Survey Area

APPENDIX 6: LEVEL 1 FLORA AND FAUNA SURVEY OF GRUYERE BOREFIELDS (BOTANICA 2016B)

Level 1 Flora & Fauna Survey
Gruyere Borefields

Prepared For
Gold Road Resources Limited

September 2016
Version 2

Prepared by:
Botanica Consulting
PO Box 2027
Boulder WA 6432
90930024

Disclaimer

Quality Assurance

An internal quality review process has been implemented to each project task undertaken by BC. Each document and its contents is carefully reviewed by core members of the Consultancy team and signed off at Director Level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

Document Job Number:	2016/67
Prepared by:	Pat Harton Environmental Consultant Botanica Consulting Lauren Pick Environmental Consultant Botanica Consulting
Reviewed by:	Andrea Williams Director Botanica Consulting
Approved by:	Jim Williams Director Botanica Consulting

Contents

Appendices

Tables

Figures

Plates

Glossary

Acronym	Description
BA	Birdlife Australia (Formerly RAOU, Birds Australia).
BAM Act	*Biosecurity and Agriculture Management Act 2007*, WA Government.
BC	Botanica Consulting.
BC Bill	*Biodiversity Conservation Bill (2015)*. WA Government.
BOM	Bureau of Meteorology.
CALM	Department of Conservation and Land Management (now DPaW), WA Government.
CAMBA	China Australia Migratory Bird Agreement 1998.
DAFWA	Department of Agriculture and Food, WA Government.
DEC	Department of Environment and Conservation (now DPaW), WA Government.
DEH	Department of Environment and Heritage (now DoE), Australian Government.
DEP	Department of Environment Protection (now DER), WA Government.
DEWHA	Department of the Environment, Water, Heritage and the Arts (now DotE), Australian Government

Acronym	Description
DER	Department of Environment Regulation (formerly DEC, DoE), WA Government.
DMP	Department of Mines and Petroleum (formerly DoIR), WA Government.
DoE	Department of Environment (now DER/DPaW), WA Government.
DoIR	Department of Industry and Resources (now DMP), WA Government.
DotE	Department of the Environment (formerly DSEWPaC, DEWHA, and DEH), Australian Government.
DPaW	Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DotE, formerly DEH, DEWHA), Australian Government.
EP Act	*Environmental Protection Act 1986*, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*, Australian Government.
ESA	Environmentally Sensitive Area.
GDE	Groundwater Dependent Ecosystem
GRR	Gold Road Resources Limited.
Ha	Hectare (10,000 square metres).
IBRA	Interim Biogeographic Regionalisation for Australia.
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
JAMBA	Japan Australia Migratory Bird Agreement 1981.
Km	Kilometre (1,000 metres).
MVG	Major Vegetation Groups.
NVIS	National Vegetation Information System.
OEPA	Office of the Environmental Protection Authority, WA Government.
PEC	Priority Ecological Community.
RAOU	Royal Australia Ornithologist Union.
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement 2007.
SRE	Short Range Endemic.
SSC	Species Survival Commission, International.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.
WAM	Western Australian Museum, WA Government.
WC Act	*Wildlife Conservation Act 1950*, WA Government.

Executive Summary

BC was commissioned by GRR to undertake a Level 1 flora and fauna survey of the Gruyere Borefields (referred to as the 'survey area'). The survey area consists of two main Borefields (Yeo Borefield and Anne Beadell Borefield) and associated access tracks and pipeline corridors. The survey covered a total area of approximately 15,200 ha. The Gruyere Borefields is located approximately 66km east of Cosmo Newberry and 135km north-east of Laverton. The initial field surveys (covering an area of 5,983 ha) were conducted from the 8th to 10th November 2015 and the 15th to the 21th of November 2015. Additional surveys of the Yeo Borefield (covering an area of 9,217 ha) were conducted from the 20th to the 22nd April 2016. In September 2016, following determination of the development envelope for the Gruyere Borefields (covering an area of approximately 14,020 ha), additional surveys were conducted from 1st to 3rd September 2016 in areas of the development envelope not previously surveyed. The total area of the Gruyere Borefields surveyed was 21,340 ha.

Forty-three broad vegetation communities were identified within the survey area, thirty-nine of which are located within the proposed development envelope. These communities comprised of seven landform types and nine major vegetation groups according to the NVIS definition. The communities were represented by a total 42 Families, 112 Genera and 269 Taxa, (including sub-species and variants). The broad scale terrestrial fauna habitats within the survey area have been identified as:

- **Clay-Loam Plains**
  Acacia Forests and Woodlands, *Acacia* Shrublands, Mallee Open Woodlands and Sparse Mallee Shrublands

- **Closed Depressions**
  Acacia Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands, Chenopod Shrublands, Samphire Shrublands and Forblands.

- **Drainage Depressions**
  Acacia Forests and Woodlands, *Acacia* Open Woodlands, Mallee Woodlands and Shrublands.

- **Quartz/Rocky Plains**
  Acacia Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands.

- **Sand Dunes**
  Eucalypt Woodlands, Mallee Woodlands and Shrublands.

- **Sand-Loam Plains**
  Acacia Forests and Woodlands, Regrowth, modified native vegetation.

- **Sandplains**
  Acacia Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands, Regrowth, modified native vegetation.

With respect to native vertebrate fauna, 28 mammals (including eight bat species), 103 bird, 105 reptile and nine frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise at times, the survey area. A total of 56 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the survey area over the three-day survey period. Observations of four introduced species using the survey area were also gathered.

No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the WC Act and the Commonwealth EPBC Act were identified within the survey area/ development envelope. No Priority Flora taxa as listed by DPaW were identified within the survey area/ development envelope.

Two vertebrate fauna species of conservation significance (listed under State or Federal threatened/migratory species lists or as a DPaW priority species) were positively identified as utilising the study area for some purpose during the survey period, this being:

1. Rainbow Bee-eater *Merops ornatus* – Migratory (*EPBC Act*), S5 (*WC Act*)
2. Southern Marsupial Mole *Notoryctes typhlops* –P4 (DPaW Priority Species)

The current status on site and/or in the general area of some other species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, six additional species of conservation significance can be regarded as possibly utilising the survey area/ development envelope for some purpose at times, these being:

1. Buff-snouted Blind Snake *Anilios margaretae* – P2 (DPaW Priority Species)
2. Malleefowl *Leipoa ocellata* – S3 (*WC Act*), Vulnerable (*EPBC Act*)
3. Peregrine Falcon *Falco peregrinus* – S7 (*WC Act*)
4. Princess Parrot *Polytelis alexandrae* – Vulnerable (*EPBC Act*), P4 (DPaW Priority Species)
5. Striated Grasswren (sand plain) *Amytornis striatus striatus* - P4 (DPaW Priority Species)
6. Brush-tailed Mulgara *Dasycercus blythi* - P4 (DPaW Priority Species)

None of the vegetation communities/ habitats within the survey area were found to have National Environmental Significance as defined by the Commonwealth EPBC Act. No TEC pursuant to Commonwealth or State legislation were recorded within the survey area. The survey area is not located within an ESA as listed under the EP Act, or Schedule 1 Areas. The survey area is not located within a listed or proposed conservation area managed by DPaW. The nearest DPaW managed land is the Yeo Lake Nature Reserve, which is listed as a "Class A" Nature Reserve, located approximately 700m east of the survey area.

Based on field observations and analysis of hydrological information from within the survey area, two vegetation communities are potential GDE:

1. Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa (CD-AFW2); and
2. Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1).

Only one of these potential GDE communities is located within the proposed development envelope; DD-MWS1.

Based on the vegetation health condition scale adapted from Keighery, 1994 and Trudgen, 1988 (rating 1 'pristine' to rating 7 'completed degraded'), twenty-nine vegetation communities had a '2' health condition rating. The remaining fourteen vegetation communities had a '3' health condition rating. One introduced flora taxon; *Cenchrus ciliaris* (Buffel Grass), was identified within the survey area. According to the DAFWA it is not listed as a Declared Plant under Section 22 of the BAM Act. Evdience of four introduced fauna taxa were observed during the survey.

1 Introduction

1.1 Project Description

BC was commissioned by GRR to undertake a Level 1 flora and fauna survey of the Gruyere Borefields survey area (survey area). The Gruyere Borefields is located approximately 66km east of Cosmo Newberry and 135km north-east of Laverton (Figure 1). The survey area consists of two main Borefields (Yeo Borefield and Anne Beadell Borefield) and associated access tracks and pipeline corridors. The survey covered a total area of approximately 15,200 ha. The initial field surveys (covering an area of 5,983 ha) were conducted from the 8th to 10th November 2015 and the 15th to the 21st of November 2015. Additional surveys of the Yeo Borefield (covering an area of 9,217 ha) were conducted from the 20th to the 22nd April 2016. In September 2016, following determination of the development envelope for the Gruyere Borefields (covering an area of approximately 14,020 ha), additional surveys were conducted from 1st to 3rd September 2016. The total area of the Gruyere Borefields surveyed was 21,340 ha.

The aim of the survey was to identify fauna habitats, produce a vegetation map and species list as well as to document and map locations of any Threatened Ecological Communities (TEC), Priority Ecological Communities (PEC) and Threatened/ Priority Flora and Fauna species within the survey area.

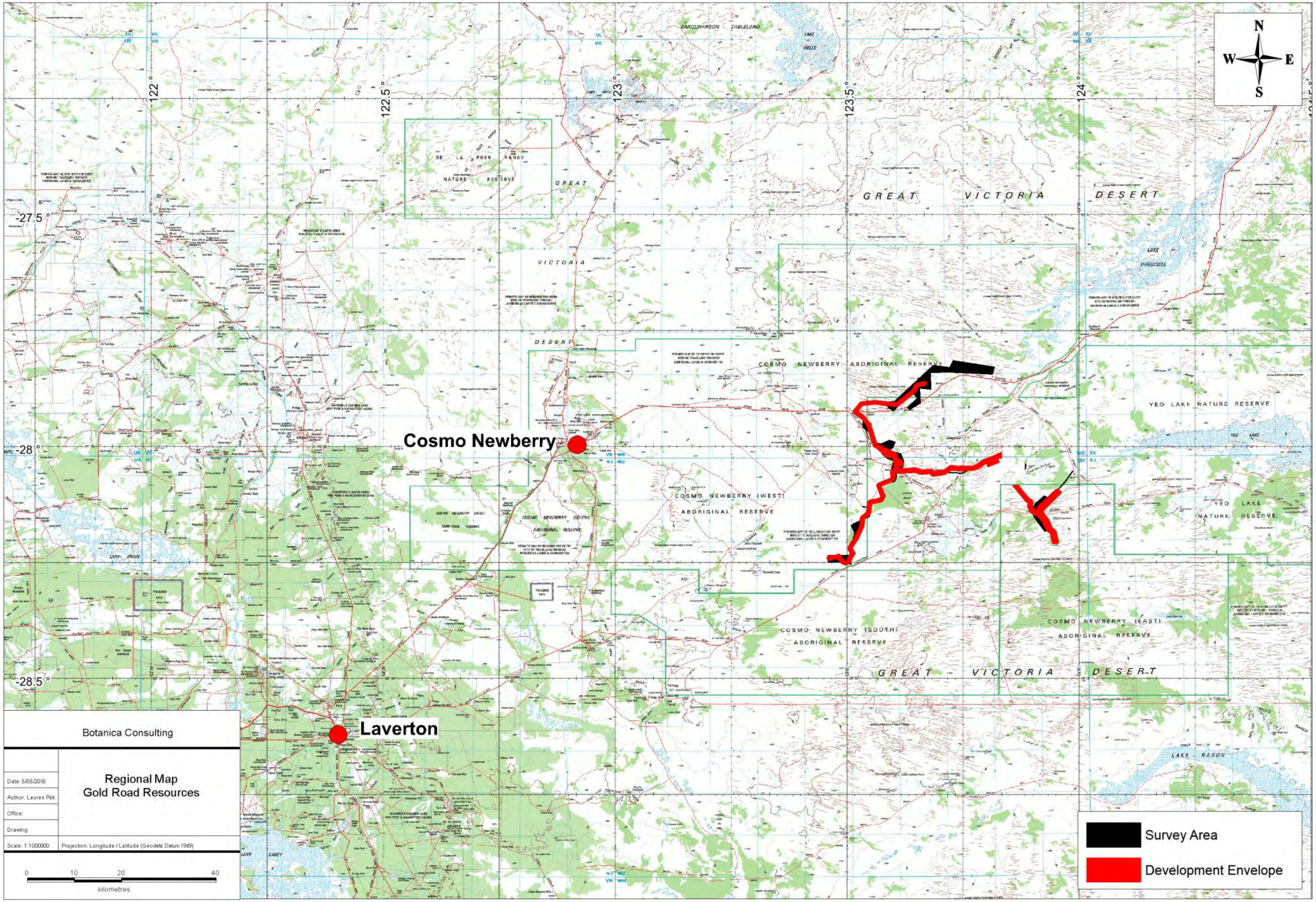


Figure 1: Regional map of the Gruyere Borefields survey area

2 Regional Biophysical Environment

2.1 Regional Environment

The survey area lies within the Austin Botanical District and Helms Botanical District of the Eremaean Province of WA. The Austin Botanical District consists of predominantly of Mulga low woodland on plains and reduces to scrub on hills (Beard, 1990). The Helms Botanical District is described as Mulga low woodland on hardpan soils between dunes. Where this is not prominent tree steppes of *Eucalyptus gongylocarpa, E. youngiana* and *Triodia basedowii* occur (Beard, 1990).

Based on the Interim Biogeographic Regionalisation of Australia (IBRA) the Eremaean Province is divided into IBRA regions with the survey area located within the Great Victoria Desert bioregion of Western Australia. The Great Victoria Desert bioregion is further divided into six subregions, Shield, Central, Maralinga, Kintore, Tallaringa and Yellaringa. The survey area is located within the Shield (GVD1 4,741,854 hectares) and Central (GVD2 12,590,867 hectares) of the Great Victoria Desert bioregion (Barton & Cowan, 2001a; Barton & Cowan, 2001b) (Figure 2).

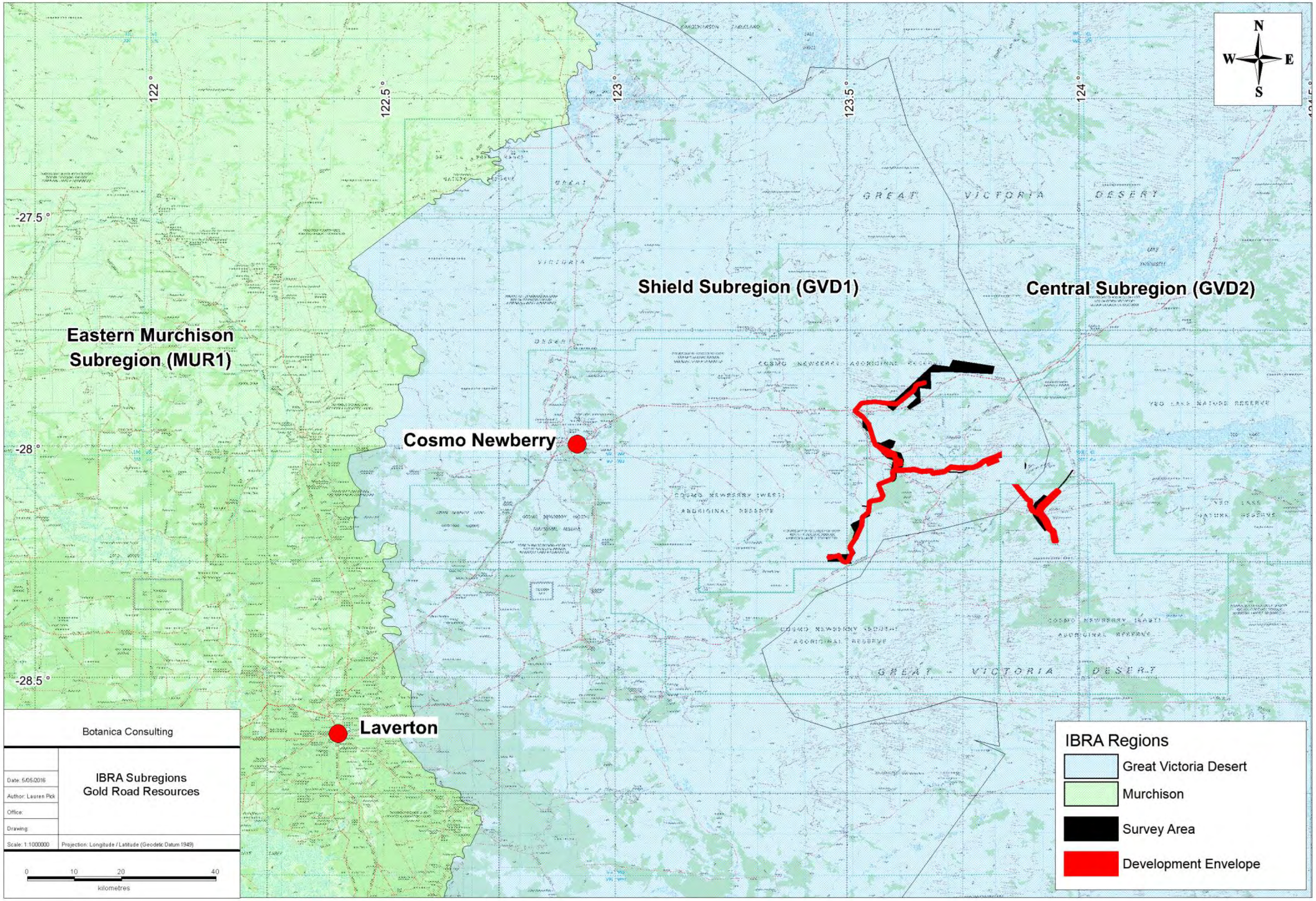


Figure 2: Map of IBRA subregions in the vicinity of the Gruyere Borefields survey area

2.2 Vegetation

Vegetation of the Great Victoria Desert and the Helms Botanical District (as described by Beard, 1990) comprises a mosaic of tree and shrub steppe between sand hills and on sandplains, consisting of Marble gum, mallee and spinifex (*Eucalyptus gongylocarpa, E. youngiana, Triodia basedowii*). Beard states that dunes in the west are rather thinner, few and weak. *E. gongylocarpa* is comparatively scarce with *E. youngiana* replaced by *E. kingsmillii* and *Acacia aneura* and *A. linophylla* becoming frequent on the sandplain (Beard, 1990; Cowan, 2001).

The DAFWA GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation associations Great Victoria Desert 18, 24, 45, 84, 85, 239, 676 and 1239 (Figure 3). The extent of these associations as described by the DAFWA is shown in Table 1.

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered “endangered”. Development within the survey area will not significantly reduce the extent of these vegetation associations.

Table 1: Remaining Beard Vegetation Associations within Western Australia (DAFWA, 2011)

Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Pre-European extent remaining (%)	% of Current extent within DPaW managed lands	Vegetation Description (Beard, 1990)
Great Victoria Desert 18	497636.98	497636.98	100	0.24	Low woodland; mulga (*Acacia aneura*)
Great Victoria Desert 24	21669.70	21669.70	100.00	0	Low woodland; *Allocasuarina cristata*
Great Victoria Desert 45	10.77	10.77	100	0	Shrublands; mallee scrub (Great Victoria Desert)
Great Victoria Desert 84	876295.94	876295.94	100	15.16	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*Eucalyptus youngiana*) over hard spinifex *Triodia basedowii* between sandhills
Great Victoria Desert 85	788407.28	788407.28	100	8.56	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*Eucalyptus youngiana*) over hard spinifex on sandplain
Great Victoria Desert 239	122137.73	122137.73	100	0	Hummock grasslands, open medium tree & mallee steppe; marble gum (*E. gongylocarpa* & mallee (*Eucalyptus youngiana*) over hard spinifex *Triodia basedowii* between sandhills
Great Victoria Desert 676	40329.39	40329.39	100	0	Succulent steppe; samphire
Great Victoria Desert 1239	1393810.04	1393810.04	100	2.46	Hummock grasslands, open medium tree & mallee steppe; marble gum & mallee (*E. youngiana*) over hard spinifex *Triodia basedowii* on sandplain

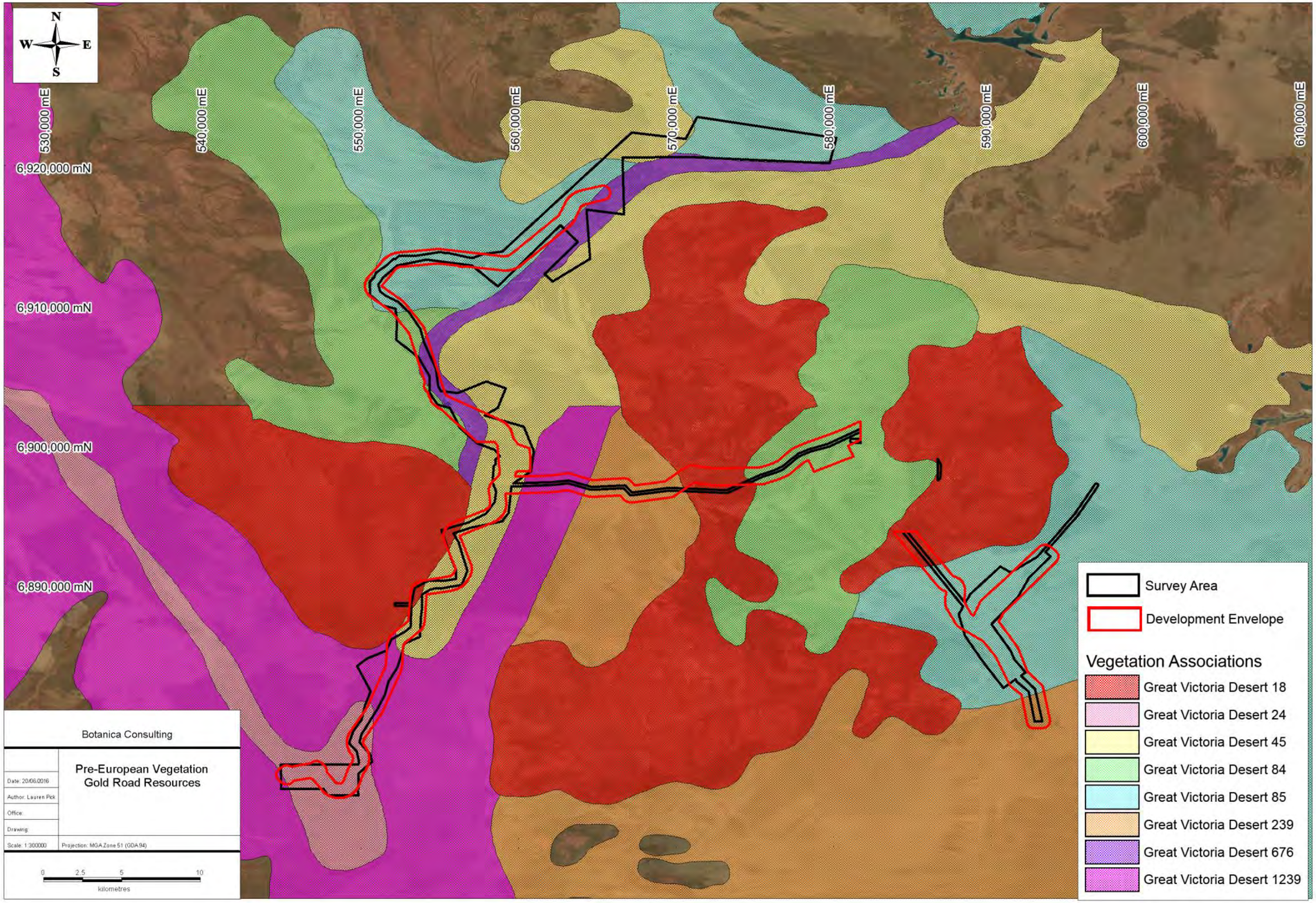


Figure 3: Map of Pre-European Vegetation Associations within the Gruyere Borefields survey area

2.3 Topography & Soils

The Great Victoria Desert bioregion forms the southern part of the anti-clockwise whorl of dune fields of Australia. The dominating landforms are dunes and swales. There are local occurrences of playa lakes, associated lee-sided mounds (lunettes) and rocky prominences (Commonwealth Government, 2008b). Playa lakes are a minor, but locally significant landform in the desert, occurring in topographically low-lying regions and many represent the dried remnants of former drainage channels (Shephard, 1995). It consists of active sand-ridge desert of deep Quaternary (less than 65 million years ago) Aeolian sands overlying Permian (251 – 298 million years ago) and Mesozoic (65 - 251 million years ago) units of the Office Basin (Commonwealth Government, 2008b). The GVD is underlain on its eastern, western and northern margins by an ancient crystalline basement comprising rocks at least 1000 million years old (Shephard, 1995).

The western end of the Shield subregion is underlain by the Yilgarn Craton. Here there is a higher proportion of sandplains in comparison to the entire bioregion. To the east is an arid active sand-ridge desert of deep Quaternary Aeolian sands overlying Permian and Mesozoic strata of the Officer Basin. Landforms consist of salt lakes and major valley floors with lake derived dunes. The sandplains occur with patches of seif dunes running east-west and areas of moderate relief without-cropping and silcrete-capped mesas and plateaus (breakaways). The subregion contains a major paleo channel of Ponton Creek (Cowan, 2001).

The Central subregion is characterised as an arid active sand-ridge desert with extensive dune fields of deep Quaternary aeolian sands overlying Permian strata of the Gunbarrel Basin. Landforms consist of salt lakes and major valley floors with lake derived dunes. Sand plains with extensive seif dunes running east-west, with occasional outcropping (breakaways) and quartzite hills provide minor relief (Barton & Cowan, 2001).

Based on geographic information provided by DAFWA (2014), the survey area is located within the North-western Great Victoria Desert Zone 122 of the Gunbarrel Province 12 and the Leemans Sandplain Zone 274 of the Murchison Province 27. The North-western Great Victoria Desert Zone is characterised by sandplains and dunes (with some undulating plains and uplands) on sedimentary rocks of the Gunbarrel Basin. Soils are comprised of red sandy earths and red deep sands with some red loamy earths and red-brown hardpan shallow loams. Vegetation is predominately mulga shrublands and spinifex grasslands with mallee. The zone is located in the southern Arid Interior sitting between Lake Carnegie, Rason Lake and Warburton.

The Leemans Sandplain Zone is characterised by sandplains (with some gravel plains, mesas and salt lakes) on granitic rocks of the Yilgarn Craton (Eastern Goldfields Super terrane). Soils are comprised of red sandy earths with red loamy earths and some red deep sands, red-brown hardpan shallow loams and Calcareous loamy earths. Vegetation is predominately spinifex grasslands with marble gum, mallee and mulga shrublands (and some halophytic shrublands). The zone is located in the south-western arid interior between Lakes Wells and Minigwal (to the east of Laverton). These zones are further divided into systems, which are displayed below in Table 2 and Figure 4.

Table 2: Soil Landscape Systems within the Gruyere Borefields survey area

Land System	Description
122Mx22	Plains often flanking areas of regional drainage; some longitudinal sand dunes
122My99	Plains with extensive gravel pavements and small tracts of longitudinal dunes
124AB47	Plains and Dunes - longitudinal and ring dunes with interdune corridors and plains; occasional salt pans
274AB47	Plains and Dunes - longitudinal and ring dunes with interdune corridors and plains; occasional salt pans
274AB49	Plains with a variable proportion of longitudinal sand dunes and scattered residuals of hard sedimentary rocks and laterites
274BY7	Scarpland - low lateritic breakaway on granites and gneisses
274My99	Plains with extensive gravel pavements and small tracts of longitudinal dunes
274SV10	Shallow valleys with lakes, clay pans, salt pans, calcrete (kunkar) platforms, sand dunes, kopi dunes and calcareous dunes

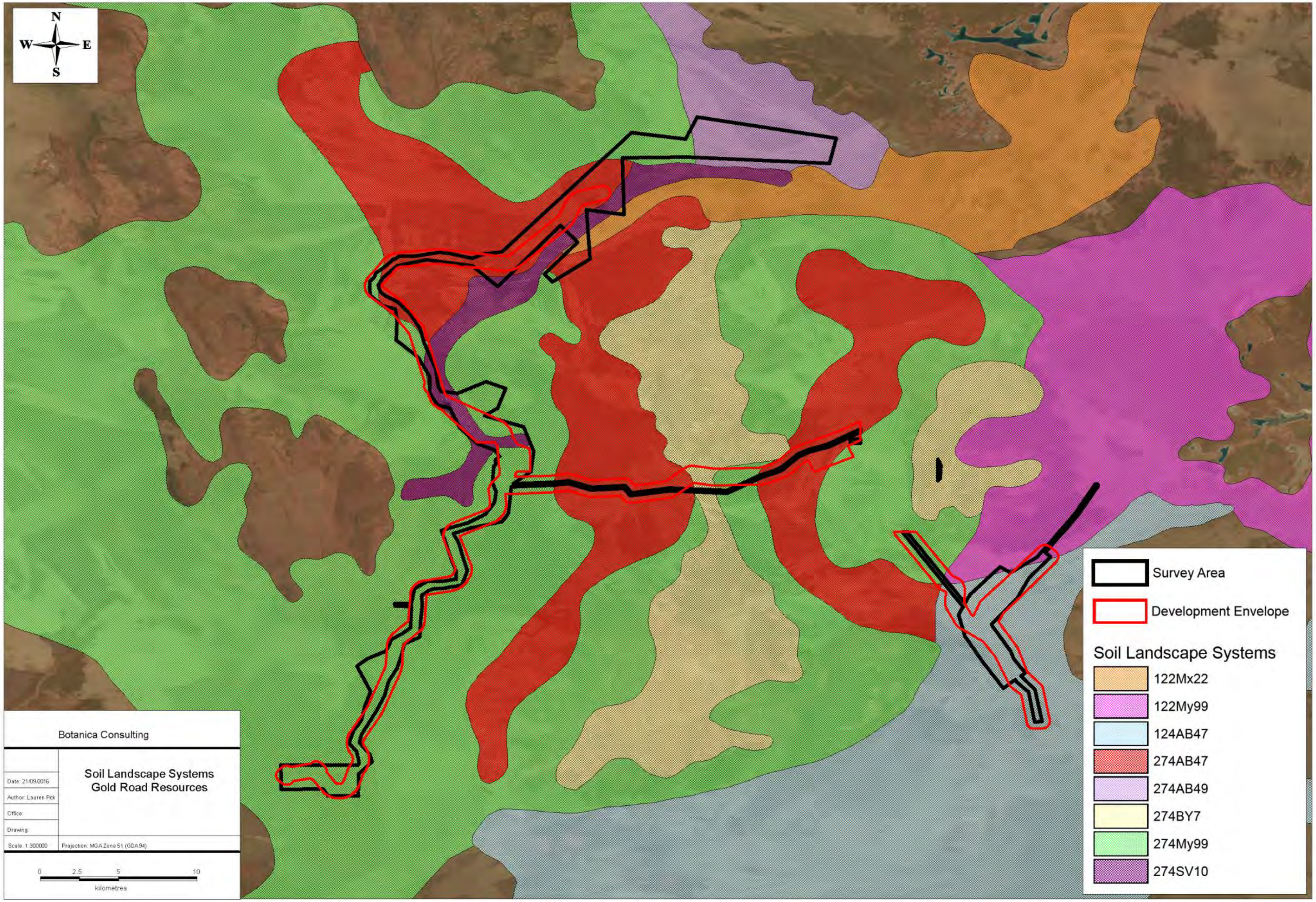


Figure 4: Map of Soil Landscape Systems within the Gruyere Borefields survey area

2.4 Regional Hydrology

Findings of a hydrology assessment of the Gruyere Borefield completed by Pennington Scott (2015) indicates the survey area lies within the Yeo Paleovalley Extent, much of which has shallower water tables between 0 and 15 m below ground, which could potentially be accessed by vegetation (Figure 5). Production Bores within the survey area have been proven to be saline, however shallow water, particularly associated with calcrete areas, can be fresh to brackish, within a range that may be conducive to vegetation use (Pennington Scott, 2015)

Potential vegetation use of groundwater in the Yeo Paleovalley was further investigated through “Normalised Difference Vegetation Index Images” (NDVI). Images from the Yeo and Anne Beadell palaeovalley’s surrounding the survey area were produced from the Rapid Eye satellite from 18 December 2014, at the end of the dry season (Figure 6).

NDVI images provide an indicator of transpiration. Areas showing a significant NDVI response during a dry period may include vegetation that is transpiring groundwater. The NDVI images highlight patches of higher greenness in the palaeochannel areas which, on review of air photos, appear to correspond to stands of trees (Pennington Scott, 2015).

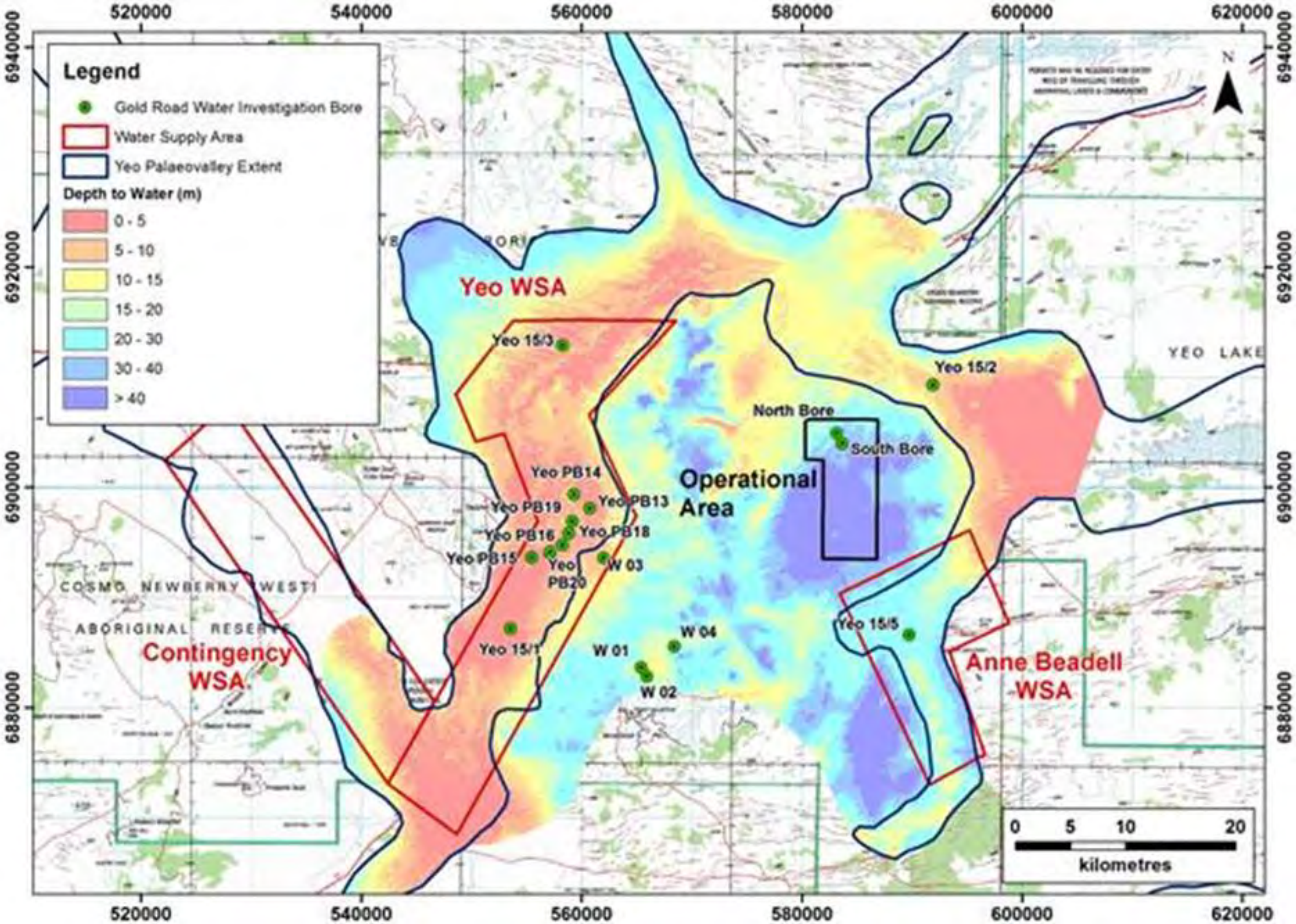


Figure 5: Map of Ground Water Depth within the Gruyere Borefields survey area (Pennington Scott, 2015)

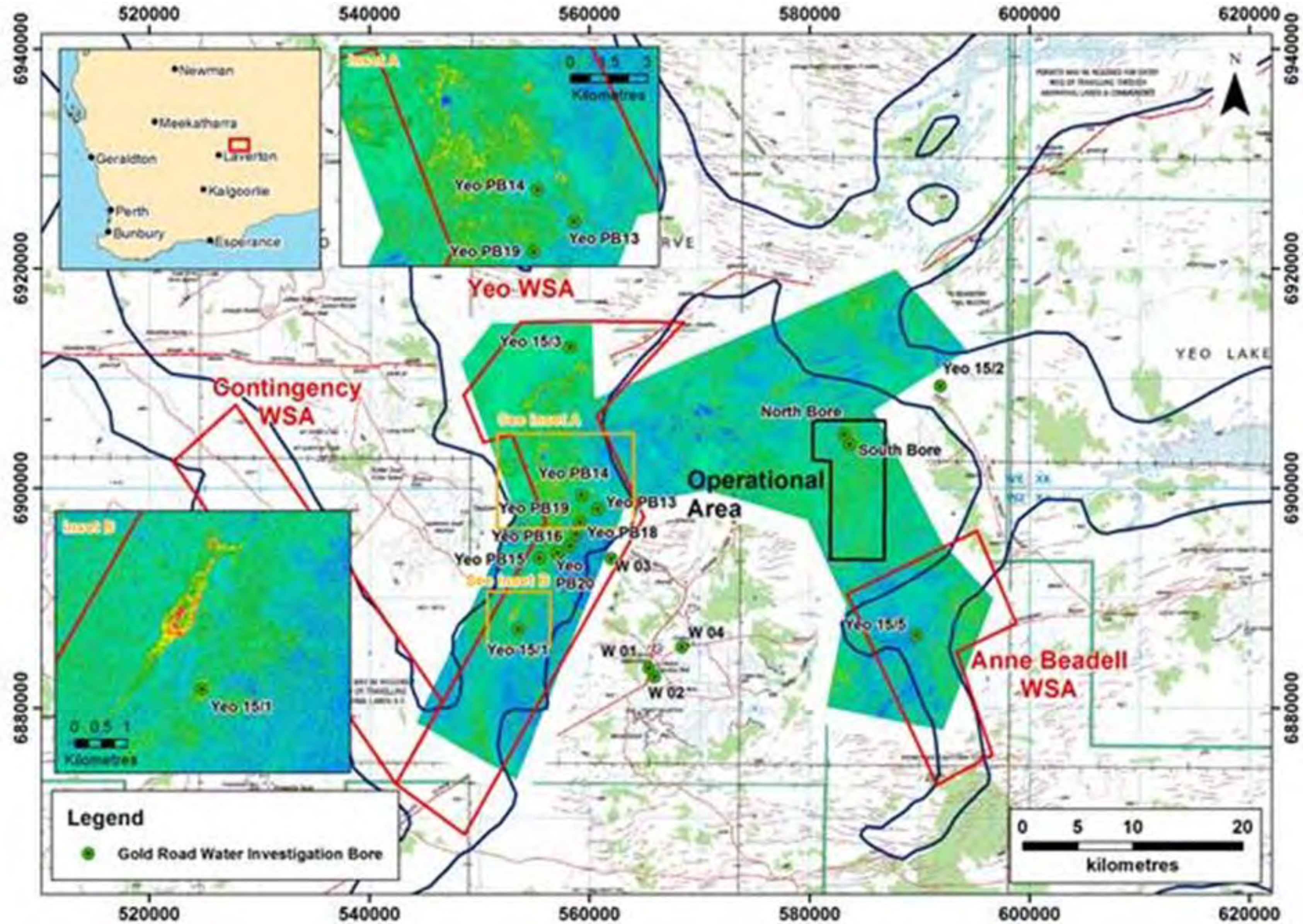


Figure 6: Map of the NDVI image within the Gruyere Borefields survey area (Pennington Scott, 2015)

2.5 Climate

The climate of the Great Victoria Desert Region is characterised as arid with summer and winter rain averaging 150 –190mm per annum (Barton & Cowan, 2001). Average weather conditions obtained from the closest Bureau of Meteorology weather station; Laverton Aero weather station (#12305), located approximately 160km south-west of the survey area are shown in Figure 7 and Figure 8 (BOM, 2016).

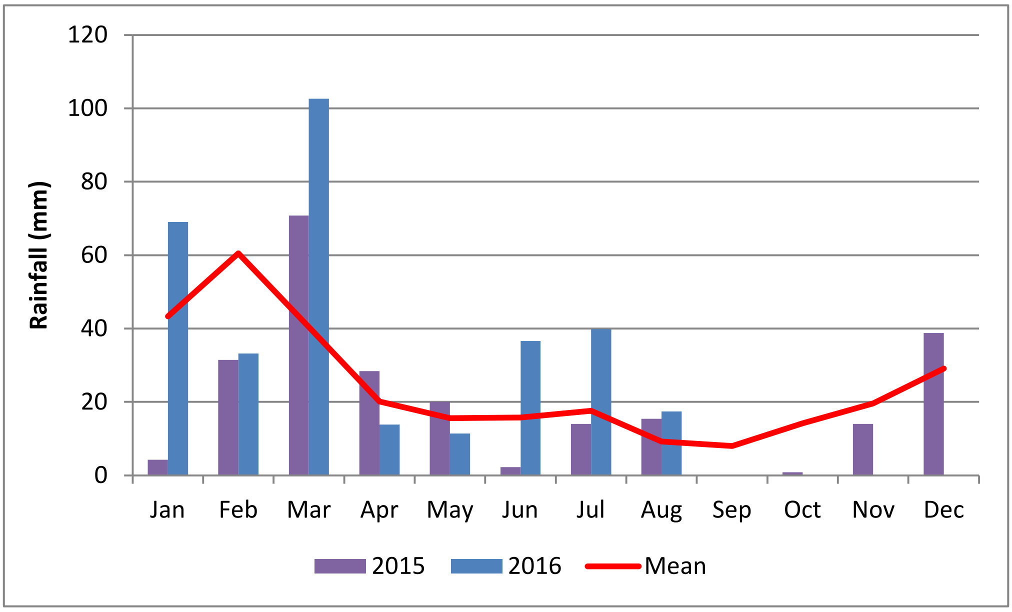


Figure 7: Monthly rainfall from January 2015 to August 2016 and mean monthly rainfall (January 1991 to August 2016) for the Laverton Aero weather station #12305 (BOM, 2016).

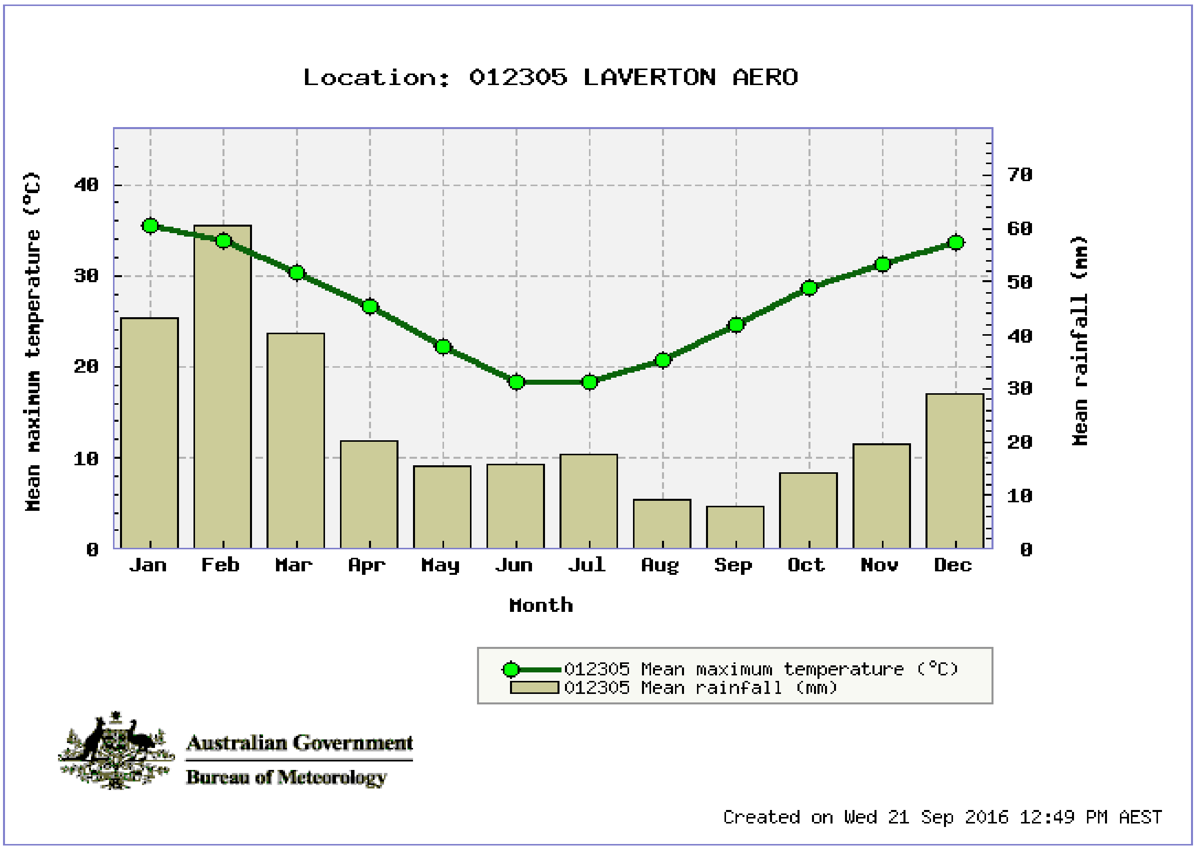


Figure 8: Mean monthly rainfall and maximum temperature for the Laverton Aero weather station #12305 (BOM, 2016).

2.6 Land Use

The dominant land uses of the Shield subregion include; Aboriginal reserves (12.3%), Conservation Reserves (7%), grazing-native pastures (24.8%), UCL and Crown Reserves (55.7%) and other-lake and major watercourse (0.1%). The Central subregion dominant land uses include; Aboriginal reserves (7.4%), Conservation Reserves (9.1%), grazing-native pastures (4.4%), UCL and Crown Reserves (78.9%) and other-lake and major watercourse (0.2%) (Cowan, 2001). The Gruyere Borefields survey area is located within the Yamarna pastoral lease.

2.7 Survey Objectives

The flora assessment was conducted in accordance with *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015* (DPaW & EPA, 2015). The objectives of the assessment were to:

- Gather background information on flora and vegetation in the target area (literature review, database and map-based searches);
- Compile broad scale vegetation community flora maps and species list of the survey area;
- Document and map locations of any Threatened or Priority listed flora species located;
- Assess the regional and local conservation status of plant species and ecological communities within the survey area; and
- Identify and map occurrences of any “Declared and Environmental” weeds within the survey area.

The fauna assessment was conducted in accordance with the requirements of a Level 1 terrestrial fauna survey as defined in EPA Guidance Statement 56 (EPA 2004). The objectives of the assessment were to:

- Gather background information on fauna in the survey area (literature review, database and map-based searches);
- Delineate and characterise the faunal assemblages and fauna habitats present in the survey area;
- Document and map locations of any Threatened or Priority listed fauna species located;
- Assess the regional and local conservation status of fauna species and fauna habitats within the survey area.

3 Survey Methodology

3.1 Desktop Assessment

Searches of the following databases were undertaken to aid in the compilation of a list of flora taxon within the survey area:

- DPaW's NatureMap Database (DPaW, 2015a); and
- DotE Protected Matters search tool (DotE, 2015a).

The searches were conducted for an area encompassing a 40km radius of the centre coordinates – 123.731E, -28.058S (Appendix 1). It should be noted that these lists are based on observations from a broader area than the survey area (40km radius) and therefore may include taxon not present. The databases also often included very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

Prior to the field survey, a combined search of the DPaW's Flora of Conservation Significance databases (DPaW, 2013a) was undertaken within a 40km radius of the survey, the results of which are provided in Appendix 2. These significant flora species were examined on the Western Australian Herbarium's (WAHERB) web page prior to the survey, to familiarise staff with their appearance. Locations of Threatened Flora and Priority Flora were overlaid on aerial photography of the area. Vegetation descriptions and available images of the Priority Flora were also obtained from Florabase.

The conservation significance of flora and fauna was assessed using data from the following sources:

- EPBC Act. Administered by the Australian Government (DotE);
- WC Act. Administered by the WA Government (DPaW);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- DPaW Priority Flora/ Fauna list. A non-legislative list maintained by DPaW for management purposes.

The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)[1];
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (NES) under the EPBC Act. Table 3 and Table 4 below provide the definitions of conservation significant flora and fauna.

[1] Species listed under JAMBA are also specially protected under Schedule 5 of the WC Act.

Table 3: Definitions of conservation significant Flora

Code	Category
State categories of threatened and priority species	
R	Declared Rare Flora – Extant Taxa "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such."
P1	Priority One – Poorly Known Taxa "Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey."
P2	Priority Two – Poorly Known Taxa "Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey."
P3	Priority Three – Poorly Known Taxa "Taxa which are known from several populations and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey."
P4	Priority Four – Rare Taxa "Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years."
P5	Priority Five-Conservation Dependent Taxa Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered	Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation dependent	Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Table 4: Definitions of Conservation Significant Fauna

Code	Category
State categories of threatened and priority species	
Schedule 1	Critically Endangered – Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2	Endangered – Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3	Vulnerable – Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7	Fauna otherwise in need of special protection to ensure their conservation.
P1	Priority One – Poorly Known Taxa Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority Two – Poorly Known Taxa Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority Three – Poorly Known Taxa Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	Priority Four – Rare, Near Threatened and other species in need of monitoring (a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.

Code	Category
Extinct in the wild	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Near Threatened	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A search of the DPaW PEC and TEC database was also conducted within a 40km radius of the survey area (DPaW, 2013b). Table 5 describes definitions of conservation significant communities.

Table 5: Definition of conservation significant communities

Category Code	Category
Threatened Ecological Communities (TEC)	
PTD	**Presumed Totally Destroyed** An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; all occurrences recorded within the last 50 years have since been destroyed.
CE	**Critically Endangered** An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	**Endangered** An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the short term future.

Category Code	Category
V	**Vulnerable** An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.
Priority Ecological Communities (PEC)	
P1	**Poorly-known ecological communities** Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities** Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Ecological communities that are adequately known, rare but not threatened** or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

3.2 Flora Field Assessment

BC was commissioned by GRR to undertake a Level 1 flora survey of the Gruyere Borefield survey area. The survey covered a total area of 15,200 ha. The initial field surveys (covering an area of 5,983 ha) were conducted from the 8th to 10th November 2015 and the 15th to the 21th of November 2015. Additional surveys of the Yeo Borefield (covering an area of 9,217 ha) were conducted from the 20th to the 22nd April 2016. In September 2016, following determination of the development envelope for the Gruyere Borefields (covering an area of approximately 14,020 ha), additional surveys were conducted from 1st to 3rd September 2016 in areas of the development envelope not previously surveyed. The total area surveyed was 21,340 ha. The survey area was traversed on foot, ATV and 4WD by four staff members.

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between vegetation communities. At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant species;
- Landform classification;
- Health Rating;
- Fauna habitat;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of fauna of conservation significance if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and WAHERB. Structural vegetation classification (based on Muir Life Form/ Height Classifications provided in Appendix 3) was used to determine different vegetation communities based on the vegetation structure and dominant species. Similar vegetation communities were recognised visually in the field. Vegetation communities were classified in accordance with the NVIS to a minimum Level 5 classification which includes recording Dominant growth form, height, cover and species for the three traditional strata (*i.e*. Upper, Middle and Ground).

3.3 Fauna Field Assessment

The initial fauna survey was conducted from the 8th to 10th November 2015 and the 15th to the 21st of November 2015. Additional surveys of the Yeo Borefield (covering an area of 9,217 ha) were conducted from the 20th to the 22nd April 2016. Fauna survey work was carried out by Greg Harewood (B.Sc. Zoology) with some assistance from staff of Botanica Consulting and the Yilka Traditional Owners (including but not limited to Harvey Murray (HM) and Harvey Murray (HJ)).

3.3.1 Habitat Assessment

Landforms and vegetation units identified during the flora and vegetation survey, carried out by Botanica Consulting have been used to define broad fauna habitat types across the site. This information has been supplemented with observations made during the site survey. The main aim of the habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that maybe impacted as a consequence of the proposal proceeding. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey the habitats within the survey area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

3.3.2 Opportunistic Fauna Observations

Opportunistic observations of fauna species were made during the field survey work which involved a series of transects across/along the defined survey area while searching microhabitats such as logs, rocks, leaf litter and observations of bird species with binoculars.

Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

The opportunity was also taken to examine the walls of a temporary water holding dam constructed on a sand dune in the northern section of the survey area for evidence (backfilled tunnels) of marsupial moles.

3.3.3 Personnel involved

Jim Williams - Environmental Consultant/Botanist (Diploma of Horticulture)
Andrea Williams - Environmental Consultant (BSc Hons Mineral Resources Management)
Greg Harewood - Zoologist (BSc Zoology)
Emma Williams - Environmental Technician
Aidan Williams - Environmental Technician
Cosmo Newberry Traditional Land Owners

3.3.4 Scientific licences

Table 6: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL011451	21-05-2017
Andrea Williams	SL011450	21-05-2017

3.4 Flora and Fauna survey limitations and constraints

It is important to note that flora and fauna surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 7.

The conclusions presented in this report are based upon field data and environmental assessments 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 the field assessments. Also it should be recognised that site conditions can change with time. Information not available at the time of this assessment which may subsequently become available may alter the conclusions presented. No seasonal sampling has been carried out as part of the fauna assessment.

Some flora and fauna species are reported as potentially occurring based on there being suitable habitat (quality and extent) within the survey area or immediately adjacent. The habitat requirements and ecology of many of the species known to occur in the wider area are however often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitats or microhabitats within the survey area. As a consequence of this limitation, the potential species lists produced are most likely an overestimation of those that actually utilise the survey area for some purpose. In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any flora or fauna species that would possibly occur within the survey area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author, has been listed as having the potential to occur.

Table 7: Limitations and constraints associated with the flora and vegetation survey.

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD, all-terrain vehicle and on foot.
Experience levels	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Botanist/Zoologist:** Jim Williams & Greg Harewood **Field Staff:** Jim Williams, Andrea Williams, Greg Harewood, Emma Williams & Aidan Williams **Data Interpretation:** Jim Williams, Greg Harewood, Lauren Pick, Pat Harton
Timing of survey, weather & season	Not a constraint	Initial fieldwork was conducted in November 2015 and additional in September 2016 within the EPA's recommended timing for flora surveys (*i.e.* spring Sept-Nov) for detecting most ephemeral flora and when the majority of species are in flower. Additional fieldwork was conducted in April 2016 within the recommended DPaW/ EPA guidelines primary survey period (Eremaean Province-6-8 weeks post wet season, March – June). The survey was conducted following above average rainfall received in March and as a result annual species were present. The timing of the survey did not represent a constraint on the field reconnaissance survey undertaken as part of the Level 1 fauna assessment.
Sources of information	Not a constraint	BC was able to obtain information about the area from previous research conducted within the area which enabled adequate background information about the region.
Mapping reliability	Not a constraint	BC were able to obtain high quality ortho aerial images of the area which was sufficient to reliably determine changes in vegetation/habitats within the survey area.
Area disturbance	Minor constraint	Ranged from Health Rating 2 to 3. Vegetation in various stages of fire regrowth (<6 months to 10+ years)
Survey Intensity	Not a constraint	Survey intensity was appropriate for the significance of the area with a Level 1 flora survey completed in two seasons to identify vegetation communities and any Flora of Conservation Significance. The intensity of the field reconnaissance survey undertaken as part of the Level 1 fauna assessment was consistent with the requirements detailed in Guidance Statement 56 (EPA 2004). It should be noted that several other fauna surveys have been undertaken in the near vicinity (including Level 2 fauna surveys) and information from these sources was also used as part of the assessment.
Resources	Not a constraint	Threatened database searches provided by the DPaW were used to identify any potential locations of Threatened/Priority Flora and Fauna species. DAFWA, DPaW and DotE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Results of previous flora, vegetation and fauna surveys within the local area were also obtained which provided valuable background information.
Completeness	Not a constraint	In the opinion of BC, the survey area was covered sufficiently in order to identify vegetation assemblages. Due to the extensive experience and familiarity of the BC staff with flora

Variable	Potential Impact on Survey	Details
		within the region it is estimated that approximately 90% of the flora within the survey area was able to be fully identified despite minimal flowering material and some annual species were present. The vegetation communities for this study were based on visual descriptions of locations in the field. The distribution of these vegetation communities outside the study area is not known, however vegetation communities identified were categorised via comparison to vegetation distributions throughout WA given on Natural Vegetation Information System (DotE, 2016b). The intensity of the field reconnaissance survey undertaken as part of the Level 1 fauna assessment was sufficient to allow for the identification and characterisation of the primary fauna habitats present within the survey area. This information was supported by data collected during the flora survey and also previous fauna surveys in the immediate vicinity.

4 Results

4.1 Desktop Assessment

4.1.1 Flora of Conservation Significance

The results of the combined search of the DPaW's Flora of Conservation Significance databases (Appendix 2), NatureMap Database and Protected Matters search tool (Appendix 1), recorded no Threatened Flora and no Priority Flora taxon within the survey area. Seven Priority Flora taxa were listed within a 40km radius of the survey area; However, there appears to be an error with NatureMap database listing as one taxon identified in the NatureMap database search, *Triodia bromoides* (P4), is not known to occur within a 40km radius of the survey area. This taxon is located in the Edel and Geraldton Hills subregions. As such this taxon has been excluded from the desktop assessment. The remaining taxa were assessed and ranked for their likelihood of occurrence within the survey area (Table 8). The rankings and criteria used were:

- Unlikely: Area is outside of the currently documented distribution for the species/no suitable habitat (type, quality and extent) was identified as being present during the field/desktop assessment.
- Possible: Area is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field/desktop assessment, supported in some cases by recent records being documented from within or near the area.
- Known to Occur: The species in question was positively identified as being present during the field survey.

Table 8: Likelihood of occurrence-Flora of Conservation Significance

Taxon	Conservation Code	Description (WAHERB, 2015)	Likelihood of Occurrence
Calytrix warburtonensis	2	Shrub, 0.3-0.6 m high. Fl. white, Mar or Sep to Oct. Rocky hills, breakaways.	Possible
Comesperma viscidulum	4	Shrub, to ca 0.7 m high.	Possible
Conospermum toddii	4	Spreading shrub, 1.2-2 m high. Fl. white/white-yellow, Jul to Oct. Yellow sand. Sand dunes.	Possible
Grevillea secunda	4	Low spreading shrub, 0.3-0.8 m high. Fl. red, Sep to Oct. Yellow or red sand. Sand dunes, sandplains.	Possible
Sauropus ramosissimus	3	Slender, much-branched shrub, to 0.3 m high.	Possible
Thryptomene nealensis	3	Shrub, ca 0.3 m high. Fl. pink, Oct. Lateritic breakaways	Possible

4.1.2 Vertebrate Fauna of Conservation Significance

For vertebrate fauna of conservation significance identified during the literature review as previously being recorded in the general area, each was assessed and ranked for their likelihood of occurrence within the survey area itself (Table 9). The rankings and criteria used were:

- Unlikely: Survey area is outside of the currently documented distribution for the species in question or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records), or no suitable habitat (type, quality and extent) was identified as being likely to be present during the field survey and literature review. Individuals of some species may occur very occasionally as vagrants/transients especially if suitable habitat is located nearby but the survey area itself would not support a population or part population of the species.

- Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20km of the survey area. Populations do however persist outside of this area.

- Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the Goldfields region, Populations do however persist outside of this area.

- Possible: Survey area is within the known distribution of the species in question and habitat of at least marginal quality was identified as likely to be present during the field survey and literature review, supported in some cases by recent records being documented in literature from within or near the survey area. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- Known to Occur: The species in question has been positively identified as being present (for sedentary species) or as using the survey area as habitat for some other purpose (for non-sedentary/mobile species) during field surveys within or near the survey area. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. tracks, foraging debris, scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

Table 9: Likelihood of Occurrence – Vertebrate Fauna of Conservation Significance

Species	Conservation Status (see Appendix A for codes)			Potential Habitats Within Survey Area			Likelihood of Occurrence
	EPBC Act	WC Act	DPAW Priority	Foraging Habitat	Breeding Habitat	Total Extent (ha)	
Buff-snouted Blind Snake *Anilios margaretae*	-	-	P2	Sand plains and sand dunes		10.727 ha - ~77% of development envelope	Possible
Great Desert Skink *Liopholis kintorei*	VU	S3	-	Sand plains and sand dunes		10.727 ha - ~77% of development envelope.	Unlikely. Outside current documented range/locally extinct?
Woma *Aspidites ramsayi*	-	-	P1	Sand plains and sand dunes		10.727 ha - ~77% of development envelope	Unlikely. Outside current documented range/locally extinct?
Malleefowl *Leipoa ocellata*	VU	S3	-	Vegetated clay loam plains, sand loam plains, drainage depressions and quartz rocky plains.	None	2,807 ha - ~20% of development envelope	Possible transient individuals only. Breeding unlikely.
Great Egret *Ardea alba*	Mig	S5	-	Drainage depressions, closed depressions. (when inundated).	None	895 ha - ~6% of development envelope	Unlikely. Outside normal range.

Species	Conservation Status (see Appendix A for codes)			Potential Habitats Within Survey Area			Likelihood of Occurrence
	EPBC Act	WC Act	DPAW Priority	Foraging Habitat	Breeding Habitat	Total Extent (ha)	
Peregrine Falcon *Falco peregrinus*	-	S7	-	sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains	Large trees with open spouts suitable for nesting or abandoned bird of prey nests	14,020 ha – 100% of development envelope. No potential nest sites observed.	Possible.
Grey Falcon *Falco hypoleucos*	-	S3	-	sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains.	None	14,020 ha – 100% of development envelope	Unlikely. Outside normal range.
Oriental Plover *Charadis veredus*	Mig	S5	-	Closed depressions (with chenopods.	None	170 ha - ~1.2% of development envelope.	Unlikely Outside normal range.
Princess Parrot *Polytelis alexandrae*	VU	-	P4	Vegetated sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains	Large trees with hollows suitable for nesting.	14,020 ha – 100% of development envelope Number of suitable tree hollows, if any unknown.	Possible
Night Parrot *Pezoporus occidentalis*	EN	S1	-	Vegetated sand plains, closed depression (with chenopods)		9,433 ha – ~67 % of development envelope	Unlikely. Outside current documented range/locally extinct?
Fork-tailed Swift *Apus pacificus*	Mig	S5	-	Air space over entre area.	None	14,020 ha – 100% of development envelope	Unlikely.
Striated Grasswren (sandplain) *Amytornis striatus striatus*	-	-	P4	Sand plains, sand dunes, clay loam plains and sand loam plains		12,079 ha – ~86% of development envelope.	Possible.
Thick-billed Grass-wren (western ssp) *Amytornis textilis textilis*	-	-	P4	Densely vegetated sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains		14,020 ha – 100% of development envelope	Unlikely. Outside current documented range/locally extinct?
Rainbow Bee-eater *Merops ornatus*	Mig	S5	-	sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains	Sand plains and sand dunes.	14,020 ha – 100% of development envelope	Known to Occur
Grey Wagtail *Motacilla cinerea*	Mig	S5	-	None.		0 ha	Unlikely.
Yellow Wagtail *Motacilla flava*	Mig	S5	-	None.		0 ha	Unlikely.
Brush-tailed Mulgara *Dasycercus blythi*	-	-	P4	Sand plains, sand dunes, clay loam plains and sand loam plains.		12,079 ha – ~86% of development envelope	Possible.
Southern Marsupial Mole *Notoryctes typhlops*	-	-	P4	Sand dunes in the northern section of western borefield (north of Great Central Road).		346 ha-~2.5% of development envelope	Known to Occur

Species	Conservation Status (see Appendix A for codes)			Potential Habitats Within Survey Area			Likelihood of Occurrence
	EPBC Act	WC Act	DPAW Priority	Foraging Habitat	Breeding Habitat	Total Extent (ha)	
Sandhill Dunnart *Sminthopsis psammophila*	EN	S2	-	None.		0 ha	Unlikely. Habitat Appears unsuitable.
Bilby *Macrotis lagotis*	VU	S3	-	Sand plains, sand dunes, quartz rocky plains, clay loam plains, sand loam plains and drainage depressions.		13,534 ha - ~97% of development envelope.	Unlikely. Outside current documented range/locally extinct?
Central Long-eared Bat *Nyctophilus major tor*	-	-	P4	Sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains.		14,020 ha – 100% of development envelope	Unlikely. Outside current documented range

4.1.3 Invertebrate Fauna of Conservation Significance

It can be difficult to identify what may be significant invertebrate species (e.g. Short Range Endemics - SREs) as there are uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

The review of potential terrestrial invertebrate species of conservation significance has included a search of the DPaW NatureMap database (DPaW, 2015) and the DotE protected matters database (DotE, 2015) with the aim of identifying previously recorded threatened and endemic species.

These sources do however have limitations and therefore the results and conclusions of several terrestrial short range endemic studies carried out previously within GRR's Yamarna tenements/Project areas have also been used as a reference in determining the likelihood of terrestrial invertebrate species of conservation significance being impacted on by the installation and operation of the borefield itself. The reports have included:

- 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.
- Judd, S. (2015). Terrestrial Isopod Identification for Dorothy Hills, Yamarna Station. Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.
- Phoenix Environmental Sciences (2014). Identification and assessment of short-range endemism of trapdoor spiders from Yamarna Station, Western Australia. Unpublished report prepared for Botanica Consulting.
- Phoenix Environmental Sciences (2015a). Identification and assessment of short-range endemism of invertebrates from Yamarna Station, Western Australia. Unpublished report prepared for Rapallo Ltd.
- Phoenix Environmental Sciences (2015b). Identification and assessment of short-range endemism of trapdoor spiders from Gruyere Project (Yamarna Station), Western Australia. Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.
- Volschenk, E. (Scorpion ID) (2012). Yamarna Scorpion Identification Report. Unpublished report for Keith Linbeck and Associates.

- Volschenk, E. (Scorpion ID) (2015a). Taxonomic Report for Invertebrates Surveyed from Yamarna Station. Unpublished report prepared for Rapallo Ltd.
- Volschenk, E. (Scorpion ID) (2015b). Taxonomic and Short-Range Endemism Assessment of Invertebrates Surveyed from Yamarna Station (November 2015). Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

4.1.4 Previous Flora and Fauna Surveys

Flora and fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publically available and could not be referenced. The most significant of those available listed below have been used as the primary reference material for compiling the potential flora and vegetation communities and fauna habitats for the general area.

- BC (2011), *Level 1 Yamarna Proposed Haul Road Flora and Vegetation Survey,* Botanica Consulting
- BC (2012), *Level 2 Flora and Vegetation Survey, Yamarna Project,* Botanica Consulting
- BC (2014a), *Level 1 Flora and Vegetation Survey, Gruyere Project,* Botanica Consulting
- BC (2014b), *Level 1 Flora and Vegetation Survey, Sunrise Dam Gold Mine to Tropicana Gold Mine Gas Pipeline,* Botanica Consulting
- BC (2014c), *Level 1 Flora and Vegetation Survey, Miningwal Borefields,* Botanica Consulting
- BC (2015a), *Level 2 Flora and Vegetation Survey of the Gruyere Project.* Botanica Consulting
- BC (2015b), *Level 1 Flora and Vegetation Survey Proposed Gas Pipeline Routes,* Botanica Consulting
- DAFWA (1994) *Technical Bulletin: An inventory and condition survey of the north-eastern Goldfields Western Australia (No. 87),* Department of Agriculture WA, 1994.
- Ecologia (2009a). *Tropicana Gold Project. Operational Area Vertebrate Fauna Assessment.* Unpublished report for Tropicana Joint Venture. February 2009.
- Ecologia (2009b). *Tropicana Gold Project. Tropicana-Transline Infrastructure Corridor, Level 1 Fauna Assessment.* Unpublished report for Tropicana Joint Venture. July 2009.
- Hall, N. J., McKenzie, N. L. and Keighery, G. J. (eds) (1994). *The Biological Survey of the Eastern Goldfields of WA - Pt 10: Sandstone-Sir Samuel and Laverton-Leonora Survey Areas*. Records of the WAM, Supplement 47: 1 – 166.
- Harewood, G. (2011). *Terrestrial Fauna Survey (Level 1) of Yamarna Gold Project (Central Bore, Attila, Alaric, Haul Road and Khan North).* Unpublished report for Gold Road Resources. September 2011.
- Harewood G. (2014). *Fauna Assessment (Level 1) Gruyere Project*. Unpublished report for Gold Road Resources Ltd. July 2014.
- Harewood G. (2015a). *Southern Marsupial Mole (Notoryctes typhlops) – Additional Information on Presence/Absence - Gruyere Project Area*. Unpublished letter report for Gold Road Resources Ltd. June 2015.
- Harewood G. (2015b). *Southern Marsupial Mole (Notoryctes typhlops) – Northern Borefield Area.* Unpublished letter report for Gold Road Resources Ltd. November 2015.
- Harewood G. (2015c). *Fauna Assessment (Level 1) Gruyere Borefield Project.* Unpublished report for Gold Road Resources Ltd. December 2015.
- Harewood G. (2016). *Terrestrial Invertebrate Survey – Gruyere Project Area.* Unpublished report for Gold Road Resources Ltd. January 2016.

- Kingfisher Environmental Consulting (2014a). *Murrin Murrin – Sunrise Dam Infrastructure Corridor Level 1 Fauna Survey.* Unpublished report for AngloGold.
- Kingfisher Environmental Consulting (2014b). *Sunrise Dam – Tropicana Infrastructure Corridor Level 1 Fauna Survey*. Unpublished report for AngloGold.
- KLA (2012). *Fauna Assessment (Level 2) Yamarna Project.* Unpublished report for Gold Road Resources. October 2012.
- Martnick and Associates Pty Ltd (1996*). Environmental Appraisal – Yamarna Gold Project Area*. Unpublished report for Zanex NL. January 1996.
- MBS Environmental (2014). *Gruyere Project - Desktop Environmental Review and Work Program*. Unpublished report for Gold Road Resources. February 2014.
- Ninox Wildlife Consulting (2009). *A Level One Survey of the Vertebrate Fauna, Infrastructure Corridor – Pinjin Option.* L 31/57, L 39/185, Pinjin – Tropicana Gold Project. Unpublished report for Tropicana Joint Venture. January 2009.
- Rapallo Environmental (2015). *Fauna Survey of the Gruyere Project Area*. Unpublished report for Gold Road Resources Limited. May 2015.
- Terrestrial Ecosystems (2011). *Level 2 Fauna Risk Assessment for the Granny Deeps Project Area*. Unpublished report. February 2011.

Some of the above mentioned reports refer to flora and fauna surveys carried a considerable distance from the survey area being assessed and therefore, as with the databases searches, some refer to species that would not occur in the survey area due it being out of their normal range or due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential flora and fauna species list for the survey area.

4.2 Field Assessment

4.2.1 Flora of Conservation Significance

Flora of conservation significance identified in the desktop assessment as potentially occurring within the survey area were targeted during the field assessment. No Threatened Flora taxa pursuant to subsection (2) of section 23F of the WC Act and the EPBC Act were identified within the survey area/ development envelope. No Priority Flora taxa were identified within the survey area/ development envelope.

4.2.2 Fauna of Conservation Significance

Fauna of conservation significance identified in the desktop assessment as potentially occurring within the survey area were targeted during the field assessment. Two vertebrate fauna species of conservation significance (listed under State or Federal threatened/migratory species lists or as a DPaW priority species) were positively identified as utilizing the study area for some purpose during the survey period, this being:

1. **Rainbow Bee-eater *Merops ornatus* – Migratory (*EPBC Act*), S5 (*WC Act*)**
   Observed/heard on several occasions during survey period. The rainbow bee-eater is a very common and widespread seasonal visitor to the southern half of WA and would not be specifically attracted to the site. Some potential for the species to breed in some sections of the survey area where ground conditions are suitable. Population levels would however not be significant as it usually breeds in pairs and rarely in small colonies (Johnstone and Storr, 1998).

   Extent of potential habitat within the development envelope: Foraging habitat - sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains (14,020 ha- 100% of development envelope).

   Breeding habitat - sand plains and sand dunes (10.727 ha-~77% of development envelope).

2. **Southern Marsupial Mole *Notoryctes typhlops* – P4 (DPaW Priority Species)**
   The distinctive backfilled burrows of this species were found in the walls of a temporary holding dam constructed on a sand dune in the northern section of the proposed Yeo Borefield, north of the Great Central Road, confirming this species presence in this particular area.

   This area of dunes appears to be separate from those in other sections of Yamarna (e.g. Gruyere mine area) where no evidence of the species has been found despite targeted searches (i.e. trenches and examination of large cutting in dunes) (Harewood 2015a).

   Extent of potential habitat within the survey area: Sand dunes in the northern section of the western borefield, mainly north of the Great Central Road (346 ha-~2.5% of development envelope).

The current status on site and/or in the general area of some other species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, six additional species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

1. **Buff-snouted Blind Snake *Anilios margaretae* – P2 (DPaW Priority Species)**
   The status of this species in the survey area is difficult to determine. Given suitable habitat (i.e. sand dunes and sand plains) occurs its presence cannot be discounted despite not being recorded during previously fauna surveys nearby and in the wider area (ecologia

2009, KLA 2012, KEC 2014 and Rapallo 2015). While there are limited records for this species, it appears to have a wide distribution across the Great Victoria Desert. The lack of records could be attributed to the areas remoteness and the secretive habits of blind snakes and it may in fact be more common than records indicate.

Extent of potential habitat within the survey area: Sand plains and sand dunes (10,727 ha-~77% of development envelope).

2. Malleefowl *Leipoa ocellata* – S3 (*WC Act*), Vulnerable (*EPBC Act*)

No evidence of this species (individuals, foot prints, feathers or recent/old nest mounds) was observed during the survey period. Habitat appears unsuitable or at best marginal within much of the area surveyed primarily due to the generally sparse nature of the vegetation, recent fires and/or a lack of leaf litter.

Individual malleefowl have very occasionally been observed in the general vicinity of Yamarna (pers. comms. "Driller" and TOs) but no recent active or inactive mounds have ever been recorded despite several fauna and flora surveys over significant areas of land associated with the proposed mining operations. This would suggest that the habitats present are unsuitable for breeding and that the observations made are of transient individuals. For these reasons malleefowl have been listed as a potential species due to the possibility for occasional transient individuals to occur, but they are considered very unlikely to breed within the borefield area itself.

Extent of potential habitat within the survey area: Vegetated clay loam plains, sand loam plains, drainage depressions and quartz rocky plains (2,807 ha-~20% of development envelope). Most habitat does however appear marginal in quality at best.

3. Peregrine Falcon *Falco peregrinus* – S7 (*WC Act*)

The species potentially utilises some sections of the survey area as part of a much larger home range for foraging purposes only. Would only be represented by a very small number of individuals for limited periods. Previously recorded at Tropicana (ecologia 2009).

Extent of potential habitat within the survey area: Foraging habitat - sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains (14,020 ha-100% of development envelope).

Breeding habitat - Large trees with open spouts suitable for nesting or abandoned bird of prey nests – total number unknown, but none observed during field survey.

4. Princess Parrot *Polytelis alexandrae* – Vulnerable (*EPBC Act*), P4 (DPaW Priority Species)

The species may frequent the survey area at times, but given it is highly nomadic, its frequency of occurrence would be very low and generally temporary. Areas containing *Eucalyptus gongylocarpa* woodland are of most significance as they have the potential to contain larger trees with hollows that may represent potential breeding habitat.

Extent of potential habitat within the survey area: Foraging habitat - Vegetated sand plains, sand dunes, clay loam plains, sand loam plains, closed depressions, drainage depressions and quartz rocky plains (14,020 ha-100% of development envelope).

Breeding habitat - Large trees with hollows suitable for nesting – total number, if any, unknown.

5. **Striated Grasswren (sand plain) *Amytornis striatus striatus* - P4 (DPaW Priority Species)**

   Not observed during the field survey or during any other recent survey at Yamarna however there is a NatureMap record along the Anne Beadell Highway just east of the borefield survey area made in the year 2000 (DPaW 2015b) and therefore it is considered to be a potential species where suitable habitat occurs. This species has also been recorded recently much further south at several locations along the Tropicana to Sunrise Dam pipeline route (KEC 2014).

   Extent of potential habitat within the survey area: Sand plains, sand dunes, clay loam plains and sand loam plains (12,093 ha – ~86% of development envelope).

6. **Brush-tailed Mulgara *Dasycercus blythi* - P4 (DPaW Priority Species)**

   There is a paucity of records of this species in the area and no evidence of its presence was observed during the field survey or any previous survey at Yamarna including those where trapping has been employed (KLA 2012 and Rapallo 2015). The current status in the survey area is therefore difficult to determine. The most recent nearby records are just south west of Yamarna from 1990 (DPaW 2015) and it was also recorded at several locations along the Tropicana to Sunrise Dam pipeline route (KEC 2014). This information coupled with the fact that habitat in some sections of the survey area appears suitable (e.g. sand plains, sand ridges, *Acacia* shrubland on loamy sand) suggests that the species may be present in some areas.

   Extent of potential habitat within the survey area: Sand plains, sand dunes, clay loam plains and sand loam plains (12,079 ha – ~86% of development envelope).

It should be recognised that habitat within the survey area for some of the species listed above, while considered possibly suitable, may be marginal in extent/quality and the species listed may therefore only visit the area for short periods or as rare/uncommon vagrants.

4.2.3 Invertebrate Fauna of Conservation Significance

The NatureMap database search of the survey area returned 65 invertebrate species records (DPaW 2015b) none of which are listed as threatened or as priority species. One species (*Wandella stuartensis* - a spider) was shown as being "Endemic to Query Area" (i.e. those DPaW species records that are wholly contained within the search area) but this species is also known from several locations in the eastern states (ALA 2015) and therefore it is not likely to be an SRE.

No other invertebrate species listed in the NatureMap search were flagged as being endemic to the query area which indicates that there are other records of each of these species, within the NatureMap database, outside the 40km (~5,000 km^2) search area, suggesting none would be classified as SREs though this assessment has limitations.

A search of the federal *EPBC Act* database using the Protected Matters Search Tool (DotE 2015) returned no reference to invertebrates.

A search of the WAM databases for invertebrates was undertaken by MBS as part of their initial desktop review for the Gruyere Project (MBS 2014). The database search was based on a 20 km area and buffer respectively around a central coordinate (-27.98669 S and 123.85007 E). The search results were limited to one potential SRE species being reported, a scorpion (*Urodacus* sp. 'Point Sunday') which was recovered from a borrow pit on Point Sunday Road in July 2007, approximately 11 km north of the central coordinate (MBS 2014). The individual record was a new and previously undescribed species.

During a Level 2 Fauna survey carried out at Yamarna in 2011 and 2012 (KLA 2012), 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 the WAM were often inconclusive depending on the families or genera. Of the invertebrates identified, results indicated that seven species were not SREs or unlikely to be SREs, for three it was, at the time, not possible to say if the species represent an SRE and the remaining two required further taxonomic research in order to determine or confirm their SRE status. This highlights the lack of knowledge currently available in relation to the conservation status of many invertebrate species. It was concluded that not one specimen collected from the area was known to be a SRE (KLA 2012).

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.

Two myglamorph spiders were collected within the Gruyere Project area during a Level 1 fauna survey carried out in May 2014 (Harewood 2014) and submitted to specialists for identification. The specimens included a male "trapdoor spider" identified as the widespread *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).

During a Level 2 Fauna Survey within the Gruyere Project area carried out in late 2014 (Rapallo 2015) a total of 37 invertebrate specimens were collected. These comprised eight spiders, 27 scorpions, and two pseudoscorpions.

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

More recently, a targeted invertebrate survey has been completed within the Gruyere Project area between August and October 2015 (Harewood 2015). The survey included the deployment of 120 wet pit traps left in place for about two months and the collection and examination of 12 leaf litter samples. The survey yielded 249 specimens of SRE target groups (scorpions (59), isopods (59), pseudoscorpions (61), Mygalomorph spiders (10) and centipedes (60)).

The Mygalomorph spiders were identified as including four potential SREs and a widespread species (Phoenix 2015b). However, until material at the WA Museum (which is currently closed due to a major re-organisation of specimen storage) is available for comparative analysis, it will remain unclear some of the specimens collected are conspecific with those previously collected in the area by KLA (2012) (i.e. if *Synothele* 'gruyere' is conspecific with *Synothele* sp. indet. (as reported in Burger *et al.* 2012) 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)).

Other specimens collected included five species of scorpions, three species of pseudoscorpions, four species of scolopendromorph centipedes, one species of stone centipede and one species of earth centipede. Of these 14 species, two scorpions (*Lychas* 'annulatus complex' and *Urodacus* sp. indet), and the earth centipede (*Mecistocephalus* sp. indet.) were determined to be potential SRE’s. The remaining 11 species were considered to have widespread ranges (Volschenk 2015b) and therefore not SREs.

The isopod specimens collected were determined to represent a single species that is considered to be a potential SRE primarily because there are knowledge gaps for the taxon and insufficient geographic information to determine its full distribution (Judd 2015).

To date no confirmed terrestrial SREs have been identified within the Yamarna area.

The results of the abovementioned surveys indicate that it is possible that potential SREs could occur within the proposed borefield areas, given the proximity of the records acquired to date and the presence of similar habitat types. Based on available information it is however concluded that terrestrial SRE invertebrates, if present, are unlikely to be significantly impacted on by installation and operation of a borefield given the relatively small size of the impact footprint at any one point and the extensive habitat connectivity with adjoining areas. As a consequence, there is a very low likelihood of any significant impact/change occurring to local invertebrate communities or to the conservation status of individual species given that populations will persist in adjoining unaffected locations.

4.3 Vegetation Communities

A total of forty-three vegetation communities were identified within the Gruyere Borefields survey area, of which thirty-nine are located within the proposed development envelope. These communities comprised of seven different landform types and nine NVIS major vegetation groups as listed in Table 10 below. The communities were represented by a total 42 Families, 112 Genera and 269 Taxa, (including sub-species and variants). A summary of vegetation communities including area of vegetation communities within the survey area and the development envelope is provided in Table 10 below. Species lists for the vegetation communities are provided in Appendix 4. Maps of the vegetation communities are provided in Appendix 5.

Table 10: Vegetation Communities identified within the Gruyere Borefields survey area

Landform	NVIS Vegetation Group	Code	Vegetation Community	Survey Area (15,200 ha)		Development Envelope (14,020 ha)	
				Area (ha)	Area (%)	Area (ha)	Area (%)
Clay-Loam Plain	Acacia Forests and Woodlands	CLP-AFW1	Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus* on clay-loam plain	434	2.9	322	2.3
	Acacia Shrublands	CLP-AS1	Scrub of *Acacia burkittii* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus/* low grass of *Aristida contorta* on clay-loam plain	158	1.0	133	0.9
	Mallee Open Woodlands and Sparse Mallee Shrublands	CLP-MOW/SMS1	Very open tree mallee of *Eucalyptus lucasii/* low woodland of *Acacia caesaneura/ A. incurvaneura* over heath of *Eremophila latrobei* subsp. *glabra* and very open low grass of *Eragrostis eriopoda* on clay-loam plain	6	0.04	0	0
Closed Depression	Acacia Forests and Woodlands	CD-AFW1	Open low woodland of *Acacia caesaneura* over open dwarf scrub of *Eremophila maculata* subsp. *brevifolia* and low heath of *Frankenia interioris* var. *parviflora* in playa	20	0.1	42	0.3
		CD-AFW2	Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa	39	0.3	0	0
	Casuarina Forests and Woodlands/ Mallee Woodlands and Shrublands	CD-CFS/MWS1	Open tree mallee of *Eucalyptus gypsophila/* low woodland of *Casuarina pauper* over low scrub of *Melaleuca interioris* and open hummock grass of *Triodia basedowii* on playa edge	395	2.6	265	1.9
	Chenopod Shrublands, Samphire Shrublands and Forblands	CD-CSSSF1	Low heath of *Tecticornia undulata/ T. halocnemoides* on playa	164	1.1	170	1.2
	Mallee Woodlands and Shrublands	CD-MWS1	Very open tree mallee of *Eucalyptus gypsophila* over open low scrub of *Eremophila scoparia* and dwarf scrub of *Atriplex bunburyana* on playa edge	39	0.3	9	0.1
Drainage Depression	Acacia Forests and Woodlands	DD-AFW1	Low woodland of *Acacia aptaneura/ A. caesaneura* over open low scrub of *Eremophila latrobei* subsp. *latrobei* and dwarf scrub of *Eremophila gilesii/ Eremophila malacoides* with occasional *Eragrostis eriopoda* in drainage depression	8	0.1	0	0

Landform	NVIS Vegetation Group	Code	Vegetation Community	Survey Area (15,200 ha)		Development Envelope (14,020 ha)	
				Area (ha)	Area (%)	Area (ha)	Area (%)
	Acacia Open Woodlands	DD-AOW1	Open low woodland of *Acacia incurvaneura* over dwarf scrub of *Maireana pyramidata* and low heath of *Frankenia georgei/ Sclerolaena densiflora* in drainage depression	14	0.1	0	0
		DD-AOW2	Open low woodland of *Acacia caesaneura/A. macraneura/A. ayersiana* over low scrub of *A. ramulosa* var. *ramulosa/Eremophila forrestii* subsp. *forrestii/ Eremophila margarethae/ Maireana triptera* and open low grass of *Eragrostis laniflora* in drainage depression	36	0.2	73	0.5
	Mallee Woodlands and Shrublands	DD-MWS1	Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression	213	1.4	336	2.4
Quartz/Rocky Plain	Acacia Forests and Woodlands	QRP-AFW1	Low woodland of *Acacia aptaneura/ A. caesaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus/ Maireana triptera* on quartz/rocky plain	13	0.1	9	0.1
		QRP-AFW2	Low woodland of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei* and low heath of *Eremophila exilifolia* on quartz/rocky plain	21	0.1	113	0.8
		QRP-AFW7	Forest of *Acacia caesaneura/ A. incurvaneura* over low scrub of *Eremophila latrobei* subsp. *glabra/ Prostanthera campbellii* and very open low grass of *Eragrostis eriopoda*/ open hummock grass of *Triodia irritans* quartz/rocky plain	30	0.2	193	1.4
		QRP-AFW8	Open low woodland of *Acacia caesaneura* over low scrub of *A. grasbyi/ Senna artemisioides* subsp. *filifolia* and low heath of *Scaevola spinescens* on quartz/rocky plain	10	0.1	11	0.1
	Casuarina Forests and Woodlands	QRP-CFW2	Low woodland of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain	411	2.7	463	3.3
	Mallee Woodlands and Shrublands	QRP-MWS1	Open tree mallee of *Eucalyptus gypsophila* over low scrub of *Acacia burkittii* and open hummock grass of *Triodia irritans* on quartz/rocky plain	241	1.6	215	1.5
		QRP-MWS2	Low woodland of *Eucalyptus lucasii* over heath of *Acacia colletioides/ Eremophila scoparia* and open low grass of *Eragrostis pergracilis*/ hummock grass of *Triodia irritans* on quartz/ rocky plain	56	0.4	42	0.3
Sand Dune	Eucalypt Woodlands/Mallee Woodlands and Shrublands	SD-EW/MWS1	Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune	221	1.5	1090	7.8
	Mallee Woodlands and Shrublands	SD-MWS1	Very open tree mallee of *Eucalyptus youngiana* over scrub of *Grevillea juncifolia* subsp. *juncifolia* and dwarf scrub of *Aluta maisonneuvei* subsp. *auriculata*/ hummock grass of *Triodia basedowii* on sand dune	832	5.5	375	2.7
Sand-Loam Plain	Acacia Forests and Woodlands	SLP-AFW1	Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain	763	5.0	572	4.1

Landform	NVIS Vegetation Group	Code	Vegetation Community	Survey Area (15,200 ha)		Development Envelope (14,020 ha)	
				Area (ha)	Area (%)	Area (ha)	Area (%)
		SLP-AFW2	Forest of *Acacia caesaneura* over heath of *Cratystylis subspinescens* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain	267	1.8	75	0.5
	Regrowth, modified native vegetation	SLP-RMNV1	Regrowth open tree mallee of *Eucalyptus ?concinna/ E. ?mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain	241	1.6	250	1.8
Sandplain	Acacia Forests and Woodlands	S-AFW1	Low forest of *Acacia caesaneura/ A. incurvaneura* over dense hummock grass of *Triodia basedowii* in sandplain	957	6.3	952	6.8
		S-AFW2	Low forest of *Acacia caesaneura/ A. incurvaneura* over low scrub of mixed shrubs and dwarf scrub of *Eremophila gilesii/* open hummock grass of *Triodia irritans* in sandplain	435	2.9	511	3.6
		S-AFW3	Low woodland of *Acacia incurvaneura/ Hakea lorea* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* in sandplain	557	3.7	359	2.6
		S-AFW4	Low woodland of *Acacia caesaneura/ A. incurvaneura* over dwarf scrub of *Eremophila forrestii* subsp. *forrestii* and mid-dense hummock grass of *Triodia irritans* in sandplain	43	0.3	209	1.5
		S-AFW5	Scrub of *Acacia grasbyi* over heath of *A. desertorum* and mid-dense hummock grass of *Triodia irritans* in sandplain	14	0.1	30	0.2
	Eucalypt Woodlands	S-EW1	Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain	692	4.6	844	6.0
	Eucalypt Woodlands/Mallee Woodlands and Shrublands	S-EW/MWS1	Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain	940	6.2	2071	14.8
		S-EW/MWS2	Low woodland of *Eucalyptus gongylocarpa* over open tree mallee of *Eucalyptus youngiana* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia basedowii* in sandplain	29	0.2	49	0.3
	Mallee Woodlands and Shrublands	S-MWS1	Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain	1525	10.0	2160	15.4
		S-MWS2	Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain	5	0.03	77	0.5
		S-MWS3	Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum/ A. grasbyi* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia irritans* in sandplain	3461	22.8	244	1.7
		S-MWS4	Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila latrobei* subsp. *glabra* and mid-dense hummock grass of *Triodia irritans* in sandplain	44	0.3	45	0.3

Landform	NVIS Vegetation Group	Code	Vegetation Community	Survey Area (15,200 ha)		Development Envelope (14,020 ha)	
				Area (ha)	Area (%)	Area (ha)	Area (%)
		S-MWS5	Open tree mallee of *Eucalyptus concinna/ E. mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain	452	3.0	575	4.1
		S-MWS10	Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain	112	0.7	145	1.0
		S-MWS11	Very open tree mallee of *Eucalyptus youngiana* over low heath of *Aluta maisonneuvei* subsp. *auriculata* and hummock grass of *Triodia basedowii* in sandplain	10	0.1	25	0.2
		S-MWS12	Very open tree mallee of *Eucalyptus leptopoda* subsp. *elevata/ E. youngiana*/ open scrub of *Grevillea pterosperma* over heath of *Aluta maisonneuvei* subsp. *auriculata* and mid-dense hummock grass of *Triodia basedowii* in sandplain	202	1.3	56	0.4
	Regrowth, modified native vegetation	S-RMNV3	Regrowth open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum/ Grevillea didymobotrya* subsp. *didymobotrya* and mid-dense hummock grass of *Triodia basedowii* in sandplain	585	3.8	270	1.9
		S-RMNV1	Regrowth open tree mallee of *Eucalyptus leptopoda* subsp. *elevata* over heath of *Aluta maisonneuvei* subsp. *auriculata* and low heath of *Leptosema chambersii*/ mid-dense hummock grass of *Triodia basedowii* in sandplain	220	1.4	480	3.4
		S-RMNV2	Regrowth open tree mallee of *Eucalyptus trivalva* over very open shrub mallee of *E. youngiana* and low heath of *Alyogyne pinoniana/ Sida calyxhymenia* in sandplain	285	1.9	160	1.1
Total				**15,200**	**100**	**14,020**	**100**

Clay-Loam Plain: Acacia Forests and Woodlands

4.3.1 Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus* on clay-loam plain (CLP-AFW1)

The total flora recorded within this vegetation community was represented by a total of 18 Families, 28 Genera and 49 Taxa (Plate 1). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 11. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 11: Vegetation assemblage for Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia caesaneura* *Acacia aptaneura* *Acacia incurvaneura*
Shrub 1.5-2m	30-70%	*Senna artemisioides* subsp. x *artemisioides* *Senna artemisioides* subsp. *helmsii*
Shrub 0.5-1m	30-70%	*Ptilotus obovatus*

Plate 1: Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus* on clay-loam plain

Clay-Loam Plain: Acacia Shrublands

4.3.2 Scrub of *Acacia burkittii* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus/* low grass of *Aristida contorta* on clay-loam plain (CLP-AS1)

The total flora recorded within this vegetation community was represented by a total of 19 Families, 28 Genera and 46 Taxa (Plate 2). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 12. According to the NVIS, this vegetation community is best represented by the MVG16- Acacia Shrublands (DotE, 2015b).

Table 12: Vegetation assemblage for Scrub of *Acacia burkittii* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus/* low grass of *Aristida contorta* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub >2m	10-30%	*Acacia burkittii*
Shrub 1.5-2m	10-30%	*Senna artemisioides* subsp. *filifolia*
Shrub <0.5m	10-30%	*Ptilotus obovatus*
Bunch Grass <0.5	30-70%	*Aristida contorta*

Plate 2: Scrub of *Acacia burkittii* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus/* low grass of *Aristida contorta* on clay-loam plain

Clay-Loam Plain: Mallee Open Woodlands and Sparse Mallee Shrublands

4.3.3 Very open tree mallee of *Eucalyptus lucasii/* low woodland of *Acacia caesaneura/ A. incurvaneura* over heath of *Eremophila latrobei* subsp. *glabra* and very open low grass of *Eragrostis eriopoda* on clay-loam plain (CLP-MOW/SMS1)

The total flora recorded within this vegetation community was represented by a total of 18 Families, 28 Genera and 45 Taxa (Plate 3). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 13. According to the NVIS, this vegetation community is best represented by the MVG32- Mallee Open Woodlands and Sparse Mallee Shrublands (DotE, 2015b). This vegetation community is not located within the proposed development envelope.

Table 13: Vegetation assemblage for Very open tree mallee of *Eucalyptus lucasii/* low woodland of *Acacia caesaneura/ A. incurvaneura* over heath of *Eremophila latrobei* subsp. *glabra* and very open low grass of *Eragrostis eriopoda* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	2-10%	*Eucalyptus lucasii*
Tree <5m	10-30%	*Acacia caesaneura* *Acacia incurvaneura*
Shrub 1.5-2m	30-70%	*Eremophila latrobei* subsp. *glabra*
Bunch Grass <0.5m	10-30%	*Eragrostis eriopoda*

Plate 3: Very open tree mallee of *Eucalyptus lucasii/* low woodland of *Acacia caesaneura/ A. incurvaneura* over heath of *Eremophila latrobei* subsp. *glabra* and very open low grass of *Eragrostis eriopoda* on clay-loam plain

Closed Depression – Acacia Forests and Woodlands

4.3.4 Open low woodland of *Acacia caesaneura* over open dwarf scrub of *Eremophila maculata* subsp. *brevifolia* and low heath of *Frankenia interioris* var. *parviflora* in playa (CD-AFW1)

The total flora recorded within this vegetation community was represented by a total of 8 Families, 13 Genera and 16 Taxa (Plate 4). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 14. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 14: Vegetation assemblage for Open low woodland of *Acacia caesaneura* over open dwarf scrub of *Eremophila maculata* subsp. *brevifolia* and low heath of *Frankenia interioris* var. *parviflora* in playa

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia caesaneura*
Shrub 0.5-1m	2-10%	*Eremophila maculata* subsp. *brevifolia*
Shrub <0.5m	30-70%	*Frankenia interioris* var. *parviflora*

Plate 4: Open low woodland of *Acacia caesaneura* over open dwarf scrub of *Eremophila maculata* subsp. *brevifolia* and low heath of *Frankenia interioris* var. *parviflora* in playa

4.3.5 Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa (CD-AFW2)

The total flora recorded within this vegetation community was represented by a total of 5 Families, 9 Genera and 13 Taxa (5). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were identified within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 14. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b). This vegetation community is not located within the proposed development envelope.

Table 15: **Vegetation assemblage for Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia aptaneura* *Acacia incurvaneura*
Shrub >2m	10-30%	*Acacia tetragonophylla* *Melaleuca interioris*
Bunch Grass <0.5m	30-70%	*Eragrostis falcata*

Plate 5: Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa

<u>Closed Depression – Casuarina Forest and Woodlands/ Eucalypt Woodlands</u>

4.3.6 Open tree mallee of *Eucalyptus gypsophila*/ low woodland of *Casuarina pauper* over low scrub of *Melaleuca interioris* and open hummock grass of *Triodia basedowii* on playa edge (CD-CFS/MWS1)

The total flora recorded within this vegetation community was represented by a total of 8 Families, 13 Genera and 18 Taxa (6). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 16. According to the NVIS, this vegetation community is best represented by the MVG8-Casuarina Forests and Woodlands and MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 16: Vegetation assemblage for Open tree mallee of *Eucalyptus gypsophila*/ low woodland of *Casuarina pauper* over low scrub of *Melaleuca interioris* and open hummock grass of *Triodia basedowii* on playa edge

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus gypsophila*
Tree 5-15m	10-30%	*Casuarina pauper*
Shrub 1-1.5m	10-30%	*Melaleuca interioris*
Hummock Grass	2-10%	*Triodia basedowii*

Plate 6: Open tree mallee of *Eucalyptus gypsophila*/ low woodland of *Casuarina pauper* over low scrub of *Melaleuca interioris* and open hummock grass of *Triodia basedowii* on playa edge

Closed Depression - Chenopod Shrublands, Samphire Shrublands and Forblands

4.3.7 Low heath of *Tecticornia undulata/ T. halocnemoides* on playa (CD-CSSSF1)

The total flora recorded within this vegetation community was represented by a total of 2 Families, 2 Genera and 4 Taxa (Plate 7). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 17. According to the NVIS, this vegetation community is best represented by the MVG22- Chenopod Shrublands, Samphire Shrublands and Forblands (DotE, 2015b).

Table 17: Vegetation assemblage Low heath of *Tecticornia undulata/ T. halocnemoides* on playa

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub <0.5m	30-70%	*Tecticornia undulata* *Tecticornia halocnemoides*

Plate 7: Low heath of *Tecticornia undulata/ T. halocnemoides* on playa

Closed Depression – Mallee Woodlands and Shrublands

4.3.8 Very open tree mallee of *Eucalyptus gypsophila* over open low scrub of *Eremophila scoparia* and dwarf scrub of *Atriplex bunburyana* on playa edge (CD-MWS1)

The total flora recorded within this vegetation community was represented by a total of 9 Families, 10 Genera and 10 Taxa (Plate 8). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 18. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 18: Vegetation assemblage for Very open tree mallee of *Eucalyptus gypsophila* over open low scrub of *Eremophila scoparia* and dwarf scrub of *Atriplex bunburyana* on playa edge

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	2-10%	*Eucalyptus gypsophila*
Shrub 1-1.5m	2-10%	*Eremophila scoparia*
Shrub <0.5m	10-30%	*Atriplex bunburyana*

Plate 8: Very open tree mallee of *Eucalyptus gypsophila* over open low scrub of *Eremophila scoparia* and dwarf scrub of *Atriplex bunburyana* on playa edge

Drainage Depression – Acacia Forests and Woodlands

4.3.9 Low woodland of *Acacia aptaneura/ A. caesaneura* over open low scrub of *Eremophila latrobei* subsp. *latrobei* and dwarf scrub of *Eremophila gilesii/ Eremophila malacoides* with occasional *Eragrostis eriopoda* in drainage depression (DD-AFW1)

The total flora recorded within this vegetation community was represented by a total of 19 Families, 31 Genera and 54 Taxa (Plate 9). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 19. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b). This vegetation community is not located within the proposed development envelope.

Table 19: Vegetation assemblage for Low woodland of *Acacia aptaneura/ A. caesaneura* over open low scrub of *Eremophila latrobei* subsp. *latrobei* and dwarf scrub of *Eremophila gilesii/ Eremophila malacoides* with occasional *Eragrostis eriopoda* in drainage depression

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia aptaneura* *Acacia caesaneura*
Shrub 1.5-2m	2-10%	*Eremophila latrobei* subsp. *latrobei*
Shrub <0.5m	10-30%	*Eremophila gilesii* *Eremophila malacoides*
Bunch Grass <0.5m	2-10%	*Eragrostis eriopoda*

Plate 9: Low woodland of *Acacia aptaneura/ A. caesaneura* over open low scrub of *Eremophila latrobei* subsp. *latrobei* and dwarf scrub of *Eremophila gilesii/ Eremophila malacoides* with occasional *Eragrostis eriopoda* in drainage depression

Drainage Depression: Acacia Open Woodlands

4.3.10 Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in drainage depression (DD-AOW1)

The total flora recorded within this vegetation community was represented by a total of 10 Families, 17 Genera and 29 Taxa (Plate 10). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 20. According to the NVIS, this vegetation community is best represented by the MVG13- Acacia Open Woodlands (DotE, 2015b). This vegetation community is not located within the proposed development envelope.

Table 20: Vegetation assemblage for Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in drainage depression

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia aptaneura* *Acacia caesaneura*
Shrub >2m	10-30%	*Acacia tetragonophylla* *Melaleuca interioris*
Bunch Grass <0.5m	10-30%	*Eragrostis falcata*

Plate 10: Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in drainage depression

4.3.11 Open low woodland of *Acacia caesaneura/A. macraneura/A. ayersiana* over low scrub of *A. ramulosa* var. *ramulosa/Eremophila forrestii* subsp. *forrestii/ Eremophila margarethae/ Maireana triptera* and open low grass of *Eragrostis laniflora* in drainage depression (DD-AOW2)

The total flora recorded within this vegetation community was represented by a total of 18 Families, 27 Genera and 51 Taxa (Plate 11). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 21. According to the NVIS, this vegetation community is best represented by the MVG13- Acacia Open Woodlands (DotE, 2015b).

Table 21: Vegetation assemblage for Open low woodland of *Acacia caesaneura/A. macraneura/A. ayersiana* over low scrub of *A. ramulosa* var. *ramulosa/Eremophila forrestii* subsp. *forrestii/ Eremophila margarethae/ Maireana triptera* and open low grass of *Eragrostis laniflora* in drainage depression

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Acacia ayersiana* *Acacia caesaneura* *Acacia macraneura*
Shrub 1-1.5m	10-30%	*Acacia ramulosa var. ramulosa* *Eremophila forrestii* subsp. *forrestii* *Eremophila margarethae* *Maireana triptera*
Bunch Grass <0.5m	10-30%	*Eragrostis laniflora*

Plate 11: Open low woodland of *Acacia caesaneura/A. macraneura/A. ayersiana* over low scrub of *A. ramulosa* var. *ramulosa/Eremophila forrestii* subsp. *forrestii/ Eremophila margarethae/ Maireana triptera* and open low grass of *Eragrostis laniflora* in drainage depression

Drainage Depression: Mallee Woodlands and Shrublands

4.3.12 Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1)

The total flora recorded within this vegetation community was represented by a total of 10 Families, 16 Genera and 22 Taxa (Plate 12). No Threatened or Priority Flora taxa were identified within this vegetation community. One introduced taxa were recorded within this vegetation community; *Cenchrus ciliaris* (Buffel Grass). Dominant taxa from the vegetation assemblage are shown in Table 22. According to the NVIS, this vegetation community is best represented by the MVG14-Mallee Woodlands and Shrublands (DotE, 2015b).

Table 22: Vegetation assemblage for Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna*
Shrub 1-1.5m	10-30%	*Melaleuca interioris*
Bunch Grass <0.5m	30-70%	*Eragrostis pergracilis*

Plate 12: Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression

<u>Quartz/Rocky Plain: Acacia Forests and Woodlands</u>

4.3.13 Low woodland of *Acacia aptaneura/ A. caesaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus/ Maireana triptera* on quartz/rocky plain (QRP-AFW1)

The total flora recorded within this vegetation community was represented by a total of 18 Families, 27 Genera and 59 Taxa (Plate 13). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 23. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 23: Vegetation assemblage for Low woodland of *Acacia aptaneura/ A. caesaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus/ Maireana triptera* on quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia aptaneura* *Acacia caesaneura* *Acacia incurvaneura*
Shrub 1.5-2m	30-70%	*Senna artemisioides* subsp. x *artemisioides* *Senna artemisioides* subsp. *helmsii*
Shrub <0.5m	30-70%	*Ptilotus obovatus* *Maireana triptera*

Plate 13: Low woodland of *Acacia aptaneura/ A. caesaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus/ Maireana triptera* on quartz/rocky plain

4.3.14 Low woodland of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei* and low heath of *Eremophila exilifolia* on quartz/rocky plain (QRP-AFW2)

The total flora recorded within this vegetation community was represented by a total of 22 Families, 30 Genera and 47 Taxa (Plate 14). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 24. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 24: Vegetation assemblage for Low woodland of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei* and low heath of *Eremophila exilifolia* on quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia incurvaneura*
Shrub 1-1.5m	30-70%	*Eremophila latrobei* subsp. *latrobei*
Shrub <0.5m	10-30%	*Eremophila exilifolia*

Plate 14: Low woodland of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei* and low heath of *Eremophila exilifolia* on quartz/rocky plain

4.3.15 Forest of *Acacia caesaneura/ A. incurvaneura* over low scrub of *Eremophila latrobei* subsp. *glabra/ Prostanthera campbellii* and very open low grass of *Eragrostis eriopoda/* open hummock grass of *Triodia irritans* quartz/rocky plain (QRP-AFW7)

The total flora recorded within this vegetation community was represented by a total of 6 Families, 7 Genera and 17 Taxa (Plate 15). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 25. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 25: Vegetation assemblage for Forest of *Acacia caesaneura/ A. incurvaneura* over low scrub of *Eremophila latrobei* subsp. *glabra/ Prostanthera campbellii* and very open low grass of *Eragrostis eriopoda/* open hummock grass of *Triodia irritans* quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Acacia caesaneura* *Acacia incurvaneura*
Shrub 1-1.5m	10-30%	*Eremophila latrobei* subsp. *glabra* *Prostanthera campbellii*
Bunch Grass <0.5m	2-10%	*Eragrostis eriopoda*
Hummock Grass	2-10%	*Triodia irritans*

Plate 15: Forest of *Acacia caesaneura/ A. incurvaneura* over low scrub of *Eremophila latrobei* subsp. *glabra/ Prostanthera campbellii* and very open low grass of *Eragrostis eriopoda/* open hummock grass of *Triodia irritans* quartz/rocky plain

4.3.16 Open low woodland of *Acacia caesaneura* over low scrub of *A. grasbyi/ Senna artemisioides* subsp. *filifolia* and low heath of *Scaevola spinescens* on quartz/rocky plain (QRP-AFW8)

The total flora recorded within this vegetation community was represented by a total of 11 Families, 14 Genera and 24 Taxa (Plate 16). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 26. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 26: Vegetation assemblage for Open low woodland of *Acacia caesaneura* over low scrub of *A. grasbyi/ Senna artemisioides* subsp. *filifolia* and low heath of *Scaevola spinescens* on quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Acacia caesaneura*
Shrub 1-1.5m	10-30%	*Acacia grasbyi* *Senna artemisioides* subsp. *filifolia*
Shrub <0.5m	30-70%	*Scaevola spinescens* *Ptilotus obovatus*

Plate 16: Open low woodland of *Acacia caesaneura* over low scrub of *A. grasbyi/ Senna artemisioides* subsp. *filifolia* and low heath of *Scaevola spinescens* on quartz/rocky plain

Quarts/Rocky Plain: Casuarina Forests and Woodlands

4.3.17 Low woodland of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain (QRP-CFW2)

The total flora recorded within this vegetation community was represented by a total of 16 Families, 23 Genera and 36 Taxa (Plate 17). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 27. According to the NVIS, this vegetation community is best represented by the MVG8- Casuarina Forests and Woodlands (DotE, 2015b).

Table 27: Vegetation assemblage for Low woodland of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Casuarina pauper*
Shrub 1-1.5.	10-30%	*Acacia burkittii*
Shrub <0.5m	10-30%	*Ptilotus obovatus*

Plate 17: Low woodland of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain

Quartz/Rocky Plain: Mallee Woodlands and Shrublands

4.3.18 Open tree mallee of *Eucalyptus gypsophila* over low scrub of *Acacia burkittii* and open hummock grass of *Triodia irritans* on quartz/rocky plain (QRP-MWS1)

The total flora recorded within this vegetation community was represented by a total of 10 Families, 11 Genera and 19 Taxa (Plate 18). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 28. According to the NVIS, this vegetation community is best represented by the MVG14-Mallee Woodlands and Shrublands (DotE, 2015b).

Table 28: Vegetation assemblage for Open tree mallee of *Eucalyptus gypsophila* over low scrub of *Acacia burkittii* and open hummock grass of *Triodia irritans* on quartz/rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus gypsophila*
Shrub 1-1.5m	10-30%	*Acacia burkittii*
Hummock Grass	10-30%	*Triodia basedowii*

Plate 18: Open tree mallee of *Eucalyptus gypsophila* over low scrub of *Acacia burkittii* and open hummock grass of *Triodia irritans* on quartz/rocky plain

4.3.19 Open tree mallee of *Eucalyptus lucasii* over heath of *Acacia colletioides/ Eremophila scoparia* and open low grass of *Eragrostis pergracilis*/ hummock grass of *Triodia irritans* on quartz/ rocky plain (QRP-MWS2)

The total flora recorded within this vegetation community was represented by a total of 12 Families, 17 Genera and 22 Taxa (Plate 19). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 29. According to the NVIS, this vegetation community is best represented by the MVG14-Mallee Woodlands and Shrublands (DotE, 2015b).

Table 29: Vegetation assemblage for Open tree mallee of *Eucalyptus lucasii* over heath of *Acacia colletioides/ Eremophila scoparia* and open low grass of *Eragrostis pergracilis*/ hummock grass of *Triodia irritans* on quartz/ rocky plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus lucasii*
Shrub 1.5-2m	30-70%	*Acacia colletioides* *Eremophila scoparia*
Bunch Grass <0.5m	10-30%	*Eragrostis pergracilis*
Hummock Grass	10-30%	*Triodia irritans*

Plate 19: Open tree mallee of *Eucalyptus lucasii* over heath of *Acacia colletioides/ Eremophila scoparia* and open low grass of *Eragrostis pergracilis*/ hummock grass of *Triodia irritans* on quartz/ rocky plain

Sand Dune: Eucalypt Woodlands/ Mallee Woodlands and Shrublands

4.3.20 Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune (SD-EW/MWS1)

The total flora recorded within this vegetation community was represented by a total of 24 Families, 38 Genera and 55 Taxa (Plate 20). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 30. According to the NVIS, this vegetation community is best represented by the MVG5-Eucalypt Woodlands and MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 30: Vegetation assemblage for Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	2-10%	*Eucalyptus gongylocarpa*
Mallee Shrub Form	10-30%	*Eucalyptus youngiana*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 20: Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune

This vegetation community is in various stages of regrowth (Plate 21) as it has been affected by multiple fire events in 2009, 2012 and 2013 within the Anne Beadell Borefield and the access track from Gruyere to the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 21: Fire affected Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune

Sand Dune: Mallee Woodlands and Shrublands

4.3.21 Very open tree mallee of *Eucalyptus youngiana* over scrub of *Grevillea juncifolia* subsp. *juncifolia* and dwarf scrub of *Aluta maisonneuvei* subsp. *auriculata*/ hummock grass of *Triodia basedowii* on sand dune (SD-MWS1)

The total flora recorded within this vegetation community was represented by a total of 13 Families, 17 Genera and 19 Taxa (Plate 22). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 31. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 31: Vegetation assemblage for Very open tree mallee of *Eucalyptus youngiana* over scrub of *Grevillea juncifolia* subsp. *juncifolia* and dwarf scrub of *Aluta maisonneuvei* subsp. *auriculata*/ hummock grass of *Triodia basedowii* on sand dune

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	2-10%	*Eucalyptus youngiana*
Shrub >2m	10-30%	*Grevillea juncifolia* subsp. *juncifolia*
Shrub <0.5m	10-30%	*Aluta maisonneuvei* subsp. *auriculata*
Hummock Grass	10-30%	*Triodia basedowii*

Plate 22: Very open tree mallee of *Eucalyptus youngiana* over scrub of *Grevillea juncifolia* subsp. *juncifolia* and dwarf scrub of *Aluta maisonneuvei* subsp. *auriculata*/ hummock grass of *Triodia basedowii* on sand dune

Sand-Loam Plain: Acacia Forest and Woodlands

4.3.22 Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain (SLP-AFW1)

The total flora recorded within this vegetation community was represented by a total of 14 Families, 21 Genera and 36 Taxa (Plate 23). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 32. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 32: Vegetation assemblage for Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia caesaneura*
Shrub 1.5-2m	10-30%	*Senna artemisioides* subsp. *filifolia*
Hummock Grass	30-70%	*Triodia irritans*

Plate 23: Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain

This vegetation community is in various stages of regrowth (Plate 24) as it has been affected by multiple fire events in 2013 within the central section of the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 24: Fire affected Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain

4.3.23 Forest of *Acacia caesaneura* over heath of *Cratystylis subspinescens* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain (SLP-AFW2)

The total flora recorded within this vegetation community was represented by a total of 7 Families, 12 Genera and 20 Taxa (Plate 25). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 33. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 33: Vegetation assemblage for Forest of *Acacia caesaneura* over heath of *Cratystylis subspinescens* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	30-70%	*Acacia caesaneura*
Shrub 1-1.5m	30-70%	*Cratystylis subspinescens*
Hummock Grass	30-70%	*Triodia irritans*

Plate 25: Forest of *Acacia caesaneura* over heath of *Cratystylis subspinescens* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain

Sandplain: Acacia Forests and Woodlands

4.3.24 Low forest of *Acacia caesaneura*/ *A. incurvaneura* over dense hummock grass of *Triodia basedowii* in (S-AFW1)

The total flora recorded within this vegetation community was represented by a total of 18 Families, 28 Genera and 43 Taxa (Plate 26). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 34. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 34: Vegetation assemblage for Low forest of *Acacia caesaneura*/ *A. incurvaneura* over dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <5m	30-70%	*Acacia caesaneura* *Acacia incurvaneura*
Hummock Grass	70-100%	*Triodia basedowii*

Plate 26: Low forest of *Acacia caesaneura*/ *A. incurvaneura* over dense hummock grass of *Triodia basedowii* in sandplain

This vegetation community is in various stages of regrowth (Plate 27) as it has been affected by multiple fire events in 2012 and 2013 within the central and southern sections of the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 27: Fire affected Low forest of *Acacia caesaneura*/ *A. incurvaneura* over dense hummock grass of *Triodia basedowii* in sandplain

4.3.25 Low forest of *Acacia caesaneura*/ *A. incurvaneura* over low scrub of mixed shrubs and dwarf scrub of *Eremophila gilesii*/ open hummock grass of *Triodia irritans* in sandplain (S-AFW2)

The total flora recorded within this vegetation community was represented by a total of 17 Families, 27 Genera and 35 Taxa (Plate 28). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 35. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 35: Vegetation assemblage for Low forest of *Acacia caesaneura*/ *A. incurvaneura* over low scrub of mixed shrubs and dwarf scrub of *Eremophila gilesii*/ open hummock grass of *Triodia irritans* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <5m	30-70%	*Acacia caesaneura* *Acacia incurvaneura*
Shrub 1-1.5m	10-30%	*Eremophila latrobei* subsp. *glabra* *Sida calyxhymenia* *Scaevola spinescens*
Shrub <0.5m	10-30%	*Eremophila gilesii*
Hummock Grass	2-10%	*Triodia irritans*

Plate 28: Low forest of *Acacia caesaneura*/ *A. incurvaneura* over low scrub of mixed shrubs and dwarf scrub of *Eremophila gilesii*/ open hummock grass of *Triodia irritans* in sandplain

4.3.26 Low woodland of *Acacia incurvaneura/ Hakea lorea* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-AFW3)

The total flora recorded within this vegetation community was represented by a total of 11 Families, 17 Genera and 24 Taxa (Plate 29). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 36. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 36: Vegetation assemblage for Low woodland of *Acacia incurvaneura/ Hakea lorea* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Acacia caesaneura* *Hakea lorea*
Shrub 1-1.5m	30-70%	*Melaleuca interioris*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 29: Low woodland of *Acacia incurvaneura/ Hakea lorea* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* in sandplain

This vegetation community is in various stages of regrowth (Plate 30) as it has been affected by multiple fire events in 2012 and 2013 within the Anne Beadell Borefield and the Northern section of the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 30: Fire affected Low woodland of *Acacia incurvaneura/ Hakea lorea* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* in sandplain

4.3.27 Low woodland of *Acacia caesaneura/ A. incurvaneura* over dwarf scrub of *Eremophila forrestii* subsp. *forrestii* and mid-dense hummock grass of *Triodia irritans* in sandplain (S-AFW4)

The total flora recorded within this vegetation community was represented by a total of 20 Families, 26 Genera and 36 Taxa (Plate 31). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 37. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 37: Vegetation assemblage for Low woodland of *Acacia caesaneura/ A. incurvaneura* over dwarf scrub of *Eremophila forrestii* subsp. *forrestii* and mid-dense hummock grass of *Triodia irritans* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <5m	10-30%	*Acacia caesaneura* *Acacia incurvaneura*
Shrub 0.5-1m	10-30%	*Eremophila forrestii* subsp. *forrestii*
Hummock Grass	30-70%	*Triodia irritans*

Plate 31: woodland of *Acacia aptaneura/ A. caesaneura/ A. incurvaneura* over open low scrub of *A. ramulosa* var. *ramulosa/ Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus/* open low grass of *Eragrostis eriopoda* on quartz/ rocky plain

4.3.28 Scrub of *Acacia grasbyi* over heath of *A. desertorum* and mid-dense hummock grass of *Triodia irritans* in sandplain (S-AFW5)

The total flora recorded within this vegetation community was represented by a total of 3 Families, 6 Genera and 9 Taxa (Plate 32). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 38. According to the NVIS, this vegetation community is best represented by the MVG6-Acacia Forests and Woodlands (DotE, 2015b).

Table 38: Vegetation assemblage for Scrub of *Acacia grasbyi* over heath of *A. desertorum* and mid-dense hummock grass of *Triodia irritans* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub >2m	10-30%	*Acacia grasbyi*
Shrub 1-1.5m	30-70%	*Acacia desertorum*
Hummock Grass	30-70%	*Triodia irritans*

Plate 32: Scrub of *Acacia grasbyi* over heath of *A. desertorum* and mid-dense hummock grass of *Triodia irritans* in sandplain

Sandplain: Eucalypt Woodland

4.3.29 Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain (S-EW1)

The total flora recorded within this vegetation community was represented by a total of 19 Families, 30 Genera and 46 Taxa (Plate 33). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 39. According to the NVIS, this vegetation community is best represented by the MVG5-Eucalypt Woodland

Table 39: Vegetation assemblage for Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus gongylocarpa*
Shrub 1.5-2m	30-70%	*Acacia ligulata*
Hummock Grass	70-100%	*Triodia basedowii*

Plate 33: Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain

This vegetation community is in various stages of regrowth (Plate 34) as it has been affected by multiple fire events in 2012 within the Potable Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 34: Fire affected Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain

Sandplain: Eucalypt Woodlands/ Mallee Woodlands and Shrublands

4.3.30 Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-EW/MWS1)

The total flora recorded within this vegetation community was represented by a total of 22 Families, 35 Genera and 55 Taxa (Plate 35). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 40. According to the NVIS, this vegetation community is best represented by the MVG5- Eucalypt Woodlands and MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 40: Vegetation assemblage Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus gongylocarpa*
Mallee Shrub Form	30-70%	*Eucalyptus youngiana*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 35: Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain

This vegetation community is in various stages of regrowth (Plate 36) as it has been affected by multiple fire events in 2012 within the Anne Beadell Borefield and the southern section of the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 36: Fire affected Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain

4.3.31 Low woodland of *Eucalyptus gongylocarpa* over open tree mallee of *Eucalyptus youngiana* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia basedowii* in sandplain (S-EW/MWS2)

The total flora recorded within this vegetation community was represented by a total of 12 Families, 18 Genera and 26 Taxa (Plate 37). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 41. According to the NVIS, this vegetation community is best represented by the MVG5- Eucalypt Woodlands and MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 41: Vegetation assemblage for Low woodland of *Eucalyptus gongylocarpa* over open tree mallee of *Eucalyptus youngiana* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 5-15m	10-30%	*Eucalyptus gongylocarpa*
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
Shrub 1-1.5m	30-70%	*Aluta maisonneuvei* subsp. *auriculata*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 37: Low woodland of *Eucalyptus gongylocarpa* over open tree mallee of *Eucalyptus youngiana* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia basedowii* in sandplain

Sandplain – Mallee Woodlands and Shrublands

4.3.32 Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain (S-MWS1)

The total flora recorded within this vegetation community was represented by a total of 12 Families, 22 Genera and 40 Taxa (Plate 38). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 42. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 42: Vegetation assemblage for Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
Hummock Grass	70-100%	*Triodia basedowii*

Plate 38: Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain

This vegetation community is in various stages of regrowth (Plate 39) as it has been affected by multiple fire events in 2012 and 2013 within the Anne Beadell Borefield and the southern section of the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 39: Fire affected Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain

4.3.33 Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-MWS2)

The total flora recorded within this vegetation community was represented by a total of 17 Families, 26 Genera and 36 Taxa (Plate 40). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 43. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 43: Vegetation assemblage for Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
Shrub 1.5-2m	30-70%	*Acacia caesaneura*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 40: Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain

4.3.34 Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum/ A. grasbyi* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia irritans* in sandplain (S-MWS3)

The total flora recorded within this vegetation community was represented by a total of 15 Families, 24 Genera and 43 Taxa (Plate 41). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 44. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 44: Vegetation assemblage for Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum/ A. grasbyi* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia irritans* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
1-1.5m	30-70%	*Acacia desertorum* *Acacia grasbyi*
Shrub <0.5m	30-70%	*Aluta maisonneuvei* subsp. *auriculata*
Hummock Grass	30-70%	*Triodia irritans*

Plate 41: Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum/ A. grasbyi* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia irritans* in sandplain

4.3.35 Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila latrobei* subsp. *glabra* and mid-dense hummock grass of *Triodia irritans* in sandplain (S-MWS4)

The total flora recorded within this vegetation community was represented by a total of 15 Families, 21 Genera and 36 Taxa (Plate 42). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 45. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 45: Vegetation assemblage for Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila latrobei* subsp. *glabra* and mid-dense hummock grass of *Triodia irritans* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna*
Shrub 1-1.5m	10-30%	*Eremophila latrobei* subsp. *glabra*
Hummock Grass	30-70%	*Triodia irritans*

Plate 42: Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila latrobei* subsp. *glabra* and mid-dense hummock grass of *Triodia irritans* in sandplain

4.3.36 Open tree mallee of *Eucalyptus concinna/ E. mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain (S-MWS5)

The total flora recorded within this vegetation community was represented by a total of 15 Families, 21 Genera and 38 Taxa (Plate 43). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 46. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 46: Vegetation assemblage for Open tree mallee of *Eucalyptus concinna/ E. mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna* *Eucalyptus mannensis*
Shrub 1-1.5m	30-70%	*Acacia ligulata* *Senna artemisioides* subsp. *filifolia* *Senna artemisioides* subsp. x *artemisioides* *Scaevola spinescens*
Hummock Grass	10-30%	*Triodia basedowii*

Plate 43: Open tree mallee of *Eucalyptus concinna/ E. mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain

This vegetation community is in various stages of regrowth (Plate 44) as it has been affected by multiple fire events in 2012 and 2013 within the northern and central sections of the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 44: Fire affected Open tree mallee of *Eucalyptus concinna/ E. mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain

4.3.37 Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-MWS10)

The total flora recorded within this vegetation community was represented by a total of 15 Families, 23 Genera and 36 Taxa (Plate 45). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 47. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 47: Vegetation assemblage for Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus concinna*
Shrub 1.5-2m	30-70%	*Eremophila platythamnos* subsp. *platythamnos* *Olearia pimelioides* *Senna artemisioides* subsp. x *artemisioides* *Senna artemisioides* subsp. *filifolia*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 45: Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain

This vegetation community is in various stages of regrowth (Plate 46) as it has been affected by multiple fire events in 2013 within the northern section of the Yeo Borefield. Further details regarding fire regime in the area provided in Section 4.6.

Plate 46: Fire affected Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain

4.3.38 Very open tree mallee of *Eucalyptus youngiana* over low heath of *Aluta maisonneuvei* subsp. *auriculata* and hummock grass of *Triodia basedowii* in sandplain (S-MWS11)

The total flora recorded within this vegetation community was represented by a total of 5 Families, 7 Genera and 8 Taxa (Plate 47). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 48. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 48: Vegetation assemblage for Very open tree mallee of *Eucalyptus youngiana* over low heath of *Aluta maisonneuvei* subsp. *auriculata* and hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	2-10%	*Eucalyptus youngiana*
Shrub 1-1.5m	30-70%	*Aluta maisonneuvei* subsp. *auriculata*
Hummock Grass	10-30%	*Triodia basedowii*

Plate 47: Very open tree mallee of *Eucalyptus youngiana* over low heath of *Aluta maisonneuvei* subsp. *auriculata* and hummock grass of *Triodia basedowii* in sandplain

4.3.39 Very open tree mallee of *Eucalyptus leptopoda* subsp. *elevata/ E. youngiana*/ open scrub of *Grevillea pterosperma* over heath of *Aluta maisonneuvei* subsp. *auriculata* and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-MWS12)

The total flora recorded within this vegetation community was represented by a total of 10 Families, 16 Genera and 19 Taxa (Plate 48). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 49. According to the NVIS, this vegetation community is best represented by the MVG14- Mallee Woodlands and Shrublands (DotE, 2015b).

Table 49: Vegetation assemblage for Very open tree mallee of *Eucalyptus leptopoda* subsp. *elevata/ E. youngiana*/ open scrub of *Grevillea pterosperma* over heath of *Aluta maisonneuvei* subsp. *auriculata* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	2-10%	*Eucalyptus leptopoda* subsp. *elevata* *Eucalyptus youngiana*
Shrub >2m	2-10%	*Grevillea pterosperma*
Shrub 1-1.5m	30-70%	*Aluta maisonneuvei* subsp. *auriculata*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 48: Very open tree mallee of *Eucalyptus leptopoda* subsp. *elevata/ E. youngiana*/ open scrub of *Grevillea pterosperma* over heath of *Aluta maisonneuvei* subsp. *auriculata* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Sand Plain: Regrowth, Modified Native Vegetation

4.3.40 Regrowth open tree mallee of *Eucalyptus leptopoda* subsp. *elevata* over heath of *Aluta maisonneuvei* subsp. *auriculata* and low heath of *Leptosema chambersii*/ mid-dense hummock grass of *Triodia basedowii* in (S-RMNV1)

The total flora recorded within this vegetation community was represented by a total of 9 Families, 14 Genera and 20 Taxa (Plate 49). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 50. According to the NVIS, this vegetation community is best represented by the MVG29- Regrowth, modified native vegetation (DotE, 2015b).

Table 50: Vegetation assemblage for Regrowth open tree mallee of *Eucalyptus leptopoda* subsp. *elevata* over heath of *Aluta maisonneuvei* subsp. *auriculata* and low heath of *Leptosema chambersii*/ mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus leptopoda* subsp. *elevata*
Shrub <0.5m	30-70%	*Leptosema chambersii*
Hummock Grass	30-70%	*Triodia basedowii*

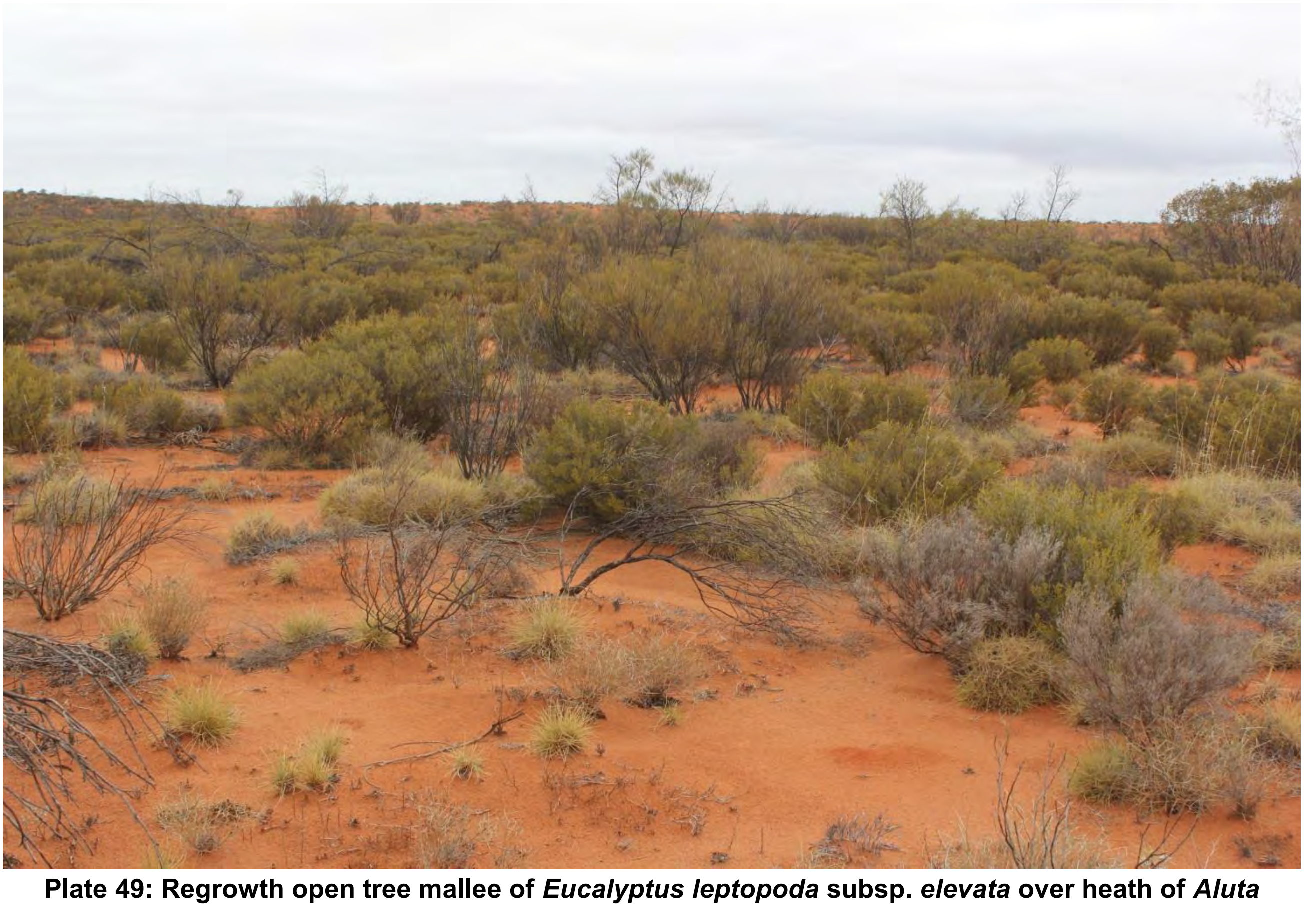


Plate 49: Regrowth open tree mallee of *Eucalyptus leptopoda* subsp. *elevata* over heath of *Aluta maisonneuvei* subsp. *auriculata* and low heath of *Leptosema chambersii*/ mid-dense hummock grass of *Triodia basedowii* in sandplain

4.3.41 Regrowth open tree mallee of *Eucalyptus trivalva* over very open shrub mallee of *E. youngiana* and low heath of *Alyogyne pinoniana/ Sida calyxhymenia* in sandplain (S-RMNV2)

The total flora recorded within this vegetation community was represented by a total of 11 Families, 15 Genera and 23 Taxa (Plate 50). No Threatened or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 51. According to the NVIS, this vegetation community is best represented by the MVG29- Regrowth, modified native vegetation (DotE, 2015b).

Table 51: Vegetation assemblage for Regrowth open tree mallee of *Eucalyptus trivalva* over very open shrub mallee of *E. youngiana* and low heath of *Alyogyne pinoniana/ Sida calyxhymenia* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus trivalva*
Shrub Mallee Form	2-10%	*Eucalyptus youngiana*
Shrub 1-1.5m	30-70%	*Alyogyne pinoniana* *Sida calyxhymenia*

Plate 50: Regrowth open tree mallee of *Eucalyptus trivalva* over very open shrub mallee of *E. youngiana* and low heath of *Alyogyne pinoniana/ Sida calyxhymenia* in sandplain

4.3.42 Regrowth Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum*/ *Grevillea didymobotrya* subsp. *didymobotrya* and mid-dense hummock grass of *Triodia basedowii* in sandplain (S-RMNV3)

The total flora recorded within this vegetation community was represented by a total of 8 Families, 13 Genera and 18 Taxa (Plate 51). No Threatened or Priority Flora taxa were identified within this vegetation community. One introduced taxon; *Cenchrus ciliaris* (Buffel Grass) was recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 52. According to the NVIS, this vegetation community is best represented by the MVG29- Regrowth, modified native vegetation (DotE, 2015b).

Table 52: Vegetation assemblage for Regrowth open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum*/ *Grevillea didymobotrya* subsp. *didymobotrya* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Mallee Tree Form	10-30%	*Eucalyptus youngiana*
Shrub 1-1.5m	30-70%	*Acacia desertorum* *Grevillea didymobotrya* subsp. *didymobotrya*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 51: Regrowth open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum*/ *Grevillea didymobotrya* subsp. *didymobotrya* and mid-dense hummock grass of *Triodia basedowii* in sandplain

Sand-Loam Plain: Regrowth, modified native vegetation

4.3.43 Regrowth open tree mallee of *Eucalyptus ?concinna/ E. ?mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain (SLP-RMNV1)

The total flora recorded within this vegetation community was represented by a total of 12 Families, 18 Genera and 21 Taxa (Plate 52). No Threatened Flora or Priority Flora taxa were identified within this vegetation community. No introduced taxa were recorded within this vegetation community. Dominant taxa from the vegetation assemblage are shown in Table 53. According to the NVIS, this vegetation community is best represented by the MVG29- Regrowth, modified native vegetation (DotE, 2015b).

Table 53: Vegetation assemblage for Regrowth open tree mallee of *Eucalyptus ?concinna/ E. ?mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree Mallee Form	10-30%	*Eucalyptus ?concinna* *Eucalyptus ?mannensis*
Shrub 1-1.5m	30-70%	*Melaleuca interioris*
Hummock Grass	30-70%	*Triodia basedowii*

Plate 52: Regrowth open tree mallee of *Eucalyptus ?concinna/ E. ?mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain

This vegetation community is in various stages of regrowth, the majority of the vegetation community has been affected by fire events, however part of the vegetation community within the central section of the Yeo Borefield has not been affected by fire (Plate 53).

Plate 53: Mature open tree mallee of *Eucalyptus concinna/ E. mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain

4.4 Fauna Habitat

The broad scale terrestrial fauna habitats within the survey area presented below are based on vegetation and associated landforms identified during the flora and vegetation assessment. The extent of the identified fauna habitats and a summary description of each are provided in Table 54 below.

Table 54: Main Terrestrial Fauna Habitats within the Gruyere Borefields Survey Area

No.	Fauna Habitat Description within survey area (15,200 ha)	Fauna Habitat Description within development envelope (14,020 ha)	Example Image
1	Clay-Loam Plains *Acacia* Forests and Woodlands, *Acacia* Shrublands, Mallee Open Woodlands and Sparse Mallee Shrublands Total Area = 598 ha (~3.9%)	Clay-Loam Plains *Acacia* Forests and Woodlands, *Acacia* Shrublands Total Area = 455 ha (~3.2%)	
2	Closed Depressions *Acacia* Forests and Woodlands, Casuarina Forests and Woodlands, Mallee Woodlands and Shrublands, Chenopod Shrublands, Samphire Shrublands and Forblands. Total Area = 657 ha (~4.3%)	Closed Depressions *Acacia* Forests and Woodlands, Casuarina Forests and Woodlands, Mallee Woodlands and Shrublands, Chenopod Shrublands, Samphire Shrublands and Forblands. Total Area = 486 ha (~3.5%)	

No.	Fauna Habitat Description within survey area (15,200 ha)	Fauna Habitat Description within development envelope (14,020 ha)	Example Image
3	Drainage Depressions *Acacia* Forests and Woodlands, *Acacia* Open Woodlands, Mallee Woodlands and Shrublands. Total Area = 271 ha (~1.8%)	Drainage Depressions *Acacia* Open Woodlands, Mallee Woodlands and Shrublands. Total Area = 409 ha (~2.9%)	
4	Quartz/Rocky Plains *Acacia* Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands. Total Area = 782 ha (~5.1%)	Quartz/Rocky Plains *Acacia* Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands. Total Area = 1046 ha (~7.5%)	
5	Sand Dunes Eucalypt Woodlands, Mallee Woodlands and Shrublands. Total Area = 1053 ha (~6.9%)	Sand Dunes Eucalypt Woodlands, Mallee Woodlands and Shrublands. Total Area = 1464 ha (~10.4%)	

No.	Fauna Habitat Description within survey area (15,200 ha)	Fauna Habitat Description within development envelope (14,020 ha)	Example Image
6	Sand-Loam Plains Acacia Forests and Woodlands, Regrowth, modified native vegetation. Total Area = 1271 ha (~8.4%)	Sand-Loam Plains Acacia Forests and Woodlands, Regrowth, modified native vegetation. Total Area = 897 ha (~6.4%)	
7	Sandplains Acacia Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands, Regrowth, modified native vegetation. Total Area = 10,568 ha (~69.5%)	Sandplains Acacia Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands, Regrowth, modified native vegetation. Total Area = 9,263 ha (~66.1%)	

4.4.1 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix 8. A total of 56 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the survey area over the three-day survey period. Evidence of four introduced species using the survey area was also gathered.

With respect to conservation significant species, evidence (back filled burrows) of the southern marsupial mole (P4 (DPaW Priority Species) was found at one location and the rainbow bee-eater (S5 (WC Act) and Migratory (EPBC Act)) was observed and heard at several locations.

4.4.2 Fauna Inventory-Vertebrate Fauna

Table 55 summarises the numbers of potential species based on vertebrate class considered likely to be present in the general vicinity of the survey area based on the complete list held Appendix 8.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. *EPBC Act's* Threatened Fauna and Migratory species lists, DPAW's NatureMap Fauna Database and various publications) are considered likely to be present within the survey area. The list of potential fauna takes into consideration that firstly the species in question is not known to be locally/regionally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the survey area, though compiling an accurate list has limitations.

Table 55: Summary of Potential Vertebrate Fauna Species

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species	Number of species observed Level 1 Survey
Amphibians	9	0	0	0	0
Reptiles	105	0	0	1	11
Birds	103	3	1	1	40
Non-Volant Mammals	29^{9}	1	0	1	9^{4}
Volant Mammals (Bats)	8	0	0	0	0
Total	**254^{9}**	**1**	**1**	**6**	**60^{4}**

Superscript = number of introduced species included in the total. Note: Where a species state and federal conservation status is different, the highest category is used.

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time only a subset of the listed potential species are likely to be present within the bounds of the study area.

4.5 Vegetation/ Habitat of Conservation Significance

None of the vegetation communities within the Gruyere Borefields survey area were found to have National Environmental Significance as defined by the Commonwealth *EPBC Act 1999*. There were no TECs or PECs listed under Commonwealth legislation or as defined by the DPaW identified within the survey area (DotE, 2015a; DPaW, 2015c).

Groundwater Dependent Ecosystems (GDE) includes biological assemblages of species such as wetlands or woodlands that use groundwater either opportunistically or as their primary water source. For the purposes of this report, a GDE is defined as any vegetation community that derives part of its water budget from groundwater and must be assumed to have some degree of groundwater dependency (Hatton and Evans 1998). Based on field observations and analysis of hydrological information from within the survey area, two vegetation communities are potentially GDE:

1. Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa (CD-AFW2); and
2. Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1).

Only one of these potential GDE communities is located within the proposed development envelope; DD-MWS1.

The survey area is not located within any ESA or Schedule 1 Area, as described in Regulation 6 and Schedule 1, clause 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

The survey area is not located within any DPaW managed land. However, the Yeo Lake Nature Reserve, which is listed as a Class A Nature Reserve managed by DPaW, is located approximately 700m to the east of the northern most extent of the Anne Beadell Borefield. The Yeo Lake Nature Reserve is also listed as an ESA and a Schedule 1 Area.

The Yeo Lake Nature Reserve is significant as it is biologically important for the different assemblage of plants and animals present. It comprises of some permanent and semi-permanent water holes in an otherwise arid region (DotE, 2015c). It is described as a system of salt lakes, with the floor of which is vegetated with rich variety of halophytes (some endemic). It includes gypsum ridges carrying *Casuarina cristata/Acacia colletioides* association that is unknown elsewhere in the desert. To the west, south-west and north are extensive sand plains and dunes interspersed with rocky hills and breakaways. The area is rich in reptiles (forty lizard species and three snake species) and is the type locality for several species. The sand areas dominated by spinifex, mallees, mulga and bara gum (DotE, 2015c).

A regional map of the survey area in relation to surrounding areas of conservation significance is provided in Appendix 6.

4.6 Vegetation/ Habitat Condition

Based on the vegetation health condition scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 7), twenty-nine vegetation communities had a ‘2’ health condition rating. The remaining fourteen vegetation communities had a ‘3’ health condition rating (Table 56 and Figure 9).

A health rating of 2 depicts that vegetation structure is intact, with disturbance affecting individual species and weeds are non-aggressive species. Damage to trees is caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.

A health rating of 3 depicts that vegetation structure is altered by obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Lightning derived fires are common within the Great Victoria Desert. The survey area has been subjected to major fire events in 2009, 2012 and 2013, with some section of the survey area subjected to multiple successional fires in 2012 and 2013 (Figure 10) (Sentinel, 2016). Thirteen vegetation communities within the survey area have been affected by the fire events, with three of these vegetation communities only existing within the survey area in a regrowth native vegetation status. Vegetation is likely to regenerate naturally over time.

Table 56: Health Rating of Vegetation Communities within the Gruyere Borefields survey area

Landform	NVIS Vegetation Group	Vegetation Community	Code	Health Rating
Clay-Loam Plain	Acacia Forests and Woodlands	Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus* on clay-loam plain	CLP-AFW1	2
	Acacia Shrublands	Scrub of *Acacia burkittii* over low scrub of *Senna artemisioides* subsp. *filifolia* and dwarf scrub of *Ptilotus obovatus/* low grass of *Aristida contorta* on clay-loam plain	CLP-AS1	2
	Mallee Open Woodlands and Sparse Mallee Shrublands	Very open tree mallee of *Eucalyptus lucasii/* low woodland of *Acacia caesaneura/ A. incurvaneura* over heath of *Eremophila latrobei* subsp. *glabra* and very open low grass of *Eragrostis eriopoda* on clay-loam plain	CLP-MOW/SMS1	2
Closed Depression	Acacia Forests and Woodlands	Open low woodland of *Acacia caesaneura* over open dwarf scrub of *Eremophila maculata* subsp. *brevifolia* and low heath of *Frankenia interioris* var. *parviflora* in playa	CD-AFW1	2
		Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa	CD-AFW2	3
	Casuarina Forests and Woodlands/ Mallee Woodlands and Shrublands	Open tree mallee of *Eucalyptus gypsophila*/ low woodland of *Casuarina pauper* over low scrub of *Melaleuca interioris* and open hummock grass of *Triodia basedowii* on playa edge	CD-CFS/MWS1	2
	Chenopod Shrublands, Samphire Shrublands and Forblands	Low heath of *Tecticornia undulata/ T. halocnemoides* on playa	CD-CSSSF1	3
	Mallee Woodlands and Shrublands	Very open tree mallee of *Eucalyptus gypsophila* over open low scrub of *Eremophila scoparia* and dwarf scrub of *Atriplex bunburyana* on playa edge	CD-MWS1	3
Drainage Depression	Acacia Forests and Woodlands	Low woodland of *Acacia aptaneura/ A. caesaneura* over open low scrub of *Eremophila latrobei* subsp. *latrobei* and dwarf scrub of *Eremophila gilesii/ Eremophila malacoides* with occasional *Eragrostis eriopoda* in drainage depression	DD-AFW1	2
	Acacia Open Woodlands	Open low woodland of *Acacia incurvaneura* over dwarf scrub of *Maireana pyramidata* and low heath of *Frankenia georgei/ Sclerolaena densiflora* in drainage depression	DD-AOW1	2
		Open low woodland of *Acacia caesaneura/A. macraneura/A. ayersiana* over low scrub of *A. ramulosa* var. *ramulosa/Eremophila forrestii* subsp. *forrestii/ Eremophila margarethae/ Maireana triptera* and open low grass of *Eragrostis laniflora* in drainage depression	DD-AOW2	3
	Mallee Woodlands and Shrublands	Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression	DD-MWS1	2

Landform	NVIS Vegetation Group	Vegetation Community	Code	Health Rating
Quartz/Rocky Plain	Acacia Forests and Woodlands	Low woodland of *Acacia aptaneura/ A. caesaneura/ A. incurvaneura* over heath of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low heath of *Ptilotus obovatus/ Maireana triptera* on quartz/rocky plain	QRP-AFW1	2
Quartz/Rocky Plain	Acacia Forests and Woodlands	Low woodland of *Acacia incurvaneura* over heath of *Eremophila latrobei* subsp. *latrobei* and low heath of *Eremophila exilifolia* on quartz/rocky plain	QRP-AFW2	2
Quartz/Rocky Plain	Acacia Forests and Woodlands	Forest of *Acacia caesaneura/ A. incurvaneura* over low scrub of *Eremophila latrobei* subsp. *glabra/ Prostanthera campbellii* and very open low grass of *Eragrostis eriopoda*/ open hummock grass of *Triodia irritans* quartz/rocky plain	QRP-AFW7	2
Quartz/Rocky Plain	Acacia Forests and Woodlands	Open low woodland of *Acacia caesaneura* over low scrub of *A. grasbyi/ Senna artemisioides* subsp. *filifolia* and low heath of *Scaevola spinescens* on quartz/rocky plain	QRP-AFW8	2
Quartz/Rocky Plain	Casuarina Forests and Woodlands	Low woodland of *Casuarina pauper* over low scrub of *Acacia burkittii* and dwarf scrub of *Ptilotus obovatus* on quartz/rocky plain	QRP-CFW2	3
Quartz/Rocky Plain	Mallee Woodlands and Shrublands	Open tree mallee of *Eucalyptus gypsophila* over low scrub of *Acacia burkittii* and open hummock grass of *Triodia irritans* on quartz/rocky plain	QRP-MWS1	3
Quartz/Rocky Plain	Mallee Woodlands and Shrublands	Low woodland of *Eucalyptus lucasii* over heath of *Acacia colletioides/ Eremophila scoparia* and open low grass of *Eragrostis pergracilis*/ hummock grass of *Triodia irritans* on quartz/ rocky plain	QRP-MWS2	3
Sand Dune	Eucalypt Woodlands/Mallee Woodlands and Shrublands	Open low woodland of *Eucalyptus gongylocarpa* over open shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* on sand dune	SD-EW/MWS1	2
Sand Dune	Mallee Woodlands and Shrublands	Very open tree mallee of *Eucalyptus youngiana* over scrub of *Grevillea juncifolia* subsp. *juncifolia* and dwarf scrub of *Aluta maisonneuvei* subsp. *auriculata*/ hummock grass of *Triodia basedowii* on sand dune	SD-MWS1	3
Sand-Loam Plain	Acacia Forests and Woodlands	Low woodland of *Acacia caesaneura* over low scrub of *Senna artemisioides* subsp. *filifolia* and hummock grass of *Triodia basedowii* on sandy-loam plain	SLP-AFW1	3
Sand-Loam Plain	Acacia Forests and Woodlands	Forest of *Acacia caesaneura* over heath of *Cratystylis subspinescens* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain	SLP-AFW2	2
Sand-Loam Plain	Regrowth, modified native vegetation	Regrowth open tree mallee of *Eucalyptus ?concinna/ E. ?mannensis* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* on sand-loam plain	SLP-RMNV1	3
Sandplain	Acacia Forests and Woodlands	Low forest of *Acacia caesaneura*/ *A. incurvaneura* over dense hummock grass of *Triodia basedowii* in sandplain	S-AFW1	2
Sandplain	Acacia Forests and Woodlands	Low forest of *Acacia caesaneura*/ *A. incurvaneura* over low scrub of mixed shrubs and dwarf scrub of *Eremophila gilesii/* open hummock grass of *Triodia irritans* in sandplain	S-AFW2	2
Sandplain	Acacia Forests and Woodlands	Low woodland of *Acacia incurvaneura/ Hakea lorea* over heath of *Melaleuca interioris* and mid-dense hummock grass of *Triodia basedowii* in sandplain	S-AFW3	2
Sandplain	Acacia Forests and Woodlands	Low woodland of *Acacia caesaneura/ A. incurvaneura* over dwarf scrub of *Eremophila forrestii* subsp. *forrestii* and mid-dense hummock grass of *Triodia irritans* in sandplain	S-AFW4	2
Sandplain	Acacia Forests and Woodlands	Scrub of *Acacia grasbyi* over heath of *A. desertorum* and mid-dense hummock grass of *Triodia irritans* in sandplain	S-AFW5	2
Sandplain	Eucalypt Woodlands	Low woodland of *Eucalyptus gongylocarpa* over heath of *Acacia ligulata* and dense hummock grass of *Triodia basedowii* in sandplain	S-EW1	2
Sandplain	Eucalypt Woodlands/Mallee Woodlands and Shrublands	Low woodland of *Eucalyptus gongylocarpa* over shrub mallee of *Eucalyptus youngiana* and mid-dense hummock grass of *Triodia basedowii* in sandplain	S-EW/MWS1	2

Landform	NVIS Vegetation Group	Vegetation Community	Code	Health Rating
		Low woodland of *Eucalyptus gongylocarpa* over open tree mallee of *Eucalyptus youngiana* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia basedowii* in sandplain	S-EW/MWS2	2
	Mallee Woodlands and Shrublands	Open tree mallee of *Eucalyptus youngiana* over dense hummock grass of *Triodia basedowii* in sandplain	S-MWS1	2
		Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia caesaneura* and mid-dense hummock grass of *Triodia basedowii* in sandplain	S-MWS2	2
		Open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum/ A. grasbyi* and low heath of *Aluta maisonneuvei* subsp. *auriculata/* mid-dense hummock grass of *Triodia irritans* in sandplain	S-MWS3	2
		Open tree mallee of *Eucalyptus concinna* over low scrub of *Eremophila latrobei* subsp. *glabra* and mid-dense hummock grass of *Triodia irritans* in sandplain	S-MWS4	2
		Open tree mallee of *Eucalyptus concinna/ E. mannensis* over heath of mixed shrubs and hummock grass of *Triodia basedowii* in sandplain	S-MWS5	2
		Open tree mallee of *Eucalyptus concinna* over heath of mixed shrubs and mid-dense hummock grass of *Triodia basedowii* in sandplain	S-MWS10	2
		Very open tree mallee of *Eucalyptus youngiana* over low heath of *Aluta maisonneuvei* subsp. *auriculata* and hummock grass of *Triodia basedowii* in sandplain	S-MWS11	3
		Very open tree mallee of *Eucalyptus leptopoda* subsp. *elevata/ E. youngiana*/ open scrub of *Grevillea pterosperma* over heath of *Aluta maisonneuvei* subsp. *auriculata* and mid-dense hummock grass of *Triodia basedowii* in sandplain	S-MWS12	2
	Regrowth, modified native vegetation	Regrowth open tree mallee of *Eucalyptus youngiana* over heath of *Acacia desertorum*/ *Grevillea didymobotrya* subsp. *didymobotrya* and mid-dense hummock grass of *Triodia basedowii* in sandplain	S-RMNV3	3
		Regrowth open tree mallee of *Eucalyptus leptopoda* subsp. *elevata* over heath of *Aluta maisonneuvei* subsp. *auriculata* and low heath of *Leptosema chambersii*/ mid-dense hummock grass of *Triodia basedowii* in sandplain	S-RMNV1	3
		Regrowth open tree mallee of *Eucalyptus trivalva* over very open shrub mallee of *E. youngiana* and low heath of *Alyogyne pinoniana/ Sida calyxhymenia* in sandplain	S-RMNV2	3

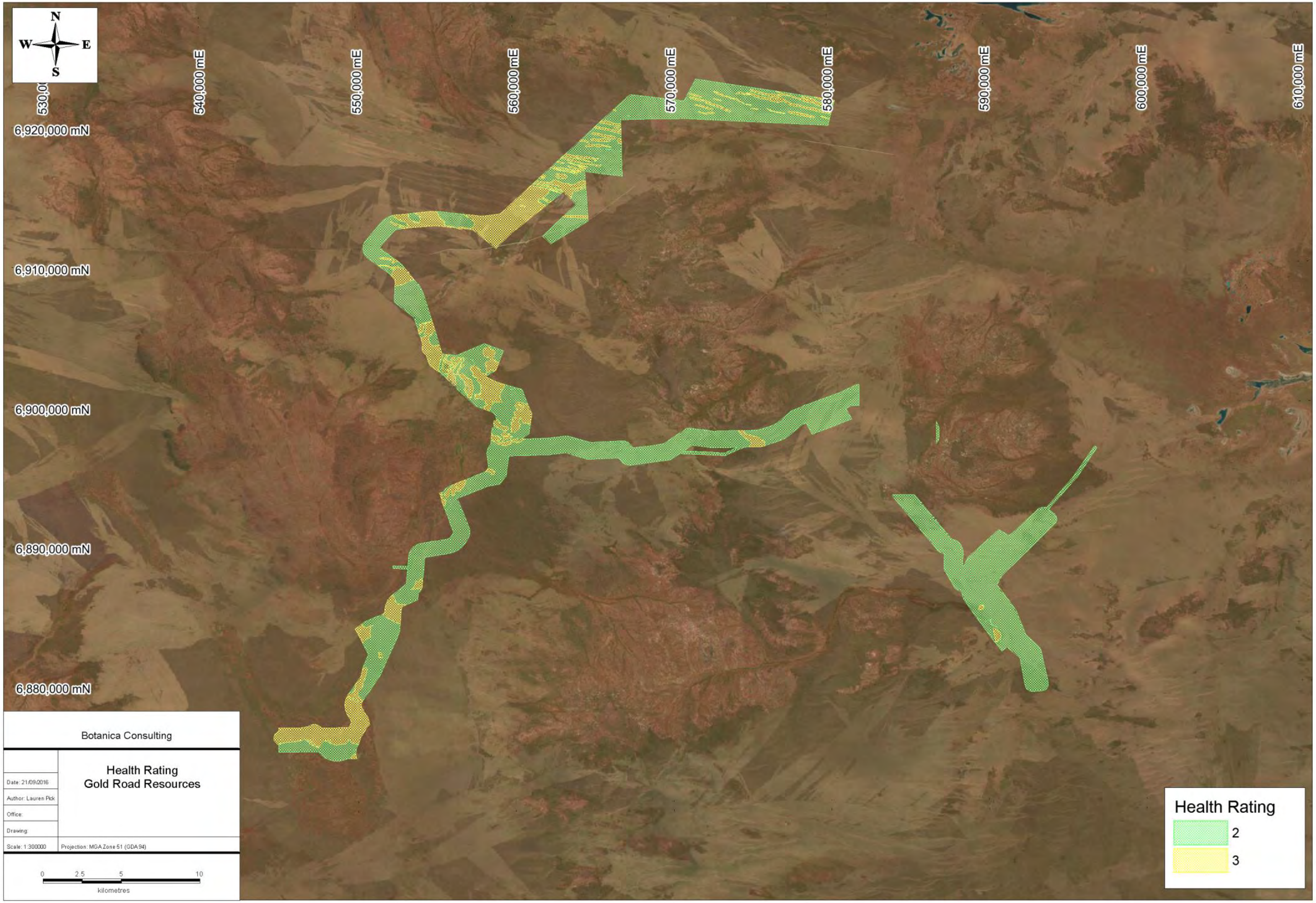


Figure 9: Health Condition of vegetation within the Gruyere Borefields survey area

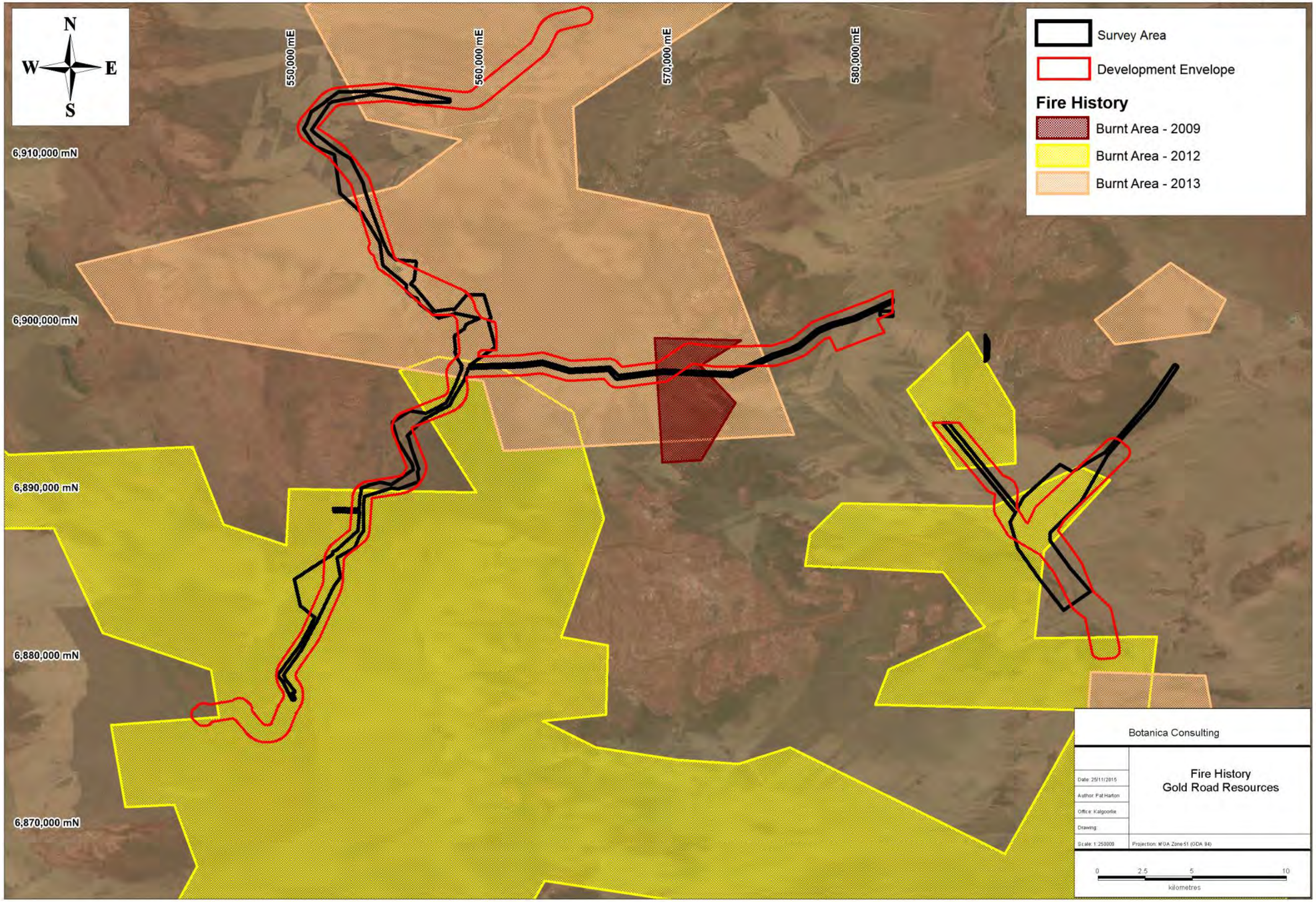


Figure 10: Fire History within the Gruyere Borefields survey area (Sentinel, 2016)

4.7 Introduced Flora

One introduced taxon; *Cenchrus ciliaris* (Buffel Grass), was identified within the Gruyere Borefields survey area. A map showing the location of the introduced taxon is provided in Figure 11. According to the DAFWA *Cenchrus ciliaris* is not listed as a Declared Plant under Section 22 of the BAM Act.

4.7.1 *Cenchrus ciliaris* (Buffel Grass)

This taxon is described as a tufted or sometimes stoloniferous perennial, grass-like or herbaceous plant which grows between 0.2-1.5 m high (Plate 54). It produces purple flowers from February to October. It occurs on white, red or brown sand, stony red loam, black cracking clay soils (WAHERB, 2016). This taxon was identified approximately 4.5km south of the Mount Shenton Yamarna Road within the Yeo Borefield in the Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1).

Plate 54: *Cenchrus ciliaris* (Buffel Grass) (WAHERB, 2015)

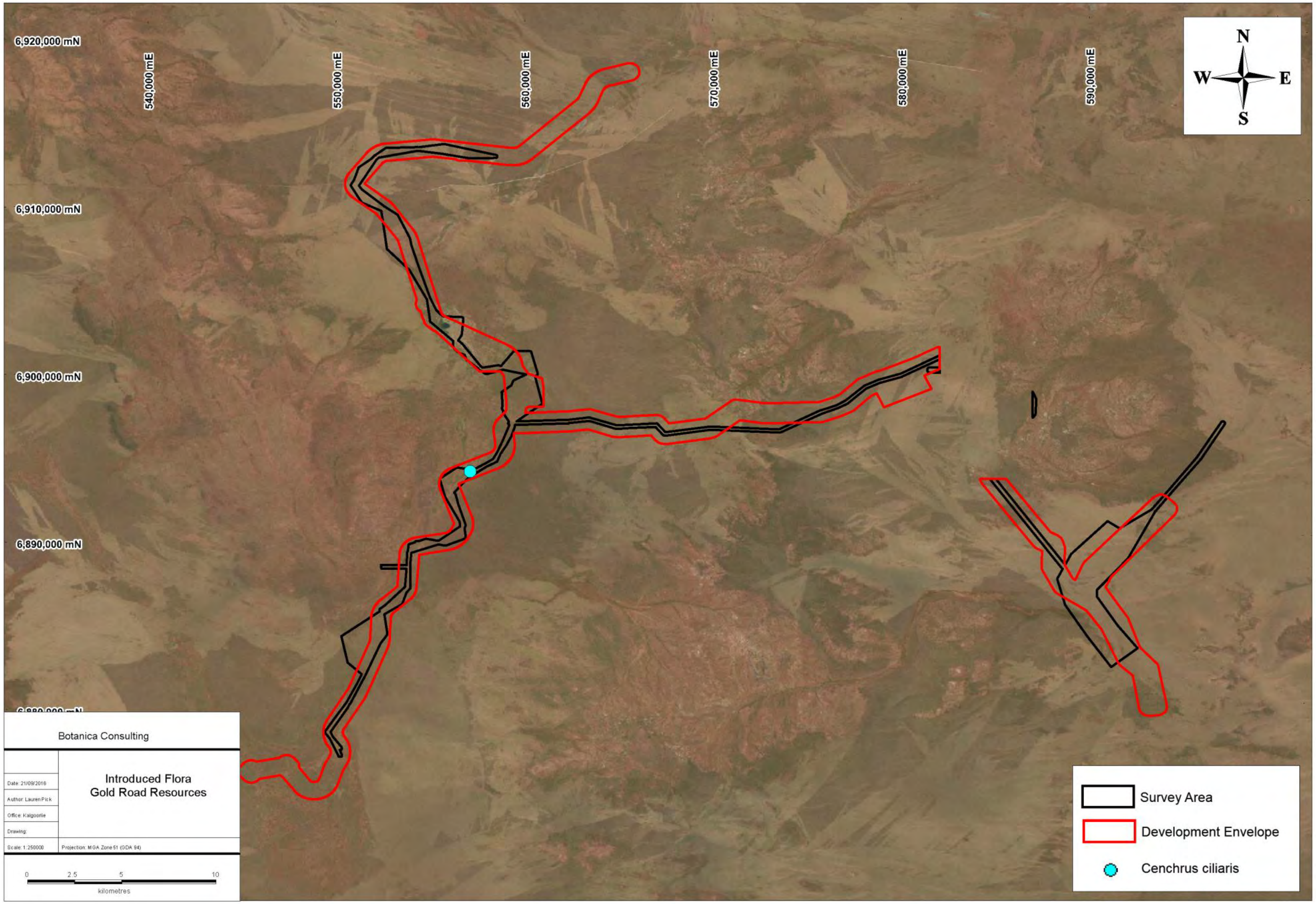


Figure 11: Locations of Introduced Taxa within the Gruyere Borefields survey area

4.8 Introduced Fauna

Evdience of four introduced fauna species were observed during the survey:

1. Camel (*Camelus dromedaries*);
2. European Cattle (*Bos taurus*);
3. Cat (*Felis catus*); and
4. Dingo/ Dog (*Canis lupus*).

5 Relevant Legislation and Compliance with Recognised Standards

5.1 Commonwealth Legislation

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*
The aim of this Act is to protect matters of national environmental significance, and is used by the Commonwealth DotE to list threatened taxa and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance.

The survey area does not have national environmental significance under the EPBC Act. There are no TEC, Threatened Flora or Threatened Fauna as listed under the EPBC Act identified within the survey area/ development envelope.

5.2 State Legislation

5.2.1 Clearing of Native Vegetation

Under Section 51C of the EP Act and the EP Regulations any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the EP Act or under the EP Regulations requires a clearing permit from the DER or DMP. Under Section 51A of the EP Act native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the EP Act defines clearing as "*the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above*".

Exemptions under Schedule 6 of the EP Act and the EP Regulations do not apply for clearing an area exceeding 10ha per tenement, per year; clearing in ESA's as declared under Section 51B of the EP Act or within Schedule 1 Areas as described in Regulation 6 and Schedule 1, clause 4 of the EP Regulations.

The survey area/ development envelope is not located within an ESA or a Schedule 1 Area; a Schedule 1 Area, the "Yeo Lake Nature Reserve" (Class A) is located approximately 700m east of the survey area (Potable Borefield). If development of the project will require >10ha of clearing, a clearing permit is required.

5.2.2 Environmental Protection Act WA 1986

This Act pertains to the assessment of applications for clearing permits and aims to protect Threatened Flora/Fauna and Threatened Ecological Communities from clearing. Threatened Ecological Communities are protected even where exemptions for a clearing permit may apply. The act enforces both financial and/or imprisonment penalties on those who unlawfully damage a TEC.

The survey area/ development envelope does not contain any TEC or Threatened Flora/ Fauna.

5.2.3 Wildlife Conservation Act WA 1950

This Act is used by the Western Australian DPaW to list flora taxa as being protected and the level of protection needed for such flora. Flora taxa are classified as 'Declared Rare Flora' when their populations are geographically restricted or are threatened by local processes. Under this Act all native flora (spermatophytes, Pteridophyta, bryophytes and thallophytes) are protected throughout the State. Financial penalties are enforced under this Act if threatened plant taxa are collected without an appropriate licence.

5.2.4 DPaW Priority lists

The DPaW lists 'Priority' flora and fauna taxa which are under consideration for declaration as Rare Flora or Fauna. Taxa classed as Priority 1-3 are in urgent need of further survey, whereas Priority 4 taxa are considered to have been adequately surveyed but may become vulnerable or rare in future years. Priority 4 taxa are also taxa that have been removed from the threatened taxa list in the past 5 years. Priority 5 flora taxa are those taxa which are not currently threatened but are subject to a specific conservation program, the cessation of which would result in the taxon likely to become threatened within 5 years The DPaW also lists PECs, which identifies those communities that may need monitoring before possible nomination for TEC status. These priority taxa and communities have no formal legal protection until they are endorsed by the Minister as being Declared Rare Flora and TEC's respectively.

Results of the database searches revealed six Priority Flora within a 40km radius of the survey area, all of which had the potential to occur within the survey area/ development envelope. No Priority Flora were identified within the survey area/ development enveleopt. One Priority Fauna species was identified within the survey area/ development envelope. No PECs were identified within the survey area/ development envelope.

5.3 EPA Position Statements

The EPA develops Position Statements to inform the public about environmental issues facing Western Australia, and the plans for the future to ensure protection and ecological sustainability of environmentally important ecosystems. It provides a set of principles to assist the public and decision-makers on their responsibilities for managing land with care. These principles also provide the basis for the Environmental Protection Authority to evaluate and report upon achieving environmental and ecological sustainability, and the protection of natural resources.

5.3.1 Position Statement No. 2

Environmental Protection of Native Vegetation in Western Australia (EPA 2000) outlines EPA policy on the protection of native vegetation in Western Australia, particularly in the agricultural area. It identifies basic elements that the EPA should consider when assessing proposals that impact on biological diversity. These include comparison of all proposal options; avoidance of taxa and community extinctions; an expectation that implementing the proposal will not take a vegetation type below the "threshold level" of 30%; and that proponents should demonstrate that on- and off-site impacts can be managed.

The survey area/ development envelope does not contain any Threatened Flora or TEC suggesting that clearing within the area will meet the EPA standards outlined in Position Statement No. 2. According to DAFWA (2011) the survey area occurs within the pre-European Beard vegetation associations Great Victoria Desert 18, 24, 45, 84, 85, 239, 676 and 1239 all of which retain approximately 100% of the original pre-European vegetation extent.

5.3.2 Position Statement No. 3

Terrestrial Biological Surveys as an Element of Biodiversity Protection establishes that the EPA has adopted the definition and principles of biological diversity as defined in the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996), and has stipulated the following requirements:

- The quality of information and scope of field surveys should meet standards, requirements and protocols as determined and published by the EPA; and
- The IBRA regionalisation's should be used as the largest unit for Environmental Impact assessment (EIA) decision-making in relation to the conservation of biodiversity.

Pursuant to the IBRA regionalisation's, 26 bioregions in WA, which are affected by a range of different threatening processes and have varying levels of sensitivity to impact, have been identified. Terrestrial biological surveys should provide sufficient information to address both biodiversity conservation and ecological functional values within the context of proposals and the results of surveys should be publicly available.

The flora survey was planned and implemented as far as practicable according to the *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015* (DPaW & EPA, 2015). Also, the IBRA regionalisation's have been used in preparing the report to identify the conservation status of the area and identify the main threats to the biodiversity of plant taxa in the region.

5.4 Native Vegetation Clearing Principles

Based on the outcomes from the survey undertaken, as presented in this report, BC provides the following comments regarding the native vegetation clearing principles (relevant to flora and fauna only) listed under Schedule 5 of the EP Act (Table 57).

Table 57: Assessment of development within the Gruyere Borefields survey area against native vegetation clearing principles

Letter	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	Vegetation identified within the survey area is not considered to be of high biological diversity, and is well represented outside of the proposed impact area.	Development within the Gruyere Borefields development envelope is unlikely to be at variance to this principle
(b)	Native vegetation should not be cleared it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	No significant fauna habitat identified within the project area. Fauna habitats are well represented outside of the project area.	Development within the development envelope is unlikely to be at variance to this principle
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the *WC Act 1950* and the *EPBC Act 1999* were identified within the survey area	Development within the Gruyere Borefields development envelope is unlikely to be at variance to this principle
(d)	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of a threatened ecological community (TEC).	No TEC listed under the *EPBC Act 1999* or by the DPaW occur within the survey area.	Development within the Gruyere Borefields development envelope is unlikely to be at variance to this principle
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	According to DAFWA (2011), the survey area occurs in pre-European Beard vegetation associations Great Victoria Desert 18, 24, 45, 84, 85, 239, 676 and 1239 all of which retain approximately 100% of the original pre-European vegetation extent in the Shield (GVD1) and Central (GVD2) subregions, all of which retain approximately 100% of the original vegetation extent.	Development within the Gruyere Borefields development envelope is unlikely to be at variance to this principle
(f)	Native vegetation should not be cleared if it is growing, in, or in association with, an environment associated with a watercourse or wetland	According to the Geoscience Australia GIS database, a river/stream (non-perennial/intermittent) intersects the survey area within the Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1) vegetation community of the Yeo Borefield. The survey area also intersects several small playas within Low woodland of	Development within the Gruyere Borefields development envelope may be at variance to this principle

Letter	Principle	Assessment	Outcome
		Acacia aptaneura/ A. incurvaneura over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa (CD-AFW2) vegetation community in the Yeo Borefield; however, these playas are not listed on Geoscience Australia GIS database.	
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	According to DAFWA (2011), the survey area occurs in pre-European Beard vegetation associations Great Victoria Desert 18, 24, 45, 84, 85, 239, 676 and 1239 all of which retain approximately 100% of the original pre-European vegetation extent in the Shield (GVD1) and Central (GVD2) subregions, all of which retain approximately 100% of the original vegetation extent. Clearing within these vegetation associations is not likely to lead to land degradation issues such as salinity, water logging or acidic soils.	Development within the Gruyere Borefields development envelope is unlikely to be at variance to this principle
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The survey area is not located within a conservation area. No PEC as listed by DPaW is located within the survey area. The closest conservation area is the Yeo Lake Nature Reserve (Class A) located approximately 700m east of the survey area	Development within the Gruyere Borefields development envelope is unlikely to be at variance to this principle

6 Conclusions

Forty-three broad vegetation communities were identified within the survey area, of which thirty-nine were identified within the proposed development envelope. These communities comprised of seven landform types and nine major vegetation groups according to the NVIS definition. The communities were represented by a total 42 Families, 112 Genera and 269 Taxa, (including sub-species and variants). The broad scale terrestrial fauna habitats within the survey area have been identified as:

- **Clay-Loam Plains**
  Acacia Forests and Woodlands, *Acacia* Shrublands, Mallee Open Woodlands and Sparse Mallee Shrublands

- **Closed Depressions**
  Acacia Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands, Chenopod Shrublands, Samphire Shrublands and Forblands.

- **Drainage Depressions**
  Acacia Forests and Woodlands, *Acacia* Open Woodlands, Mallee Woodlands and Shrublands.

- **Quartz/Rocky Plains**
  Acacia Forests and Woodlands, *Casuarina* Forests and Woodlands, Mallee Woodlands and Shrublands.

- **Sand Dunes**
  Eucalypt Woodlands, Mallee Woodlands and Shrublands.

- **Sand-Loam Plains**
  Acacia Forests and Woodlands, Regrowth, modified native vegetation.

- **Sandplains**
  Acacia Forests and Woodlands, Eucalypt Woodlands, Mallee Woodlands and Shrublands, Regrowth, modified native vegetation.

With respect to native vertebrate fauna, 28 mammals (including eight bat species), 103 bird, 105 reptile and nine frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise at times, the survey area/ development envelope. A total of 56 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the survey area over the three-day survey period. Observations of four introduced species using the survey area were also gathered.

No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the WC Act and the Commonwealth EPBC Act were identified within the survey area/ development envelope. No Priority Flora taxa as listed by DPaW were identified within the survey area/ development envelope.

Two vertebrate fauna species of conservation significance (listed under State or Federal threatened/migratory species lists or as a DPaW priority species) were positively identified as utilising the study area for some purpose during the survey period, this being:

1. Rainbow Bee-eater *Merops ornatus* – Migratory (*EPBC Act*), S5 (*WC Act*)
2. Southern Marsupial Mole *Notoryctes typhlops* – P4 (DPaW Priority Species)

The current status on site and/or in the general area of some other species is difficult to determine, however, based on the habitats present and, in some cases, recent nearby records, six additional species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

1. Buff-snouted Blind Snake *Anilios margaretae* – P2 (DPaW Priority Species)
2. Malleefowl *Leipoa ocellata* – S3 (*WC Act*), Vulnerable (*EPBC Act*)
3. Peregrine Falcon *Falco peregrinus* – S7 (*WC Act*)
4. Princess Parrot *Polytelis alexandrae* – Vulnerable (*EPBC Act*), P4 (DPaW Priority Species)
5. Striated Grasswren (sand plain) *Amytornis striatus striatus* - P4 (DPaW Priority Species)
6. Brush-tailed Mulgara *Dasycercus blythi* - P4 (DPaW Priority Species)

None of the vegetation communities/ habitats within the survey area/ development envelope were found to have National Environmental Significance as defined by the Commonwealth EPBC Act. No TEC pursuant to Commonwealth or State legislation were recorded within the survey area/ development envelope. The survey area/ development envelope is not located within an ESA as listed under the EP Act, or Schedule 1 Areas.

Based on field observations and analysis of hydrological information from within the survey area, two vegetation communities are potential GDE:

1. Low woodland of *Acacia aptaneura/ A. incurvaneura* over scrub of *A. tetragonophylla/ Melaleuca interioris* and open low grass of *Eragrostis falcata* in playa (CD-AFW2); and
2. Open tree mallee of *Eucalyptus concinna* over low scrub of *Melaleuca interioris* and low grass of *Eragrostis pergracilis* in drainage depression (DD-MWS1).

Only one of these potential GDE communities is located within the proposed development envelope; DD-MWS1.

Based on the vegetation health condition scale adapted from Keighery, 1994 and Trudgen, 1988 (rating 1 'pristine' to rating 7 'completed degraded'), twenty-nine vegetation communities had a '2' health condition rating. The remaining fourteen vegetation communities had a '3' health condition rating. One introduced taxon; *Cenchrus ciliaris* (Buffel Grass), was identified within the survey area. According to the DAFWA it is not listed as a Declared Plant under Section 22 of the BAM Act. Evdience of four introduced fauna taxa were observed during the survey.

7 Bibliography

Anstis, M. (2013). *Tadpoles and Frogs of Australia.* New Holland Publishers, Sydney.

Aplin, K. P. and Smith, L.A. (2001). Checklist of the frogs and reptiles of Western Australia, Records of the Western Australian Museum Supplement No. 63, 51-74.

ASRIS (2014), *Atlas of Australian Soils Database,* Australian Soil Resource Information System

Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.

Barton & Cowan, (2001a), *A Biodiversity Audit of Western Australia's 53 Biogeographical Region in 2001- Great Victoria Desert (GVD1 - Shield Subregion)*, Department of Conservation and Land Management.

Barton & Cowan, (2001b), *A Biodiversity Audit of Western Australia's 53 Biogeographical Region in 2001- Great Victoria Desert (GVD2 – Central Subregion)*, Department of Conservation and Land Management.

BC (2011), *Level 1 Yamarna Proposed Haul Road Flora and Vegetation Survey,* Botanica Consulting

BC (2012), *Level 2 Flora and Vegetation Survey, Yamarna Project,* Botanica Consulting

BC (2014a), *Level 1 Flora and Vegetation Survey, Gruyere Project,* Botanica Consulting

BC (2014b), *Level 1 Flora and Vegetation Survey, Sunrise Dam Gold Mine to Tropicana Gold Mine Gas Pipeline,* Botanica Consulting

BC (2014c), *Level 1 Flora and Vegetation Survey, Miningwal Borefields,* Botanica Consulting

BC (2015a), *Level 2 Flora and Vegetation Survey of the Gruyere Project.* Botanica Consulting

BC (2015b), *Level 1 Flora and Vegetation Survey Proposed Gas Pipeline Routes,* Botanica Consulting

Beard, J.S., (1990), *Plant Life of Western Australia*, Kangaroo Press Pty Ltd, NSW.

BOM, (2016), Laverton Aero Weather Station (#12305) Rainfall Data 1991-2016, Bureau of Meteorology

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 8 May 2012. Western Australian Museum.

Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). *Reptiles and Frogs in the Bush: Southwestern Australia*. UWA Press, Nedlands.

Christidis, L. and Boles, W.E. (2008) *Systematics and Taxonomy of Australian Birds.* CSIRO Publishing, Melbourne

Churchill, S. (2008). *Australian Bats.* Second Edition, Allen & Unwin.

Cogger, H.G. (2014). *Reptiles and Amphibians of Australia*. 7th Edition. CSIRO Publishing.

Corbett, L.K. (1975). Geographical distribution and habitat of the Marsupial Mole, *Notoryctes typhlops*. Australian Mammalogy. 1:375-378.

DAFWA (1994) *Technical Bulletin: An inventory and condition survey of the north-eastern Goldfields Western Australia (No. 87),* Department of Agriculture WA, 1994.

DAFWA, (2011), *Pre-European Vegetation - Western Australia (NVIS Compliant Version GIS file),* Department of Agriculture and Food Western Australia

DAFWA (2014), *Soil Landscape System of Western Australia,* Department of Agriculture and Food Western Australia

DAFWA, (2016), *Declared Organism-database search,* Department of Agriculture and Food Western Australia

DotE (2015). Threatened Species & Ecological Communities Species Profile and Threats Database: *Liopholis kintorei* — Great Desert Skink. Available online: http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=83160.

Accessed November 2015.

DotE, (2016a), *Protected Matters Search Tool, Environment Protection and Biodiversity Conservation Act 1999,* Department of the Environment

DotE, (2016b), *National Vegetation Information System (NVIS) Version 4.2*, Department of the Environment

DPaW, (2013a), *TEC and PEC search*, Department of Parks and Wildlife

DPaW, (2013b), *Threatened Flora Database search results*, Department of Parks and Wildlife

DPaW/ EPA, (2015), *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015.* Department of Parks and Wildlife & Environmental Protection Authority

DPaW (2015). Threatened and Priority Fauna Rankings. November 2015.

DPaW (2016), *Nature Map Database search*, Department of Parks and Wildlife

Duncan, Anne. & Baker, G. B. & Montgomery, Narelle. & Natural Heritage Trust (Australia) (1999). *The action plan for Australian bats* / edited by Anne Duncan, G. Barry Baker and Narelle Montgomery; with assistance from Lindy Lumsden *et al*. Natural Heritage Trust, Canberra.

Ecologia (2009a). *Tropicana Gold Project. Operational Area Vertebrate Fauna Assessment.* Unpublished report for Tropicana Joint Venture. February 2009.

Ecologia (2009b). *Tropicana Gold Project. Tropicana-Transline Infrastructure Corridor, Level 1 Fauna Assessment.* Unpublished report for Tropicana Joint Venture. July 2009.

Ecologia (2009c). *Neale Junction Reserve Fauna Assessment in collaboration with DEC.* Unpublished report for Tropicana Joint Venture.

EPA, (2000), Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia,* Environmental Protection Authority

EPA, (2002), Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection,* Environmental Protection Authority

EPA, (2004), Guidance for the Assessment of Environmental Factors (in accordance with the *Environmental Protection Act 1986*), *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia,* Environmental Protection Authority

Glauret, L. (1961). *A Handbook of the Lizards of Western Australia.* Handbook 6, Western Australian Naturalists Club, Perth.

Government of Western Australia (2015). *Wildlife Conservation Act 1950*. Wildlife Conservation (Specially Protected Fauna) Notice 2014. Government Gazette, WA. 9 November 2015.

Hall, N.J., Newbey, K.R., McKenzie, N.L., Keighery, G.J., Rolfe, J.K & Youngson, W. K., (1993), *The Biological survey of the Eastern Goldfields of Western Australia Part 7: Sandstone-Sir Samuel. Laverton-Leonora study area,* West. Aust. Mus. Suppl. **47.**

Harewood G. (2014). *Fauna Assessment (Level 1) Gruyere Project*. Unpublished report for Gold Road Resources Ltd. July 2014.

Harewood G. (2015a). *Southern Marsupial Mole (Notoryctes typhlops) – Additional Information on Presence/Absence - Gruyere Project Area*. Unpublished letter report for Gold Road Resources Ltd. June 2015.

Harewood G. (2015b). *Southern Marsupial Mole (Notoryctes typhlops) – Northern Borefield Area.* Unpublished letter report for Gold Road Resources Ltd. November 2015.

Harewood G. (2015c). *Fauna Assessment (Level 1) Gruyere Borefield Project*. Unpublished report for Gold Road Resources Ltd. December 2015.

Harewood G. (2016). *Terrestrial Invertebrate Survey – Gruyere Project Area.* Unpublished report for Gold Road Resources Ltd. January 2016.

Harewood, G. (2011). *Terrestrial Fauna Survey (Level 1) of Yamarna Gold Project (Central Bore, Attila, Alaric, Haul Road and Khan North).* Unpublished report for Gold Road Resources. September 2011.

Hart, R.P. and Kitchener, D.J., (1986). *First Record of Sminthopsis psammophila (Marsupialia: Dasyuridae) from Western Australia*. Records of the Western Australian Museum 13(1): 139-144.

Harvey, M. S. (2002). *Short-range endemism among the Australian fauna: some examples from non-marine environments.* Invertebrate Systematics 16: 555-570.

Hatton T, Evans R, 1998. *Dependence of ecosystems on groundwater and its significance to Australia.* LWRRDC Occasional Paper No 12/98.

How, R., Cooper, N.K. and Bannister, J.L. (2001). *Checklist of the mammals of Western Australia*, Records of the Western Australian Museum Supplement No. 63, 91-98.

IBRA, (2015), *Interim Biogeographic Regionalisation for Australia (IBRA), Version 6.1,* Department of Sustainability, Environment, Water, Population and Communities. http://www.environment.gov.au/metadataexplorer/explorer.jsp

Jackson, S. & Groves, C. (2015). *Taxonomy of Australian mammals.* CSIRO Publishing.

Jacob, A (2014), *Wildlife Conservation Act 1950, Wildlife Conservation (Rare Flora) Notice 2014,* Minister For Environment.

Johnstone, R.E. (2001). Checklist of the birds of Western Australia, Records of the Western Australian Museum Supplement No. 63, 75-90.

Johnstone, R.E. and Storr, G.M. (1998). *Handbook of Western Australian Birds:* Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.

Johnstone, R.E. and Storr, G.M. (2004). *Handbook of Western Australian Birds:* Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.

Judd, S. (2015). *Terrestrial Isopod Identification for Dorothy Hills, Yamarna Station.* Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

Keighery, B. J., (1994), *Bushland Plant Survey: A guide to plant community survey for the community.* Wildflower Society of Western Australia (Inc.), Nedlands

Kingfisher Environmental Consulting (2014a). *Murrin Murrin – Sunrise Dam Infrastructure Corridor Level 1 Fauna Survey.* Unpublished report for AngloGold.

Kingfisher Environmental Consulting (2014b). *Sunrise Dam – Tropicana Infrastructure Corridor Level 1 Fauna Survey*. Unpublished report for AngloGold.

Martnick and Associates Pty Ltd (1996). *Environmental Appraisal – Yamarna Gold Project Area.* Unpublished report for Zanex NL. January 1996.

Masters, P., Dickman, C. R., and Crowther, M. (2003). Effects of cover reduction on mulgara *Dasycercus cristicauda* (Marsupialia: Dasyuridae), rodent and invertebrate populations in central Australia: implications for land management. Austral Ecology 28, 658-665.

MBS Environmental (2014). *Gruyere Project Desktop Environmental Review and Work Program.* Unpublished report for Gold Road Resources. February 2014.

Mc Donald, R.C, Isbell, R.F & Speight, J.G (1998), *Australian Soil and Land Survey Field Handbook* (3rd edn). CSIRO Publishing: Melbourne.

McAlpin, S. (2001). A recovery plan for the Great Desert Skink (*Egernia kintorei*) 2001-2011. Page(s) Jan-24. [Online]. Arid Lands Environment Centre. Arid Lands Environment Centre, Alice Springs. http://www.environment.gov.au/biodiversity/threatened/publications/recovery/great-desert-skink/index.html.

Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Third Edition, Oxford University Press, Melbourne.

Mitchell, A. & Wilcox, D. G. (1988), *Arid Shrubland Plants of Western Australia,* University of Western Australia Press, Nedlands, WA.

Morcombe, M. (2004). Field Guide to Australian Birds. Steve Parish Publishing, Archerfiled, Queensland.

Mitchell, A. & Wilcox, D. G. (1988), *Arid Shrubland Plants of Western Australia,* University of Western Australia Press, Nedlands, WA.

Muir, B. G., (1977), Biological Survey of the Western Australian Wheatbelt. Pt 2. Vegetation and habitat of the Bendering Reserve. *Rec. West. Aust. Mus*. Suppl. **3**.

Ninox Wildlife Consulting (2009). *A Level One Survey of the Vertebrate Fauna, Infrastructure Corridor – Pinjin Option.* L 31/57, L 39/185, Pinjin – Tropicana Gold Project. Unpublished report for Tropicana Joint Venture. January 2009.

Pearson, D., P. Davies, N. Carnegie & J. Ward (2001). The Great Desert Skink (*Egernia kintorei*) in western Australia: distribution, reproduction and ethno-zoological observations.:64-68.

Pearson, D.J. and Robinson, A.C. (1990). New records of the Sandhill Dunnart, *Sminthopsis psammophila* (Marsupialia: Dasyuridae) in south and Western Australia. Journal of Australian Mammalogy 13: 57-59.

Pennington, Scott (2015) *H3 Hydrogeological Report - Gruyere Gold Project.* Report prepared for Gold Road Resources Limited

Phoenix Environmental Sciences (2014*). Identification and assessment of short-range endemism of trapdoor spiders from Yamarna Station*, Western Australia. Unpublished report prepared for Botanica Consulting.

Phoenix Environmental Sciences (2015a). *Identification and assessment of short-range endemism of invertebrates from Yamarna Station, Western Australia*. Unpublished report prepared for Rapallo Ltd.

Phoenix Environmental Sciences (2015b). *Identification and assessment of short-range endemism of trapdoor spiders from Gruyere Project (Yamarna Station), Western Australia.* Unpublished report prepared for Greg Harewood (on behalf of GRRs).

Pizzey, G & Knight, F. (2012). *The Field Guide to the Birds of Australia*. 9th Edition. Harper Collins, Sydney.

Rapallo Environmental (2015). *Fauna Survey of the Gruyere Project Area*. Unpublished report for Gold Road Resources Limited. May 2015.

Simpson, K. and Day, N. (2010). *Field Guide to the Birds of Australia.* Penguin Books, Ringwood.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.

Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.

Terrestrial Ecosystems (2011). *Level 2 Fauna Risk Assessment for the Granny Deeps Project Area.* Unpublished report. February 2011.

Thompson, S & Thompson, G (2006). *Reptiles of the Western Australian Goldfields*. Published by the Goldfields Environmental Management Group.

Tille, P. (2006) *Soil Landscapes of Western Australia's Rangelands and Arid Interior*, Department of Agriculture and Food Western Australia

TJV (2009), *Tropicana Gold Project Public Environmental Review.* Tropicana Joint Venture (Anglo Gold Ashanti Australia and Independence Group NL).

Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.

Van Dyck, S. & Strahan, R. Eds (2008). The Mammals of Australia. Third edition Queensland Museum.

Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.

Volschenk, E. (Scorpion ID) (2012*). Yamarna Scorpion Identification Report*. Unpublished report for Keith Linbeck and Associates.

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

Volschenk, E. (Scorpion ID) (2015b). *Taxonomic and Short-Range Endemism Assessment of Invertebrates Surveyed from Yamarna Station (November 2015).* Unpublished report prepared for Greg Harewood (on behalf of GRRs). November 2015.

WAHERB, (2016), *Florabase – Information on the Western Australian Flora,* Department of Parks and Wildlife

Wilson, S. and Swan, G. (2013*). A Complete Guide to Reptiles of Australia*. Third Edition, Reed, New Holland, Sydney.

Appendix 1: DPaW's NatureMap Database and DotE Protected matters search tool

NatureMap Species Report

Animalia

1. 24559 *Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*
2. 24260 *Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*
3. 24261 *Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*
4. 24264 *Acanthiza robustirostris (Slaty-backed Thornbill)*
5. 24265 *Acanthiza uropygialis (Chestnut-rumped Thornbill)*
6. *Acariformes sp.*
7. 25535 *Accipiter cirrocephalus (Collared Sparrowhawk)*
8. 25536 *Accipiter fasciatus (Brown Goshawk)*
9. *Acrophylla nubilosa*
10. 25544 *Aegotheles cristatus (Australian Owlet-nightjar)*
11. 30833 *Amphibolurus longirostris (Long-nosed Dragon)*
12. 25647 *Amytornis striatus (Striated Grasswren)*
13. 25319 *Antaresia stimsoni subsp. orientalis (Stimson's Python)*
14. 24561 *Anthochaera carunculata (Red Wattlebird)*
15. 25528 *Aphelocephala leucopsis (Southern Whiteface)*
16. 24285 *Aquila audax (Wedge-tailed Eagle)*
17. 24610 *Ardeotis australis (Australian Bustard)*
18. *Argiope protensa*
19. 25566 *Artamus cinereus (Black-faced Woodswallow)*
20. 24356 *Artamus personatus (Masked Woodswallow)*
21. *Asadipus auld*
22. *Austracantha minax*
23. *Austrogymnocnemia bipunctata*
24. *Backobourkia collina*
25. *Backobourkia heroine*
26. *Barnardius zonarius*
27. 42374 *Brachyurophis fasciolatus subsp. fasciatus (Narrow-banded Shovel-nosed Snake)*
28. 42381 *Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*
29. 42307 *Cacomantis pallidus (Pallid Cuckoo)*
30. *Calomyrmex sp.*
31. *Camponotus perjurus*
32. *Camponotus sp.*
33. *Cardiocondyla nuda*
34. *Cavasteron crassicalcar*
35. *Cerapachys sp.*
36. 24086 *Cercartetus concinnus (Western Pygmy-possum, Mundarda)*
37. *Cheramoeca leucosterna*
38. 25580 *Cinclosoma castaneothorax (Chestnut-breasted Quail-thrush)*
39. 25675 *Colluricincla harmonica (Grey Shrike-thrush)*
40. 24361 *Coracina maxima (Ground Cuckoo-shrike)*
41. 25568 *Coracina novaehollandiae (Black-faced Cuckoo-shrike)*
42. 24416 *Corvus bennetti (Little Crow)*
43. 25593 *Corvus orru (Torresian Crow)*
44. *Corvus sp.*
45. 24420 *Cracticus nigrogularis (Pied Butcherbird)*
46. 25595 *Cracticus tibicen (Australian Magpie)*
47. 25596 *Cracticus torquatus (Grey Butcherbird)*
48. 25458 *Ctenophorus caudicinctus (Ring-tailed Dragon)*
49. 24867 *Ctenophorus caudicinctus subsp. infans (Ring-tailed Dragon)*
50. 24868 *Ctenophorus clayi (Collared Dragon)*
51. 24873 *Ctenophorus fordi (Mallee Sand Dragon)*
52. 25459 *Ctenophorus isolepis (Crested Dragon, Military Dragon)*
53. 24875 *Ctenophorus isolepis subsp. gularis (Central Military Dragon)*
54. 24882 *Ctenophorus nuchalis (Central Netted Dragon)*
55. 24884 *Ctenophorus pictus (Painted Dragon)*
56. 24886 *Ctenophorus reticulatus (Western Netted Dragon)*
57. 24889 *Ctenophorus scutulatus (Lozenge-marked Dragon)*
58. *Ctenophorus sp.*
59. 25025 *Ctenotus ariadnae*
60. 25461 *Ctenotus brooksi*
61. 25032 *Ctenotus calurus*
62. 25037 *Ctenotus dux*
63. 25041 *Ctenotus grandis subsp. grandis*
64. 25042 *Ctenotus greeri*
65. 25044 *Ctenotus hanloni*
66. 25045 *Ctenotus helenae*
67. 25050 *Ctenotus leae*
68. 25052 *Ctenotus leonhardii*
69. 25057 *Ctenotus nasutus*
70. 25463 *Ctenotus pantherinus (Leopard Ctenotus)*
71. 25064 *Ctenotus pantherinus subsp. ocellifer (Leopard Ctenotus)*
72. 25062 *Ctenotus piankai*
73. 25066 *Ctenotus quattuordecimlineatus*
74. 25074 *Ctenotus schomburgkii*
75. 25090 *Cyclodomorphus melanops subsp. melanops (Slender Blue-tongue)*
76. 25375 *Cyclorana maini (Sheep Frog)*
77. *Cyclorana sp.*
78. 30903 *Dasycercus blythi (Brush-tailed Mulgara, Ampurta)* P4
79. 24997 *Delma butleri*
80. 25001 *Delma nasuta*
81. 25247 *Demansia psammophis subsp. psammophis (Yellow-faced Whipsnake)*
82. *Dingosa humphreysi*
83. 24926 *Diplodactylus conspicillatus (Fat-tailed Gecko)*
84. 24940 *Diplodactylus pulcher*
85. 42401 *Diporiphora paraconvergens (Grey-striped Western Desert Dragon)*
86. *Drepanotermes columellaris*
87. *Drepanotermes diversicolor*
88. *Drepanotermes gayi*
89. *Drepanotermes rubriceps*
90. 24470 *Dromaius novaehollandiae (Emu)*
91. *Eolophus roseicapillus*
92. 24570 *Epthianura tricolor (Crimson Chat)*
93. 24258 *Equus caballus (Horse)* Y
94. 25109 *Eremiascincus richardsonii (Broad-banded Sand Swimmer)*
95. *Eretes australis*
96. *Ethmostigmus curtipes*
97. 25621 *Falco berigora (Brown Falcon)*
98. 25622 *Falco cenchroides (Australian Kestrel)*
99. 25623 *Falco longipennis (Australian Hobby)*
100. 25624 *Falco peregrinus (Peregrine Falcon)* S
101. 24957 *Gehyra purpurascens*
102. 24959 *Gehyra variegata*
103. 24401 *Geopelia cuneata (Diamond Dove)*
104. 24443 *Grallina cyanoleuca (Magpie-lark)*

105. 24961 *Heteronotia binoei (Bynoe's Gecko)*
106. *Hoggicosa alfi*
107. *Hoggicosa bicolor*
108. *Hoggicosa forresti*
109. *Holconia nigrigularis*
110. *Iridomyrmex chasei*
111. *Iridomyrmex difficilis*
112. *Iridomyrmex discors*
113. *Iridomyrmex hartmeyeri*
114. *Iridomyrmex purpureus*
115. *Iridomyrmex roseatus*
116. *Iridomyrmex sp.*
117. *Isopedella saundersi*
118. *Isopedella tindalei*
119. *Lamponina elongata*
120. *Lamponina scutata*
121. 25125 *Lerista bipes*
122. 25130 *Lerista desertorum*
123. *Lerista sp.*
124. 25005 *Lialis burtonis*
125. 41411 *Liopholis inornata (Desert Skink)*
126. 41417 *Liopholis striata (Night Skink)*
127. 41420 *Lucasium bungabinna (Southern Sand Plain Gecko)*
128. 30938 *Lucasium damaeum*
129. 30933 *Lucasium stenodactylum*
130. *Lycosa australicola*
131. *Lycosa woonda*
132. 24135 *Macropus robustus subsp. erubescens (Euro, Biggada)*
133. 25651 *Malurus lamberti (Variegated Fairy-wren)*
134. 25652 *Malurus leucopterus (White-winged Fairy-wren)*
135. *Manorina (Myzantha) flavigula*
136. 24583 *Manorina flavigula (Yellow-throated Miner)*
137. *Masasteron piankai*
138. *Melophorus sp.*
139. 24736 *Melopsittacus undulatus (Budgerigar)*
140. 25184 *Menetia greyii*
141. *Meranoplus sp.*
142. *Merimna atrata*
143. 25693 *Microeca fascinans (Jacky Winter)*
144. *Minasteron minusculum*
145. 24904 *Moloch horridus (Thorny Devil)*
146. *Molycria vokes*
147. *Monomorium sp.*
148. 25190 *Morethia butleri*
149. 25495 *Morethia ruficauda*
150. 24223 *Mus musculus (House Mouse)* Y
151. 25248 *Neelaps bimaculatus (Black-naped Snake)*
152. 25422 *Neobatrachus aquilonius (Northern Burrowing Frog)*
153. 25425 *Neobatrachus kunapalari (Kunapalari Frog)*
154. 42303 *Neobatrachus sudellae (Desert Trilling Frog)*
155. 25427 *Neobatrachus sutor (Shoemaker Frog)*
156. 24740 *Neophema splendida (Scarlet-chested Parrot)*
157. *Neostenus sp.*
158. *Nephila edulis*
159. 24966 *Nephrurus laevissimus*
160. 24971 *Nephrurus vertebralis*
161. 24094 *Ningaui ridei (Wongai Ningaui)*
162. 25748 *Ninox novaeseelandiae (Boobook Owl)*
163. 25430 *Notaden nichollsi (Desert Spadefoot)*
164. 24224 *Notomys alexis (Spinifex Hopping-mouse)*
165. 24229 *Notomys mitchellii (Mitchell's Hopping-mouse)*
166. 24407 *Ocyphaps lophotes (Crested Pigeon)*
167. *Odontomachus ruficeps*
168. *Odontomachus sp.*
169. 24618 *Oreoica gutturalis (Crested Bellbird)*
170. *Orthetrum caledonicum*
171. 24085 *Oryctolagus cuniculus (Rabbit)* Y
172. 25680 *Pachycephala rufiventris (Rufous Whistler)*
173. 25254 *Parasuta monachus*
174. 24627 *Pardalotus rubricatus (Red-browed Pardalote)*
175. 25682 *Pardalotus striatus (Striated Pardalote)*
176. 24630 *Pardalotus striatus subsp. westraliensis (Striated Pardalote)*
177. *Pediana horni*
178. 24659 *Petroica goodenovii (Red-capped Robin)*
179. 24409 *Phaps chalcoptera (Common Bronzewing)*
180. 25703 *Podargus strigoides (Tawny Frogmouth)*
181. *Podomyrma sp.*
182. 25510 *Pogona minor (Dwarf Bearded Dragon)*
183. 24907 *Pogona minor subsp. minor (Dwarf Bearded Dragon)*
184. *Polyrhachis sp.*
185. 24683 *Pomatostomus superciliosus (White-browed Babbler)*
186. 24103 *Pseudantechinus macdonnellensis (Fat-tailed Pseudantechinus)*
187. 25261 *Pseudechis australis (Mulga Snake)*
188. 24235 *Pseudomys desertor (Desert Mouse)*
189. 24237 *Pseudomys hermannsburgensis (Sandy Inland Mouse)*
190. 42416 *Pseudonaja mengdeni (Western Brown Snake)*
191. 25263 *Pseudonaja modesta (Ringed Brown Snake)*
192. 42342 *Ptilotula plumulus (Grey-fronted Honeyeater)*
193. 42344 *Purnella albifrons (White-fronted Honeyeater)*
194. 25009 *Pygopus nigriceps*
195. 24278 *Pyrrholaemus brunneus (Redthroat)*
196. 24243 *Rattus fuscipes (Western Bush Rat)*
197. 25614 *Rhipidura leucophrys (Willie Wagtail)*
198. 24982 *Rhynchoedura ornata (Western Beaked Gecko)*
199. *Rhytidoponera sp.*
200. 25305 *Simoselaps anomalus (Desert Banded Snake)*
201. 25266 *Simoselaps bertholdi (Jan's Banded Snake)*
202. 30948 *Smicrornis brevirostris (Weebill)*
203. 24109 *Sminthopsis dolichura (Little long-tailed Dunnart)*
204. 24114 *Sminthopsis hirtipes (Hairy-footed Dunnart)*
205. 24116 *Sminthopsis macroura (Stripe-faced Dunnart)*
206. 24117 *Sminthopsis ooldea (Ooldea Dunnart)*
207. *Storena sinuosa*
208. 25597 *Strepera versicolor (Grey Currawong)*
209. 24924 *Strophurus ciliaris subsp. aberrans*
210. 24927 *Strophurus elderi*
211. 24931 *Strophurus intermedius*
212. 24946 *Strophurus strophurus*
213. 25269 *Suta fasciata (Rosen's Snake)*
214. *Synothele meadhunteri*
215. 30870 *Taeniopygia guttata (Zebra Finch)*
216. *Tamopsis marri*
217. *Thereuopoda lesueurii*
218. 25202 *Tiliqua multifasciata (Central Blue-tongue)*

219. 25203 *Tiliqua occipitalis (Western Bluetongue)*
220. *Trichocyclus arabana*
221. *Tumulitermes tumuli*
222. 24851 *Turnix velox (Little Button-quail)*
223. 30814 *Tympanocryptis cephalus (Pebble Dragon)*
224. *Urodacus hoplurus*
225. 25210 *Varanus brevicauda (Short-tailed Pygmy Monitor)*
226. 25211 *Varanus caudolineatus*
227. 25212 *Varanus eremius (Pygmy Desert Monitor)*
228. 25216 *Varanus giganteus (Perentie)*
229. 25215 *Varanus gilleni (Pygmy Mulga Monitor)*
230. 25218 *Varanus gouldii (Bungarra or Sand Monitor)*
231. 25526 *Varanus tristis (Racehorse Monitor)*
232. *Venator yalkara*
233. *Wandella stuartensis* Y
234. *Wydundra kennedy*
235. *Wydundra uluru*

Plantae

236. *Abutilon sp.*
237. 3194 *Acacia abrupta*
238. 16159 *Acacia acanthoclada subsp. acanthoclada*
239. 3217 *Acacia aneura (Mulga, Wanari)*
240. 3248 *Acacia burkittii (Sandhill Wattle)*
241. 3264 *Acacia colletioides (Wait-a-while)*
242. 3330 *Acacia exocarpoides*
243. 3399 *Acacia kempeana (Witchetty Bush, Ilykuwara)*
244. 3475 *Acacia pachyacra*
245. 36800 *Acacia pteraneura*
246. 3507 *Acacia quadrimarginea*
247. 19483 *Acacia ramulosa var. linophylla*
248. 19499 *Acacia ramulosa var. ramulosa*
249. 3522 *Acacia rigens (Nealie)*
250. 3544 *Acacia sibilans*
251. 3545 *Acacia sibina*
252. 3577 *Acacia tetragonophylla (Kurara, Wakalpuka)*
253. 19901 *Actinobole oldfieldianum*
254. 11730 *Alectryon oleifolius subsp. canescens*
255. 1730 *Allocasuarina helmsii*
256. *Allocasuarina sp.*
257. 4907 *Alyogyne pinoniana (Sand Hibiscus)*
258. 13702 *Alyogyne pinoniana var. pinoniana*
259. 2383 *Amyema preissii (Wireleaf Mistletoe)*
260. 2333 *Anthobolus leptomerioides*
261. 2468 *Atriplex nana*
262. 2481 *Atriplex vesicaria (Bladder Saltbush)*
263. 17246 *Austrostipa nitida*
264. 2770 *Boerhavia coccinea (Tar Vine, Wituka)*
265. 7413 *Brunonia australis (Native Cornflower)*
266. *Bryum dichotomum*
267. 8466 *Callitris columellaris (White Cypress Pine)*
268. 7895 *Calocephalus multiflorus (Yellow-top)*
269. 7905 *Calotis multicaulis (Many-stemmed Burr-daisy)*
270. 5488 *Calytrix warburtonensis* P2
271. 1742 *Casuarina obesa (Swamp Sheoak, Kuli)*
272. 12658 *Casuarina pauper (Black Oak)*
273. 7922 *Cephalipterum drummondii (Pompom Head)*
274. 32 *Cheilanthes brownii*
275. 12815 *Cheilanthes sieberi subsp. pseudovellea*
276. 4565 *Comesperma viscidulum (Viscid Milkwort)* P4
277. 1884 *Conospermum toddii (Victoria Desert Smokebush)* P4
278. 3010 *Cuphonotus andraeanus*
279. 290 *Dactyloctenium radulans (Button Grass)*
280. 6218 *Daucus glochidiatus (Australian Carrot)*
281. 17733 *Daviesia ulicifolia subsp. aridicola*
282. 6758 *Dicrastylis exsuccosa*
283. 310 *Digitaria brownii (Cotton Panic Grass)*
284. 4779 *Dodonaea rigida*
285. 2501 *Dysphania glomulifera*
286. 33479 *Dysphania melanocarpa (Black Crumbweed)*
287. 2507 *Dysphania simulans*
288. 378 *Eragrostis dielsii (Mallee Lovegrass)*
289. 380 *Eragrostis eriopoda (Woollybutt Grass, Wangurnu)*
290. 381 *Eragrostis falcata (Sickle Lovegrass)*
291. *Eragrostis sp.*
292. 7178 *Eremophila abietina (Spotted Poverty Bush)* Y
293. 17584 *Eremophila abietina subsp. ciliata*
294. 7205 *Eremophila exilifolia*
295. 15052 *Eremophila forrestii subsp. forrestii*
296. 29532 *Eremophila galeata*
297. 7211 *Eremophila georgei*
298. 16732 *Eremophila gilesii subsp. gilesii*
299. 17176 *Eremophila gilesii subsp. variabilis*
300. 14340 *Eremophila glabra subsp. glabra*
301. 7221 *Eremophila homoplastica*
302. 7234 *Eremophila longifolia (Berrigan, Tulypurpa)*
303. 15003 *Eremophila oldfieldii subsp. angustifolia*
304. 18570 *Eremophila oppositifolia subsp. angustifolia*
305. 15054 *Eremophila platythamnos subsp. exotrachys*
306. 7267 *Eremophila scoparia (Broom Bush ()*
307. 7269 *Eremophila serrulata (Serrate-leaved Eremophila)*
308. 408 *Eriachne flaccida (Claypan Grass)*
309. 2514 *Eriochiton sclerolaenoides (Woolly Bindii)*
310. 35345 *Eucalyptus camaldulensis subsp. obtusa (Blunt-budded River Red Gum)*
311. 5583 *Eucalyptus carnei (Carne's Blackbutt)*
312. 5592 *Eucalyptus clelandii (Cleland's Blackbutt)*
313. 5595 *Eucalyptus comitae-vallis (Comet Vale Mallee)*
314. 5596 *Eucalyptus concinna (Victoria Desert Mallee)*
315. 5636 *Eucalyptus eremicola*
316. 20300 *Eucalyptus eremicola subsp. peeneri*
317. 5641 *Eucalyptus ewartiana (Ewart's Mallee)*
318. 13533 *Eucalyptus glomerosa (Jinjulu)*
319. 5660 *Eucalyptus gongylocarpa (Marble Gum, Baarla)*
320. 13058 *Eucalyptus leptopoda subsp. elevata*
321. 5703 *Eucalyptus lucasii (Barlee Box)*
322. 5761 *Eucalyptus rigidula (Stiff-leaved Mallee)*
323. 5773 *Eucalyptus socialis (Red Mallee, Altarpa)*
324. *Eucalyptus sp.*
325. 15595 *Eucalyptus sublucida*
326. 29733 *Eucalyptus trivalva (Victoria Spring Mallee)*
327. 11011 *Eulalia aurea*
328. 851 *Fimbristylis dichotoma (Eight Day Grass)*
329. *Frankenia sp.*
330. 6143 *Glischrocaryon aureum (Common Popflower)*

331. 8002 *Gnephosis tenuissima*
332. 32472 *Goniomitrium acuminatum subsp. enerve*
333. 12530 *Goodenia macroplectra*
334. 1946 *Grevillea acacioides*
335. 19543 *Grevillea nematophylla subsp. planicosta*
336. 2077 *Grevillea pterosperma*
337. 2092 *Grevillea secunda* P4
338. 19137 *Hakea lorea subsp. lorea*
339. 6687 *Halgania cyanea (Rough Halgania)*
340. 29840 *Halgania cyanea var. Allambi Stn (B.W. Strong 676)*
341. 31117 *Halgania cyanea var. Charleville (R.W. Purdie +111)*
342. *Halgania cyanea var. Charleville (R.W.Purdie+ 111)*
343. 17491 *Halgania cyanea var. cyanea*
344. 6180 *Haloragis trigonocarpa*
345. 6712 *Heliotropium heteranthum*
346. 8045 *Helipterum craspedioides (Yellow Billy Buttons)*
347. 5815 *Homalocalyx thryptomenoides*
348. 459 *Iseilema eremaeum*
349. 7397 *Isotoma petraea (Rock Isotome, Tundiwari)*
350. 14779 *Jacksonia arida*
351. 4021 *Jacksonia nematoclada*
352. 12059 *Jasminum didymum subsp. lineare (Desert Jasmine)*
353. 19636 *Keraudrenia velutina subsp. elliptica*
354. 5846 *Lamarchea sulcata*
355. 13289 *Lawrencella davenportii*
356. 4955 *Lawrencia glomerata*
357. 19727 *Leiocarpa semicalva subsp. semicalva*
358. 19126 *Leptochloa fusca subsp. muelleri*
359. 4055 *Leptosema chambersii*
360. 14541 *Lomandra leucocephala subsp. robusta (Woolly Mat-rush)*
361. 12051 *Lysiana exocarpi subsp. exocarpi (Harlequin Mistletoe)*
362. 2398 *Lysiana murrayi (Mistletoe, Parka-Parka)*
363. *Lysiana sp.*
364. 2533 *Maireana amoena*
365. 2538 *Maireana carnosa (Cottony Bluebush)*
366. 2555 *Maireana pentatropis*
367. 2557 *Maireana platycarpa (Shy Bluebush)*
368. 2560 *Maireana pyramidata (Sago Bush)*
369. *Maireana sp.*
370. 11662 *Maireana tomentosa subsp. tomentosa*
371. 2568 *Maireana trichoptera (Downy Bluebush)*
372. 5908 *Melaleuca eleuterostachya*
373. 3053 *Menkea sphaerocarpa*
374. 5997 *Micromyrtus hymenonema*
375. 2842 *Mollugo cerviana*
376. 490 *Monachather paradoxus*
377. 4110 *Muelleranthus stipularis*
378. 6791 *Newcastelia hexarrhena (Lambs' Tails)*
379. 11734 *Nicotiana rosulata subsp. rosulata*
380. 17 *Ophioglossum lusitanicum (Adders Tongue)*
381. 514 *Paractaenum refractum*
382. 518 *Paspalidium clementii (Clements Paspalidium)*
383. 19744 *Pittosporum angustifolium*
384. 8167 *Pluchea dentex*
385. 8173 *Podolepis capillaris (Wiry Podolepis)*
386. 29098 *Poranthera leiosperma*
387. 12702 *Prostanthera sericea*
388. 2690 *Ptilotus aervoides*
389. 2708 *Ptilotus chamaecladus*
390. 2730 *Ptilotus helichrysoides*
391. 2731 *Ptilotus helipteroides (Hairy Mulla Mulla)*
392. 41001 *Ptilotus nobilis subsp. nobilis (Yellow Tails)*
393. 2747 *Ptilotus obovatus (Cotton Bush)*
41000 *Ptilotus sp. Goldfields (R. Davis 10796)*
395. 13308 *Rhodanthe charsleyae*
396. 13241 *Rhodanthe chlorocephala subsp. rosea*
397. 13242 *Rhodanthe chlorocephala subsp. splendida*
398. 13300 *Rhodanthe citrina*
399. 13301 *Rhodanthe floribunda*
400. 13251 *Rhodanthe propinqua*
401. 13252 *Rhodanthe pygmaea*
402. 45178 *Roebuckiella similis*
403. 8198 *Rutidosis helichrysoides (Grey Wrinklewort)*
404. 13006 *Sarcostemma viminale subsp. australe*
405. *Scaevola sp.*
406. 2602 *Sclerolaena convexula*
407. 2612 *Sclerolaena eurotioides (Fluffy Bindii)*
408. 2613 *Sclerolaena fimbriolata*
409. 2626 *Sclerolaena parviflora (Small-flower Saltbush)*
410. 2627 *Sclerolaena patenticuspis (Spear-fruit Saltbush)*
411. 29941 *Sclerolaena x georgei* Y
412. 8207 *Senecio glossanthus (Slender Groundsel)*
413. 8217 *Senecio quadridentatus*
414. 17558 *Senna artemisioides subsp. x artemisioides*
415. 4732 *Stackhousia megaloptera*
416. *Stackhousia muricata subsp. Annual (W.R.Barker 2172)*
417. 3074 *Stenopetalum anfractum*
418. 3082 *Stenopetalum velutinum (Velvet Thread Petal)*
419. 12355 *Swainsona affinis*
420. 12356 *Swainsona formosa*
421. 4231 *Swainsona kingii*
422. 4235 *Swainsona microphylla (Small-leaf Swainsona)*
423. 13585 *Swainsona tenuis*
424. 33319 *Tecticornia indica subsp. bidens*
425. 31618 *Tecticornia pruinosa*
426. 1338 *Thysanotus manglesianus (Fringed Lily)*
427. 29457 *Thysanotus sp. Eremaean (S. van Leeuwen 1067)*
428. 6279 *Trachymene ornata (Spongefruit)*
429. 678 *Tragus australianus (Small Burrgrass)*
430. 680 *Triodia basedowii (Lobed Spinifex)*
431. 17885 *Triodia bromoides* P4
432. 17873 *Triodia schinzii*
433. 705 *Tripogon loliiformis (Five Minute Grass)*
434. 7661 *Velleia hispida (Hispid Velleia)*
435. 7664 *Velleia rosea (Pink Velleia)*
436. *Wahlenbergia sp.*
437. 13331 *Waitzia acuminata var. acuminata*
438. 9247 *Westringia rigida (Stiff Westringia)*
439. 20183 *Zygophyllum aurantiacum subsp. aurantiacum*
440. 4388 *Zygophyllum compressum*
441. 18140 *Zygophyllum eichleri*
442. 4389 *Zygophyllum eremaeum*

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters
protected by the EPBC Act in the area you have selected.
Information on the coverage of this report and qualifications on data supporting this report are contained in the
caveat at the end of the report.
Information is available about Environment Assessments and the EPBC Act including significance guidelines,
forms and application process details.

Other Matters Protected by the EPBC Act

Acknowledgements

Buffer: 40.0Km

Matters of NES

Report created: 10/11/15 12:24:45

Coordinates

Caveat

Extra Information

Details

Summary

Summary

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

Matters of National Environmental Significance

Listed Threatened Ecological Communities:

Listed Migratory Species:

None

Great Barrier Reef Marine Park:

Wetlands of International Importance:

Listed Threatened Species:
None
6
None
None
National Heritage Places:
Commonwealth Marine Area:
World Heritage Properties:
None
None
6
The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on
Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a
place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a
Commonwealth Heritage place. Information on the new heritage laws can be found at
http://www.environment.gov.au/heritage
This part of the report summarises other matters protected under the Act that may relate to the area you nominated.
Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land,
when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on
Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to
take an action that is likely to have a significant impact on the environment anywhere.
A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened
species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of
a listed marine species.

Other Matters Protected by the EPBC Act

None
None
None
Listed Marine Species:
Whales and Other Cetaceans:
6
Commonwealth Heritage Places:
None

None
Critical Habitats:
Commonwealth Land:
Commonwealth Reserves Terrestrial:
Commonwealth Reserves Marine: None

Extra Information

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

1
State and Territory Reserves: 1
Nationally Important Wetlands:
Regional Forest Agreements: None
Invasive Species: 6
Key Ecological Features (Marine) None

Details

Listed Threatened Species [Resource Information]

Name Status Type of Presence
Birds
Malleefowl [934] Vulnerable Species or species habitat
likely to occur within area
Leipoa ocellata
Night Parrot [59350] Endangered Species or species habitat
may occur within area
Pezoporus occidentalis
Princess Parrot, Alexandra's Parrot [758] Vulnerable Species or species habitat
may occur within area
Polytelis alexandrae
Mammals
Kakarratul, Northern Marsupial Mole [295] Endangered Species or species
habitat
may occur within area
Notoryctes caurinus
Sandhill Dunnart [291] Endangered Species or species habitat
likely to occur within area
Sminthopsis psammophila
Reptiles
Great Desert Skink, Tjakura, Warrarna, Mulyamiji
[83160]
Vulnerable Species or species habitat
may occur within area
Liopholis kintorei

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.
Name Threatened Type of Presence
Migratory Marine Birds
Fork-tailed Swift [678] Species or species habitat likely to occur within area
Apus pacificus
Migratory Terrestrial Species
Rainbow Bee-eater [670] Species or species habitat may occur within area
Merops ornatus
Grey Wagtail [642] Species or species habitat may occur within area
Motacilla cinerea
Yellow Wagtail [644] Species or species habitat may occur within area
Motacilla flava
Migratory Wetlands Species

Matters of National Environmental Significance

Name Threatened Type of Presence
Great Egret, White Egret [59541] Species or species habitat likely to occur within area
Ardea alba
Oriental Plover, Oriental Dotterel [882] Species or species habitat may occur within area
Charadrius veredus

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.
Name Threatened Type of Presence
Birds
Fork-tailed Swift [678] Species or species habitat likely to occur within area
Apus pacificus
Great Egret, White Egret [59541] Species or species habitat likely to occur within area
Ardea alba
Oriental Plover, Oriental Dotterel [882] Species or species habitat may occur within area
Charadrius veredus
Rainbow Bee-eater [670] Species or species habitat may occur within area

Merops ornatus
Grey Wagtail [642] Species or species habitat
may occur within area
Motacilla cinerea
Yellow Wagtail [644] Species or species habitat
may occur within area
Motacilla flava

Other Matters Protected by the EPBC Act

State and Territory Reserves [Resource Information]

Name State
Yeo Lake WA

Nationally Important Wetlands [Resource Information]

Name State
Yeo Lake/Lake Throssell WA

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants
that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The
following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from
Landscape Health Project, National Land and Water Resouces Audit, 2001.
Name Status Type of Presence
Mammals
Dromedary, Camel [7] Species or species habitat
likely to occur within area
Camelus dromedarius
Goat [2] Species or species habitat
likely to occur within area
Capra hircus
Cat, House Cat, Domestic Cat [19] Species or species habitat
likely to occur within area
Felis catus
House Mouse [120] Species or species habitat
likely to occur within area
Mus musculus
Rabbit, European Rabbit [128] Species or species habitat
likely to occur within area
Oryctolagus cuniculus
Red Fox, Fox [18] Species or species habitat
likely to occur within area

Vulpes vulpes
- non-threatened seabirds which have only been mapped for recorded breeding sites
- migratory species that are very widespread, vagrant, or only occur in small numbers
- some species and ecological communities that have only recently been listed
Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only.
Where available data supports mapping, the type of presence that can be determined from the data is indicated in general
terms. People using this information in making a referral may need to consider the qualifications below and may need to seek
and consider other information sources.
For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State
vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less
well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
- seals which have only been mapped for breeding sites near the Australian continent
Such breeding sites may be important for the protection of the Commonwealth Marine environment.
For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed
habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For
species whose distributions are less well known, point locations are collated from government wildlife authorities, museums,
and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some
cases, the distribution maps are based solely on expert knowledge.
The information presented in this report has been provided by a range of data sources as acknowledged at the end of the
report.

Caveat

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

- some terrestrial species that overfly the Commonwealth marine area
The following groups have been mapped, but may not cover the complete distribution of the species:
Only selected species covered by the following provisions of the EPBC Act have been mapped:
-28.058 123.731

Coordinates

Appendix 2: DPaW Threatened Flora, Nature Map and Protected Matters Database results within 40km

Taxon	Conservation Code	Description (WAHERB, 2015)
Calytrix warburtonensis	2	Shrub, 0.3-0.6 m high. Fl. white, Mar or Sep to Oct. Rocky hills, breakaways.
Comesperma viscidulum	4	Shrub, to ca 0.7 m high.
Conospermum toddii	4	Spreading shrub, 1.2-2 m high. Fl. white/white-yellow, Jul to Oct. Yellow sand. Sand dunes.
Grevillea secunda	4	Low spreading shrub, 0.3-0.8 m high. Fl. red, Sep to Oct. Yellow or red sand. Sand dunes, sandplains.
Sauropus ramosissimus	3	Slender, much-branched shrub, to 0.3 m high.
Thryptomene nealensis	3	Shrub, ca 0.3 m high. Fl. pink, Oct. Lateritic breakaways

Appendix 3: Muir Life Form/Height Class (Muir, 1977).

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70% -100%	MID-DENSE 30% -70%	SPARSE 10% - 30%	VERY SPARSE 2% -10%
Trees > 30m Trees 15 – 30m Trees 5 – 15m Trees < 5m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
Mallee Tree Form Mallee Shrub Form	Dense Tree Mallee Dense Shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
Shrubs > 2m Shrubs 1.5 – 2m Shrubs 1 – 1.5m Shrubs 0.5 – 1m Shrubs 0 – 0.5m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath B Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
Mat Plants Hummock Grass Bunch grass >0.5m Bunch grass < 0.5m Herbaceous spp.	Dense Mat Plants Dense Hummock Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants Mid-dense Hummock Grass Tall Grass Low Grass Herbs	Open Mat Plants Hummock Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hummock Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
Sedges > 0.5m Sedges < 0.5m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low Sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
Ferns Mosses, liverworts	Dense ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

Appendix 4: List of species identified within each vegetation community of the Gruyere Borefields survey area

(A) Denotes Annual species; (W) Denotes Introduced species; (P) Denotes Priority Flora as listed on Florabase (WAHERB, 2016)

Family	Genus	Taxon	Clay-Loam Plain			Closed Depression					Drainage Depression				Quartz/Rocky Plain							Sand Dune		Sand-Loam Plain			Sand Plain																		
			CLP-AFW1	CLP-AS1	CLP-MOW/SMS1	CD-AFW1	CD-AFW2	CD-CFS/EW1	CD-CSSSF1	CD-MWS1	DD-AFW1	DD-AOW1	DD-AOW2	DD-MWS1	QRP-AFW1	QRP-AFW2	QRP-AFW7	QRP-AFW8	QRP-CFW2	QRP-MWS1	QRP-MWS2	SD-EW/MWS1	SD-MWS1	SLP-AFW1	SLP-AFW2	SLP-RMNV1	S-AFW1	S-AFW2	S-AFW3	S-AFW4	S-AFW5	S-EW1	S-EW/MWS1	S-EW/MWS2	S-MWS1	S-MWS2	S-MWS3	S-MWS4	S-MWS5	S-MWS10	S-MWS11	S-MWS12	S-RMNV1	S-RMNV2	S-RMNV3
Amaranthaceae	*Ptilotus*	*aervoides* (A)									*	*																											*						
Amaranthaceae	*Ptilotus*	*gaudichaudii* (A)	*								*																																		
Amaranthaceae	*Ptilotus*	*helipteroides* (A)	*	*	*										*	*																													
Amaranthaceae	*Ptilotus*	*holosericeus*																												*															
Amaranthaceae	*Ptilotus*	*nobilis*											*											*															*					*	
Amaranthaceae	*Ptilotus*	*obovatus*	*	*	*	*					*	*	*		*	*		*	*	*		*		*				*							*			*	*	*				*	
Amaranthaceae	*Ptilotus*	*polystachyus* (A)																															*						*						
Amaranthaceae	*Ptilotus*	*schwartzii*											*	*		*																													
Amaranthaceae	*Ptilotus*	sp. (sterile)									*																			*					*										
Apocynaceae	*Marsdenia*	*australis* (A)			*								*		*	*												*		*						*			*						
Asparagaceae	*Lomandra*	*leucocephala* subsp. *robusta*																				*																							
Asteraceae	*Brachyscome*	*ciliocarpa* (A)									*																*	*		*															
Asteraceae	*Calotis*	*multicaulis* (A)																																											
Asteraceae	*Cephalipterum*	*drummondii* (A)																	*																										
Asteraceae	*Chrysocephalum*	*apiculatum*					*																																						
Asteraceae	*Chrysocephalum*	*puteale*	*	*							*				*	*						*	*				*																		
Asteraceae	*Cratystylis*	*subspinescens*																		*				*	*																				
Asteraceae	*Olearia*	*muelleri*																	*																										
Asteraceae	*Olearia*	*pimelioides*																																						*					
Asteraceae	*Olearia*	*stuartii*																																			*								
Asteraceae	*Podolepis*	*capillaris* (A)	*												*	*																													
Asteraceae	*Rhodanthe*	*charsleyae* (A)	*				*				*		*														*			*															
Asteraceae	*Rhodanthe*	*chlorocephala* subsp. *splendida* (A)	*		*						*				*	*						*					*	*								*		*							
Asteraceae	*Schoenia*	*cassiniana* (A)					*																																						
Asteraceae	*Trichanthodium*	*skirrophorum* (A)					*																																						
Asteraceae	*Vittadinia*	*eremaea* (A)																								*		*		*															
Asteraceae	*Waitzia*	*acuminata* (A)																												*															
Boraginaceae	*Halgania*	*cyanea* var. Allambi Stn (B.W. Strong 676)		*																												*	*	*			*	*		*					
Boraginaceae	*Halgania*	*cyanea* var. *charleville*																																	*	*									
Boraginaceae	*Halgania*	*integerrima*			*																					*	*					*	*												
Boraginaceae	*Trichodesma*	*zeylanicum* (A)																				*																							
Brassicaceae	*Lepidium*	*oxytrichum* (A)	*								*																																		
Brassicaceae	*Lepidium*	*phlebopetalum* (A)	*								*																																		
Brassicaceae	*Lepidium*	*platypetalum*											*																																
Campanulaceae	*Wahlenbergia*	*tumidifructa* (A)									*																																		
Casuarinaceae	*Allocasuarina*	*helmsii*																								*																			
Casuarinaceae	*Casuarina*	*pauper*						*								*			*		*																								

Family	Genus	Taxon	Clay-Loam Plain			Closed Depression					Drainage Depression				Quartz/Rocky Plain							Sand Dune		Sand-Loam Plain			Sand Plain																		
			CLP-AFW1	CLP-AS1	CLP-MOW/SMS1	CD-AFW1	CD-AFW2	CD-CFS/EW1	CD-CSSSF1	CD-MWS1	DD-AFW1	DD-AOW1	DD-AOW2	DD-MWS1	QRP-AFW1	QRP-AFW2	QRP-AFW7	QRP-AFW8	QRP-CFW2	QRP-MWS1	QRP-MWS2	SD-EW/MWS1	SD-MWS1	SLP-AFW1	SLP-AFW2	SLP-RMNV1	S-AFW1	S-AFW2	S-AFW3	S-AFW4	S-AFW5	S-EW1	S-EW/MWS1	S-EW/MWS2	S-MWS1	S-MWS2	S-MWS3	S-MWS4	S-MWS5	S-MWS10	S-MWS11	S-MWS12	S-RMNV1	S-RMNV2	S-RMNV3
Celastraceae	*Stackhousia*	*muricata* subsp. annual (W.R. Barker 2172) (A)	*	*							*	*			*	*						*																					
Chenopodiaceae	*Atriplex*	*bunburyana*				*				*									*	*	*			*	*	*																	
Chenopodiaceae	*Atriplex*	*vesicaria*						*			*	*																															
Chenopodiaceae	*Chenopodium*	*curvispicatum*						*													*																						
Chenopodiaceae	*Dysphania*	*kalpari* (A)																															*											*	
Chenopodiaceae	*Enchylaena*	*lanata*									*		*											*																			
Chenopodiaceae	*Enchylaena*	*tomentosa*																																				*					
Chenopodiaceae	*Eriochiton*	*sclerolaenoides*													*																												
Chenopodiaceae	*Maireana*	*carnosa*											*					*			*																						
Chenopodiaceae	*Maireana*	*convexa*											*		*																												
Chenopodiaceae	*Maireana*	*georgei*	*	*	*						*	*	*					*	*					*	*																	*	
Chenopodiaceae	*Maireana*	*glomerifolia*		*											*																												
Chenopodiaceae	*Maireana*	*integra*			*	*															*																						
Chenopodiaceae	*Maireana*	*pentatropis*																			*			*																			
Chenopodiaceae	*Maireana*	*planifolia*									*	*		*							*																						
Chenopodiaceae	*Maireana*	*pyramidata*									*	*												*	*																		
Chenopodiaceae	*Maireana*	*thesioides*	*		*						*		*														*	*		*						*							
Chenopodiaceae	*Maireana*	*tomentosa*																	*		*																						
Chenopodiaceae	*Maireana*	*triptera*			*						*	*	*		*	*								*	*																		
Chenopodiaceae	*Rhagodia*	*eremaeum*			*			*			*	*	*		*			*						*	*			*											*				
Chenopodiaceae	*Rhagodia*	*preissii* subsp. *preissii*																														*	*										
Chenopodiaceae	*Salsola*	*australis* (A)	*	*									*		*																							*		*			
Chenopodiaceae	*Sclerolaena*	*cuneata*															*		*		*																						
Chenopodiaceae	*Sclerolaena*	*densiflora*	*	*							*	*	*		*																												
Chenopodiaceae	*Sclerolaena*	*diacantha*	*	*	*						*	*	*	*	*							*			*															*			
Chenopodiaceae	*Sclerolaena*	*eriacantha*											*				*		*																								
Chenopodiaceae	*Sclerolaena*	*parviflora*												*	*											*																	
Chenopodiaceae	*Tecticornia*	*disarticulata*								*	*	*																															
Chenopodiaceae	*Tecticornia*	*halocnemoides*							*																																		
Chenopodiaceae	*Tecticornia*	*indica* subsp. *biden*							*																																		
Chenopodiaceae	*Tecticornia*	*undulata*							*																																		
Colchicaceae	*Wurmbea*	*deserticola*																									*					*	*		*		*			*			
Convolvulaceae	*Bonamia*	*erecta*																														*	*	*			*					*	
Convolvulaceae	*Convolvulus*	*remotus*	*	*																										*													
Cupressaceae	*Callitris*	*preissii*																				*										*	*										
Cyperaceae	*Fimbristylis*	*dichotoma*																												*													
Ericaceae	*Leucopogon*	*?cuneifolius*																														*	*										
Euphorbiaceae	*Euphorbia*	*drummondii* (A)	*								*		*		*	*						*					*															*	
Euphorbiaceae	*Euphorbia*	*tannensis*																				*	*					*	*														
Fabaceae	*Acacia*	*abrupta*																														*	*		*	*	*	*		*	*		*		
Fabaceae	*Acacia*	*aptaneura*	*				*				*		*	*	*											*				*		*				*							
Fabaceae	*Acacia*	*burkittii*		*				*					*	*		*			*	*	*				*												*						
Fabaceae	*Acacia*	*caesaneura*	*	*	*	*					*	*	*		*	*	*	*	*	*				*	*		*	*	*	*	*	*	*		*	*	*	*	*	*			
Fabaceae	*Acacia*	*colletioides*						*											*		*																					*	
Fabaceae	*Acacia*	*craspedocarpa*											*			*																	*										
Fabaceae	*Acacia*	*cuthbertsonii*																*	*	*											*						*	*	*				
Fabaceae	*Acacia*	*desertorum*																													*	*	*	*	*		*					*		*

Family	Genus	Taxon	Clay-Loam Plain			Closed Depression					Drainage Depression				Quartz/Rocky Plain							Sand Dune		Sand-Loam Plain			Sand Plain																		
			CLP-AFW1	CLP-AS1	CLP-MOW/SMS1	CD-AFW1	CD-AFW2	CD-CFS/EW1	CD-CSSSF1	CD-MWS1	DD-AFW1	DD-AOW1	DD-AOW2	DD-MWS1	QRP-AFW1	QRP-AFW2	QRP-AFW7	QRP-AFW8	QRP-CFW2	QRP-MWS1	QRP-MWS2	SD-EW/MWS1	SD-MWS1	SLP-AFW1	SLP-AFW2	SLP-RMNV1	S-AFW1	S-AFW2	S-AFW3	S-AFW4	S-AFW5	S-EW1	S-EW/MWS1	S-EW/MWS2	S-MWS1	S-MWS2	S-MWS3	S-MWS4	S-MWS5	S-MWS10	S-MWS11	S-MWS12	S-RMNV1	S-RMNV2	S-RMNV3
Fabaceae	*Acacia*	*duriuscula*															*																												
Fabaceae	*Acacia*	*exocarpoides*													*	*																													
Fabaceae	*Acacia*	*grasbyi*																*													*						*								
Fabaceae	*Acacia*	*hemiteles*								*																																			
Fabaceae	*Acacia*	*incurvaneura*	*	*	*		*				*	*	*	*	*	*	*	*	*	*				*	*	*	*	*	*	*		*	*		*	*		*	*					*	
Fabaceae	*Acacia*	*jennerae*																														*	*				*			*					
Fabaceae	*Acacia*	*ligulata*		*				*												*	*	*	*	*			*		*			*	*	*	*	*	*	*	*	*		*			*
Fabaceae	*Acacia*	*mulganeura*															*																												
Fabaceae	*Acacia*	*murrayana*																				*					*						*				*					*		*	
Fabaceae	*Acacia*	*pachyacra*						*																*			*						*		*				*	*					
Fabaceae	*Acacia*	*platycarpa*																																						*					
Fabaceae	*Acacia*	*quadrimarginea*	*	*	*								*		*	*						*																*							
Fabaceae	*Acacia*	*ramulosa* var. *ramulosa*			*						*				*													*	*	*									*						
Fabaceae	*Acacia*	*stowardii*																																			*								
Fabaceae	*Acacia*	*tetragonophylla*	*		*		*				*		*		*	*			*	*								*							*	*			*						
Fabaceae	*Acacia*	*victoriae*											*																																
Fabaceae	*Daviesia*	*benthamii*																																						*					
Fabaceae	*Daviesia*	*purpurascens*																				*																							
Fabaceae	*Daviesia*	*ulicifolia*																				*	*																						
Fabaceae	*Leptosema*	*chambersii*																									*		*			*	*		*	*	*	*					*	*	*
Fabaceae	*Senna*	*artemisioides* subsp. *filifolia*	*	*	*	*	*	*			*	*	*	*	*			*	*	*		*		*	*	*						*	*		*	*		*	*	*					
Fabaceae	*Senna*	*artemisioides* subsp. *helmsii*	*	*									*		*	*																													
Fabaceae	*Senna*	*artemisioides* subsp. x *artemisioides*	*	*	*		*				*	*	*		*	*											*	*						*	*			*	*	*					
Fabaceae	*Senna*	*cardiosperma*																													*								*			*			
Fabaceae	*Senna*	*pleurocarpa* var. *angustifolia*											*																																
Fabaceae	*Senna*	sp. Meekatharra (E. Bailey 1-26)																*																											
Frankeniaceae	*Frankenia*	*georgei*									*	*			*																														
Frankeniaceae	*Frankenia*	*interioris* var. *parviflora*				*																																							
Frankeniaceae	*Frankenia*	*setosa*						*		*										*					*																				
Geraniaceae	*Erodium*	*crinitum*									*																			*															
Goodeniaceae	*Brunonia*	*australis* (A)											*																						*	*									
Goodeniaceae	*Dampiera*	*ramosa*																					*																						
Goodeniaceae	*Goodenia*	*centralis* (A)																									*								*	*									
Goodeniaceae	*Goodenia*	*mimuloides* (A)																									*			*							*								
Goodeniaceae	*Goodenia*	*ramelii*																				*																							
Goodeniaceae	*Goodenia*	sp. (sterile) (A)																												*															
Goodeniaceae	*Goodenia*	*xanthosperma*																									*					*	*				*								
Goodeniaceae	*Scaevola*	*basedowii*																				*											*												
Goodeniaceae	*Scaevola*	*parvifolia*																			*											*	*				*	*						*	
Goodeniaceae	*Scaevola*	*spinescens*	*	*	*										*	*		*	*	*				*				*				*						*	*						
Gyrostemonaceae	*Codonocarpus*	*cotinifolius*																					*			*																	*		
Gyrostemonaceae	*Gyrostemon*	*ramulosus*																				*	*										*												
Haloragaceae	*Glischrocaryon*	*aureum*																														*	*												
Haloragaceae	*Haloragis*	*odontocarpa* (A)	*	*	*						*	*			*	*						*					*	*	*	*						*			*						
Hemerocallidaceae	*Corynotheca*	*micrantha* var. *divaricata*																				*	*																						
Hemerocallidaceae	*Dianella*	*revoluta*											*	*					*																										

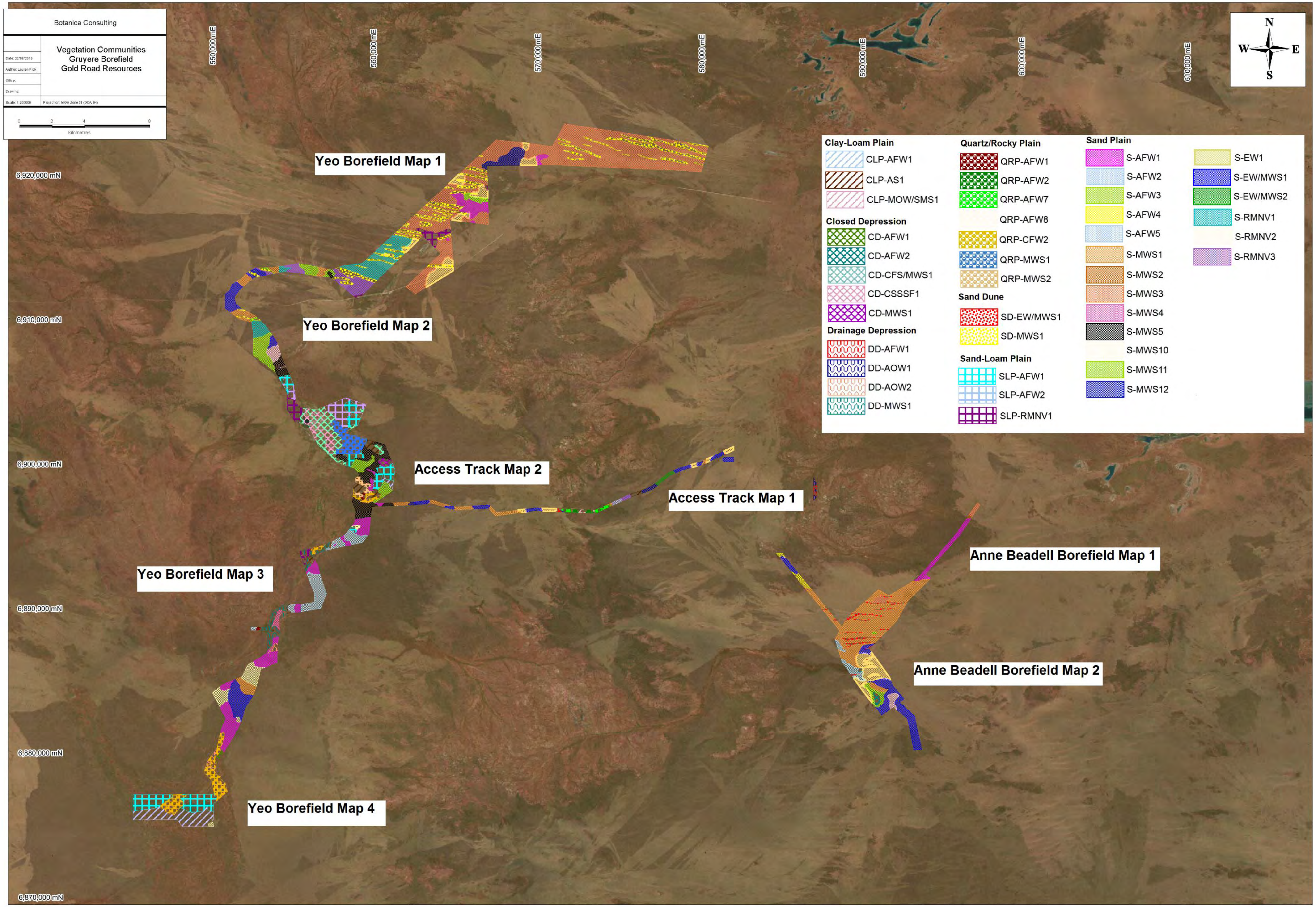
Family	Genus	Taxon	Clay-Loam Plain			Closed Depression					Drainage Depression				Quartz/Rocky Plain							Sand Dune		Sand-Loam Plain			Sand Plain																		
			CLP-AFW1	CLP-AS1	CLP-MOW/SMS1	CD-AFW1	CD-AFW2	CD-CFS/EW1	CD-CSSSF1	CD-MWS1	DD-AFW1	DD-AOW1	DD-AOW2	DD-MWS1	QRP-AFW1	QRP-AFW2	QRP-AFW7	QRP-AFW8	QRP-CFW2	QRP-MWS1	QRP-MWS2	SD-EW/MWS1	SD-MWS1	SLP-AFW1	SLP-AFW2	SLP-RMNV1	S-AFW1	S-AFW2	S-AFW3	S-AFW4	S-AFW5	S-EW1	S-EW/MWS1	S-EW/MWS2	S-MWS1	S-MWS2	S-MWS3	S-MWS4	S-MWS5	S-MWS10	S-MWS11	S-MWS12	S-RMNV1	S-RMNV2	S-RMNV3
Lamiaceae	*Dicrastylis*	*doranii*																					*				*					*	*				*	*							
Lamiaceae	*Dicrastylis*	*exsuccosa*																																									*	*	
Lamiaceae	*Dicrastylis*	*sessilifolia*																														*	*				*						*		
Lamiaceae	*Microcorys*	*macrediana*																									*						*	*			*					*			
Lamiaceae	*Newcastelia*	*hexarrhena*																																								*	*		
Lamiaceae	*Prostanthera*	*campbellii*	*		*											*	*											*																	
Lamiaceae	*Prostanthera*	*wilkieana*		*												*												*											*						
Lamiaceae	*Spartothamnella*	*teucriiflora*	*		*						*													*			*	*		*		*				*			*						
Lamiaceae	*Westringia*	*rigida*																	*		*					*																			
Lamiaceae	*Pityrodia*	*loricata*																					*																						
Loranthaceae	*Amyema*	*fitzgeraldii*											*																														*		
Loranthaceae	*Amyema*	*miquelii*																														*	*												
Malvaceae	*Abutilon*	*cryptopetalum*																										*									*								
Malvaceae	*Abutilon*	*otocarpum*									*											*					*																		
Malvaceae	*Alyogyne*	*pinoniana*																				*	*	*		*						*	*	*				*	*	*				*	
Malvaceae	*Androcalva*	*loxophylla*																																*	*		*								*
Malvaceae	*Androcalva*	*luteiflora*																																	*		*								
Malvaceae	*Brachychiton*	*gregorii*											*																														*		
Malvaceae	*Commersonia*	*craurophylla*																																	*		*					*	*		
Malvaceae	*Hibiscus*	*burtonii*																														*	*												
Malvaceae	*Keraudrenia*	*integrifolia*																																			*								*
Malvaceae	*Keraudrenia*	*prorepens*																																	*	*		*							
Malvaceae	*Keraudrenia*	*velutina*																				*					*						*	*	*	*		*							
Malvaceae	*Lawrencia*	*glomerata*							*	*																																			
Malvaceae	*Sida*	*calyxhymenia*	*	*	*										*													*				*	*												
Malvaceae	*Sida*	*cardiophylla*																*		*																								*	
Malvaceae	*Sida*	*fibulifera*	*								*	*																		*															
Malvaceae	*Sida*	*intricata*		*							*	*																		*															
Malvaceae	*Sida*	sp. (sterile)																											*																
Malvaceae	*Sida*	sp. Excedentifolia (J.L. Egan 1925)	*	*	*						*	*	*		*	*												*	*						*	*			*	*					
Malvaceae	*Sida*	sp. spiciform panicles (E. Leyland s.n. 14/8/90)																*	*		*																							*	
Myrtaceae	*Aluta*	*maisonneuvei* subsp. *auriculata*																				*	*						*		*	*	*	*	*	*	*	*			*	*	*		*
Myrtaceae	*Baeckea*	sp. Great Victoria Desert (A.S. Weston 14813)																																								*	*		
Myrtaceae	*Calothamnus*	*aridus*												*																	*														
Myrtaceae	*Eucalyptus*	*comitae-vallis*																																			*								
Myrtaceae	*Eucalyptus*	*concinna*						*						*				*	*	*				*													*	*	*	*				*	
Myrtaceae	*Eucalyptus*	*?concinna*																								*																			
Myrtaceae	*Eucalyptus*	*eremicola*											*																										*						
Myrtaceae	*Eucalyptus*	*glomerosa*																				*										*	*	*											
Myrtaceae	*Eucalyptus*	*gongylocarpa*																				*	*									*	*	*	*		*	*		*					
Myrtaceae	*Eucalyptus*	*gypsophila*						*		*										*																									
Myrtaceae	*Eucalyptus*	*hypolaena*																																									*		
Myrtaceae	*Eucalyptus*	*leptopoda* subsp. *elevata*		*																		*															*				*	*	*		
Myrtaceae	*Eucalyptus*	*lucasii*			*		*							*		*				*	*			*			*	*										*							
Myrtaceae	*Eucalyptus*	*mannensis*																																					*						

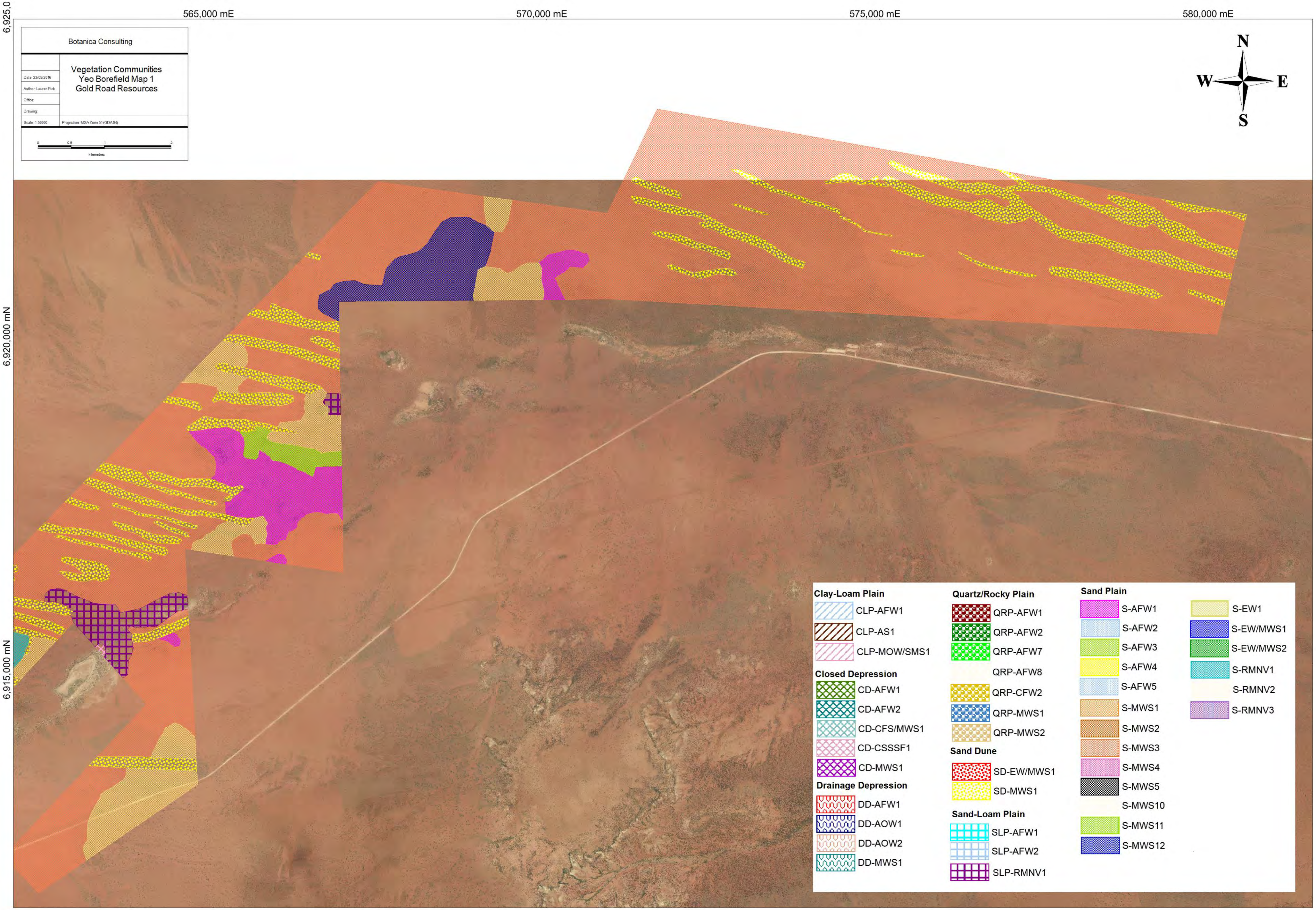
Family	Genus	Taxon	Clay-Loam Plain			Closed Depression					Drainage Depression				Quartz/Rocky Plain							Sand Dune		Sand-Loam Plain			Sand Plain																		
			CLP-AFW1	CLP-AS1	CLP-MOW/SMS1	CD-AFW1	CD-AFW2	CD-CFS/EW1	CD-CSSSF1	CD-MWS1	DD-AFW1	DD-AOW1	DD-AOW2	DD-MWS1	QRP-AFW1	QRP-AFW2	QRP-AFW7	QRP-AFW8	QRP-CFW2	QRP-MWS1	QRP-MWS2	SD-EW/MWS1	SD-MWS1	SLP-AFW1	SLP-AFW2	SLP-RMNV1	S-AFW1	S-AFW2	S-AFW3	S-AFW4	S-AFW5	S-EW1	S-EW/MWS1	S-EW/MWS2	S-MWS1	S-MWS2	S-MWS3	S-MWS4	S-MWS5	S-MWS10	S-MWS11	S-MWS12	S-RMNV1	S-RMNV2	S-RMNV3
Myrtaceae	*Eucalyptus*	*?mannensis*																								*																			
Myrtaceae	*Eucalyptus*	*rigidula*																				*					*													*					
Myrtaceae	*Eucalyptus*	*trivalva*																			*											*	*											*	
Myrtaceae	*Eucalyptus*	*youngiana*			*		*															*	*				*		*	*		*	*	*	*	*	*	*		*	*	*		*	*
Myrtaceae	*Melaleuca*	*interioris*						*						*										*		*			*		*														
Myrtaceae	*Melaleuca*	*xerophila*						*																																					
Myrtaceae	*Micromyrtus*	*flaviflora*																											*			*	*	*	*	*	*				*	*			*
Nyctaginaceae	*Boerhavia*	*coccinea*			*													*																											
Oleaceae	*Jasminum*	*didymum* subsp. *lineare*																				*					*					*	*			*				*					
Pittosporaceae	*Pittosporum*	*angustifolium*												*								*											*	*					*						
Poaceae	*Aristida*	*contorta* (A)	*	*	*						*	*	*		*	*						*					*	*											*						
Poaceae	*Aristida*	*holathera* (A)																				*	*										*				*			*					
Poaceae	*Austrostipa*	*elegantissima*																	*																										
Poaceae	*Cenchrus*	*ciliaris* (W)												*																															
Poaceae	*Enneapogon*	*caerulescens*		*	*								*			*						*						*																	
Poaceae	*Enteropogon*	*ramosus*									*	*						*			*																								
Poaceae	*Eragrostis*	*eriopoda*	*	*	*	*		*			*	*	*		*	*	*		*			*		*	*	*	*	*	*	*		*			*	*		*	*	*				*	
Poaceae	*Eragrostis*	*falcata*					*																																						
Poaceae	*Eragrostis*	*pergracilis*												*							*																								
Poaceae	*Eragrostis*	*setifolia*									*	*									*																								
Poaceae	*Eriachne*	*mucronata*		*	*										*	*														*															
Poaceae	*Eriachne*	*pulchella* (A)		*	*										*	*												*																	
Poaceae	*Monachather*	*paradoxus*	*	*							*					*						*					*	*		*															
Poaceae	*Themeda*	*triandra*											*													*																			
Poaceae	*Triodia*	*basedowii*				*		*														*	*	*	*	*	*		*			*	*	*	*	*	*		*	*	*	*	*	*	*
Poaceae	*Triodia*	*desertorum*			*												*	*	*	*	*		*																			*	*		
Poaceae	*Triodia*	*irritans*		*	*												*	*	*	*	*	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*					*
Poaceae	*Triodia*	*rigidissima*																												*													*		
Poaceae	*Triraphis*	*mollis*				*																		*		*																			
Polygonaceae	*Duma*	*florulenta*												*																															
Portulacaceae	*Calandrinia*	sp. sterile (A)	*								*					*														*															
Proteaceae	*Grevillea*	*acacioides*																				*													*	*									
Proteaceae	*Grevillea*	*berryana*											*	*										*																					
Proteaceae	*Grevillea*	*didymobotrya* subsp. *didymobotrya*		*																									*												*		*		*
Proteaceae	*Grevillea*	*juncifolia* subsp. *juncifolia*																				*	*										*	*				*	*				*		
Proteaceae	*Grevillea*	*nematophylla* subsp. *supraplana*																																			*								
Proteaceae	*Grevillea*	*pterosperma*																				*										*	*	*								*			
Proteaceae	*Hakea*	*francisiana*																				*										*	*	*				*		*					
Proteaceae	*Hakea*	*lorea*		*										*													*		*						*	*				*		*			
Proteaceae	*Hakea*	*multilineata*																																											*
Pteridaceae	*Cheilanthes*	*sieberi* subsp. *sieberi*			*		*				*				*	*	*										*			*						*									
Rubiaceae	*Psydrax*	*latifolia*			*						*		*		*	*											*	*	*	*							*								
Santalaceae	*Anthobolus*	*leptomerioides*			*																							*																	
Santalaceae	*Exocarpos*	*aphyllus*								*								*	*		*				*								*				*			*	*				*
Santalaceae	*Exocarpos*	*sparteus*																				*										*	*	*	*	*	*	*							*
Santalaceae	*Santalum*	*acuminatum*																																							*			

Family	Genus	Taxon	Clay-Loam Plain			Closed Depression					Drainage Depression				Quartz/Rocky Plain							Sand Dune		Sand-Loam Plain			Sand Plain																		
			CLP-AFW1	CLP-AS1	CLP-MOW/SMS1	CD-AFW1	CD-AFW2	CD-CFS/EW1	CD-CSSSF1	CD-MWS1	DD-AFW1	DD-AOW1	DD-AOW2	DD-MWS1	QRP-AFW1	QRP-AFW2	QRP-AFW7	QRP-AFW8	QRP-CFW2	QRP-MWS1	QRP-MWS2	SD-EW/MWS1	SD-MWS1	SLP-AFW1	SLP-AFW2	SLP-RMNV1	S-AFW1	S-AFW2	S-AFW3	S-AFW4	S-AFW5	S-EW1	S-EW/MWS1	S-EW/MWS2	S-MWS1	S-MWS2	S-MWS3	S-MWS4	S-MWS5	S-MWS10	S-MWS11	S-MWS12	S-RMNV1	S-RMNV2	S-RMNV3
Santalaceae	*Santalum*	*lanceolatum*											*																														*		
Santalaceae	*Santalum*	*spicatum*		*									*			*			*					*																*					
Sapindaceae	*Alectryon*	*oleifolius*						*											*					*																*					
Sapindaceae	*Dodonaea*	*adenophora*																																						*					
Sapindaceae	*Dodonaea*	*lobulata*																																					*						
Sapindaceae	*Dodonaea*	*rigida*	*	*											*	*																													
Sapindaceae	*Dodonaea*	*viscosa* subsp. *angustissima*																				*																							
Scrophulariaceae	*Eremophila*	*abietina* subsp. *ciliata*															*																												
Scrophulariaceae	*Eremophila*	*alternifolia*		*												*																													
Scrophulariaceae	*Eremophila*	*clarkei*									*	*	*					*				*			*		*												*						
Scrophulariaceae	*Eremophila*	*drummondii*															*																												
Scrophulariaceae	*Eremophila*	*exilifolia*	*													*						*																							
Scrophulariaceae	*Eremophila*	*forrestii* subsp. *forrestii*			*								*									*								*		*	*	*	*		*		*			*			*
Scrophulariaceae	*Eremophila*	*fraseri*															*																												
Scrophulariaceae	*Eremophila*	*georgei*																*																											
Scrophulariaceae	*Eremophila*	*gilesii*									*					*												*		*						*									
Scrophulariaceae	*Eremophila*	*glabra*		*										*				*	*					*		*			*				*		*		*	*	*	*					*
Scrophulariaceae	*Eremophila*	*homoplastica*			*										*	*											*	*		*															
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *glabra*	*	*	*										*		*					*					*	*	*						*	*	*	*		*					
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *latrobei*	*		*						*	*	*		*	*									*		*	*	*	*		*		*											
Scrophulariaceae	*Eremophila*	*longifolia*												*					*					*	*	*								*	*			*						*	
Scrophulariaceae	*Eremophila*	*maculata* subsp. *brevifolia*				*																		*																					
Scrophulariaceae	*Eremophila*	*malacoides*				*																			*																				
Scrophulariaceae	*Eremophila*	*margarethae*											*				*	*																										*	
Scrophulariaceae	*Eremophila*	*oldfieldii* subsp. *angustifolia*	*	*											*																														
Scrophulariaceae	*Eremophila*	*paisleyi* subsp. *paisleyi*											*	*																															
Scrophulariaceae	*Eremophila*	*platycalyx* subsp. *platycalyx*																			*				*																				
Scrophulariaceae	*Eremophila*	*platythamnos* subsp. *platythamnos*		*												*						*										*	*	*					*	*					*
Scrophulariaceae	*Eremophila*	*punctata*															*																												
Scrophulariaceae	*Eremophila*	*scoparia*	*							*					*				*	*				*																					
Scrophulariaceae	*Eremophila*	*serrulata*	*	*							*	*			*									*																					
Scrophulariaceae	*Eremophila*	*spectabilis*													*																														
Solanaceae	*Anthotroche*	*pannosa*																				*	*									*	*	*			*					*			*
Solanaceae	*Duboisia*	*hopwoodii*																				*																							
Solanaceae	*Lycium*	*australe*				*				*																																			
Solanaceae	*Nicotiana*	*rosulata* subsp. *rosulata* (A)	*		*											*														*						*									
Solanaceae	*Solanum*	*centrale*			*																						*					*	*		*	*									
Solanaceae	*Solanum*	*ferocissimum*														*		*	*																										
Solanaceae	*Solanum*	*lasiophyllum*	*	*	*	*					*	*	*		*	*			*		*	*		*			*	*	*	*		*	*		*	*		*	*	*				*	
Solanaceae	*Solanum*	*nummularium*				*													*					*																				*	
Solanaceae	*Solanum*	*orbiculatum*	*	*		*					*				*				*					*			*								*	*		*							
Solanaceae	*Solanum*	*plicatile*											*											*		*									*										
Solanaceae	*Solanum*	sp. (sterile)	*								*																																		
Thymelaeaceae	*Pimelea*	*microcephala*				*													*																										
Zygophyllaceae	*Tribulus*	*astrocarpus* (A)	*																																										

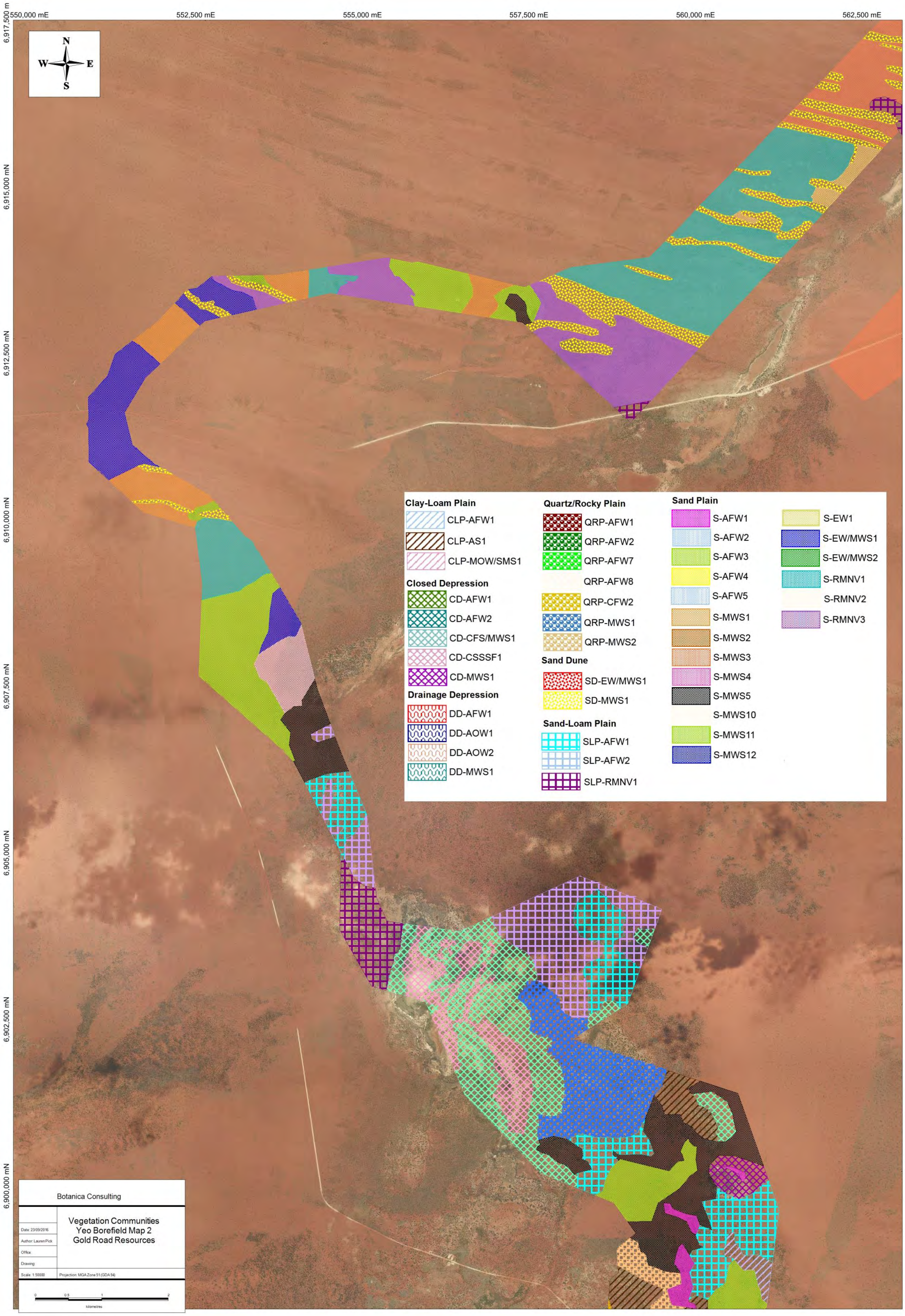
Family	Genus	Taxon	Clay-Loam Plain			Closed Depression					Drainage Depression				Quartz/Rocky Plain							Sand Dune		Sand-Loam Plain			Sand Plain																		
			CLP-AFW1	CLP-AS1	CLP-MOW/SMS1	CD-AFW1	CD-AFW2	CD-CFS/EW1	CD-CSSSF1	CD-MWS1	DD-AFW1	DD-AOW1	DD-AOW2	DD-MWS1	QRP-AFW1	QRP-AFW2	QRP-AFW7	QRP-AFW8	QRP-CFW2	QRP-MWS1	QRP-MWS2	SD-EW/MWS1	SD-MWS1	SLP-AFW1	SLP-AFW2	SLP-RMNV1	S-AFW1	S-AFW2	S-AFW3	S-AFW4	S-AFW5	S-EW1	S-EW/MWS1	S-EW/MWS2	S-MWS1	S-MWS2	S-MWS3	S-MWS4	S-MWS5	S-MWS10	S-MWS11	S-MWS12	S-RMNV1	S-RMNV2	S-RMNV3
Zygophyllaceae	*Zygophyllum*	*eremaeum* (A)	*	*											*	*					*	*							*									*							
Zygophyllaceae	*Zygophyllum*	*iodocarpum* (A)						*		*																																			

Appendix 5: Vegetation maps of the Gruyere Borefield Survey Area/ Development Envelope

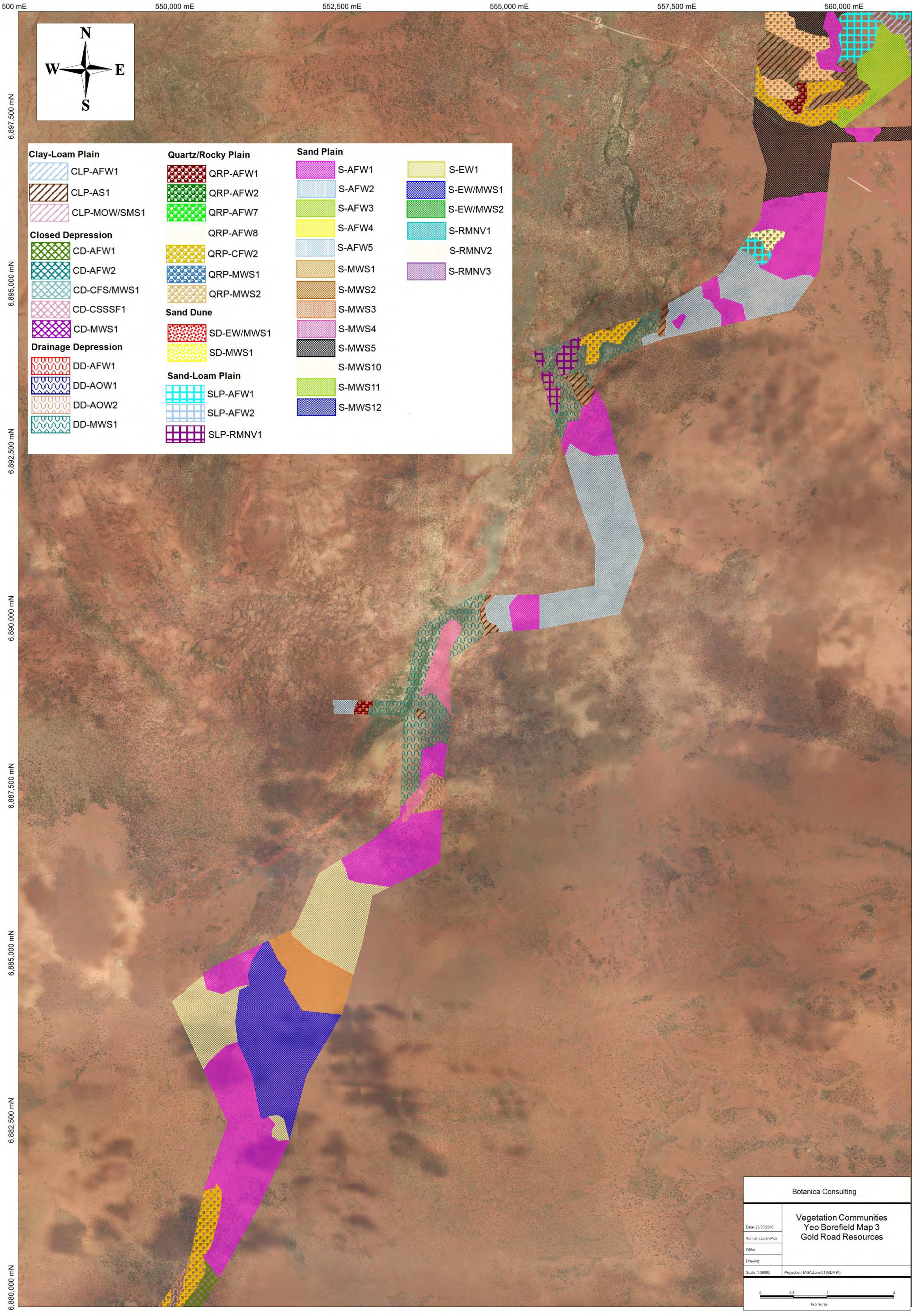




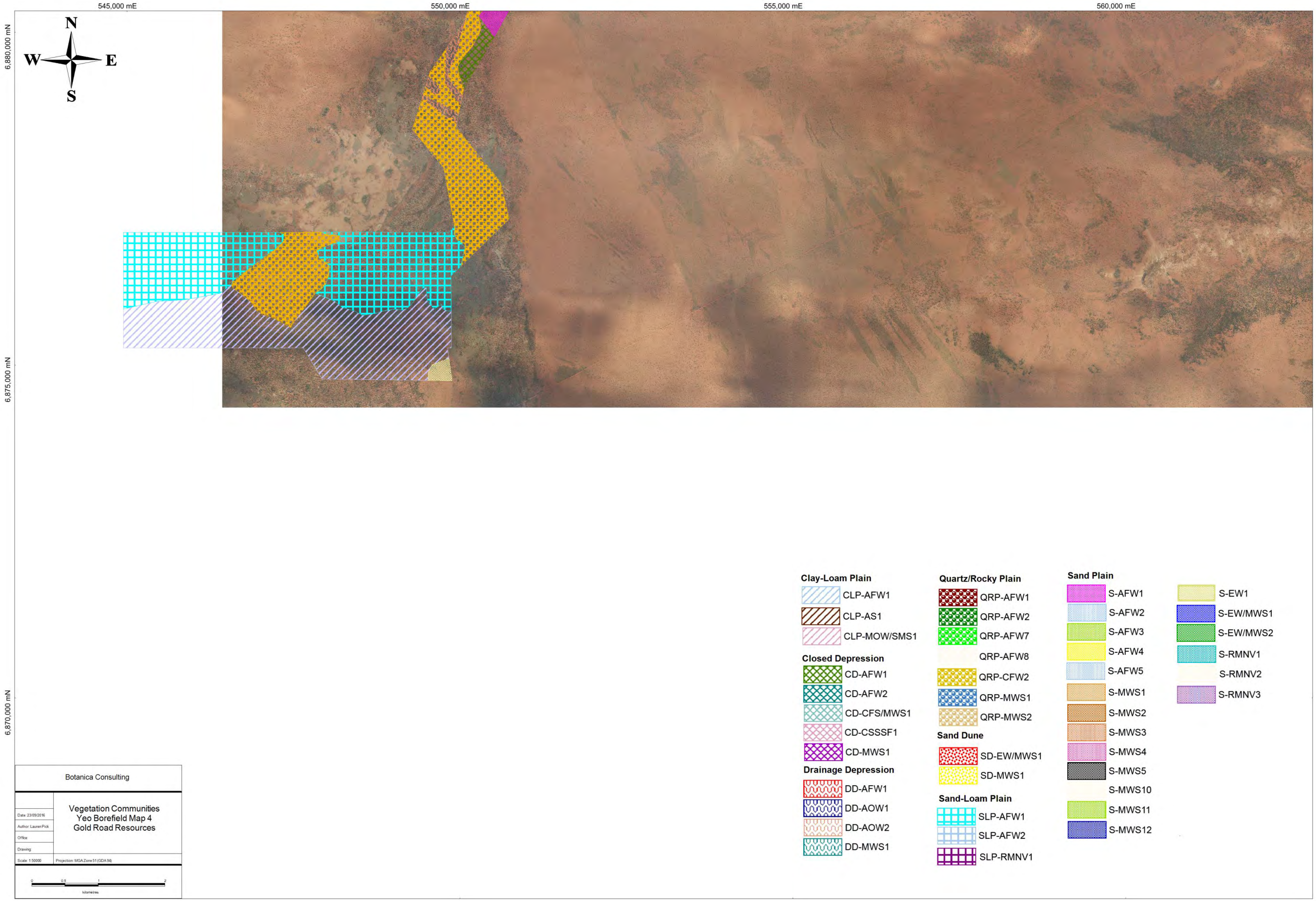
Botanica Consulting
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Vegetation Communities
Yeo Borefield Map 1
Gold Road Resources
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres
565,000 mE
570,000 mE
575,000 mE
580,000 mE
6,925,0
6,920,000 mN
6,915,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3

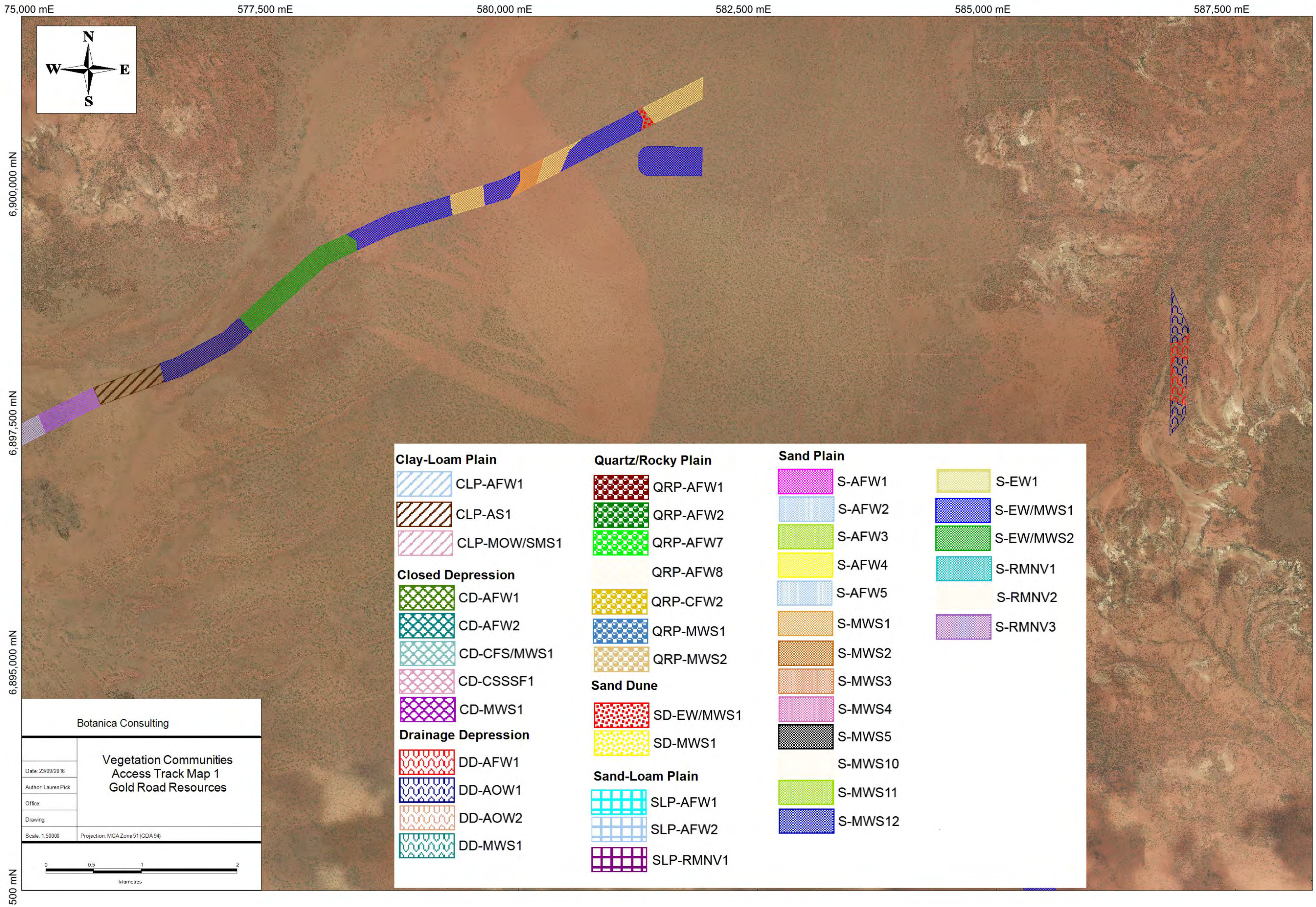


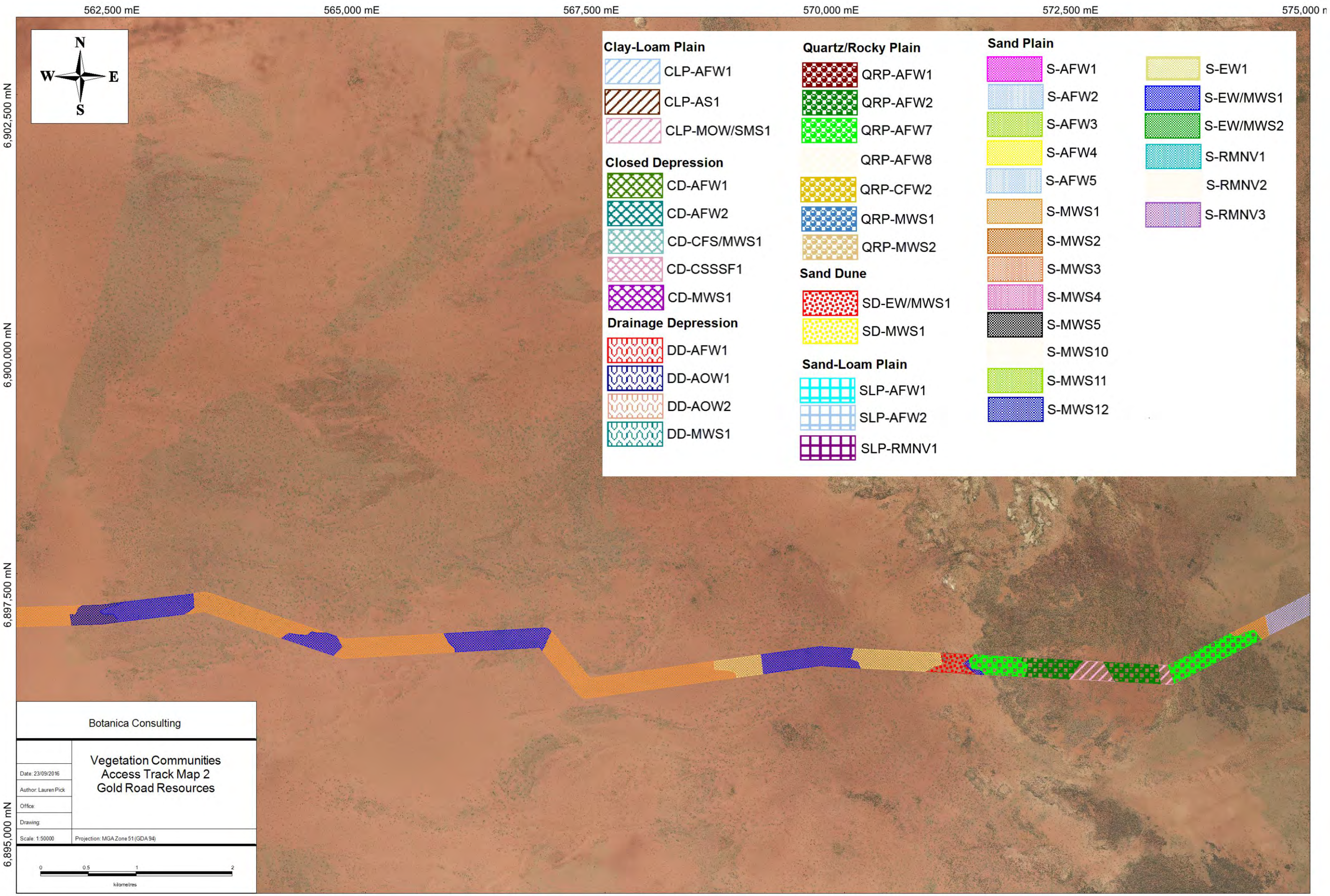
550,000 mE
552,500 mE
555,000 mE
557,500 mE
560,000 mE
562,500 mE
6,917,500 mN
6,915,000 mN
6,912,500 mN
6,910,000 mN
6,907,500 mN
6,905,000 mN
6,902,500 mN
6,900,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Yeo Borefield Map 2
Gold Road Resources
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres

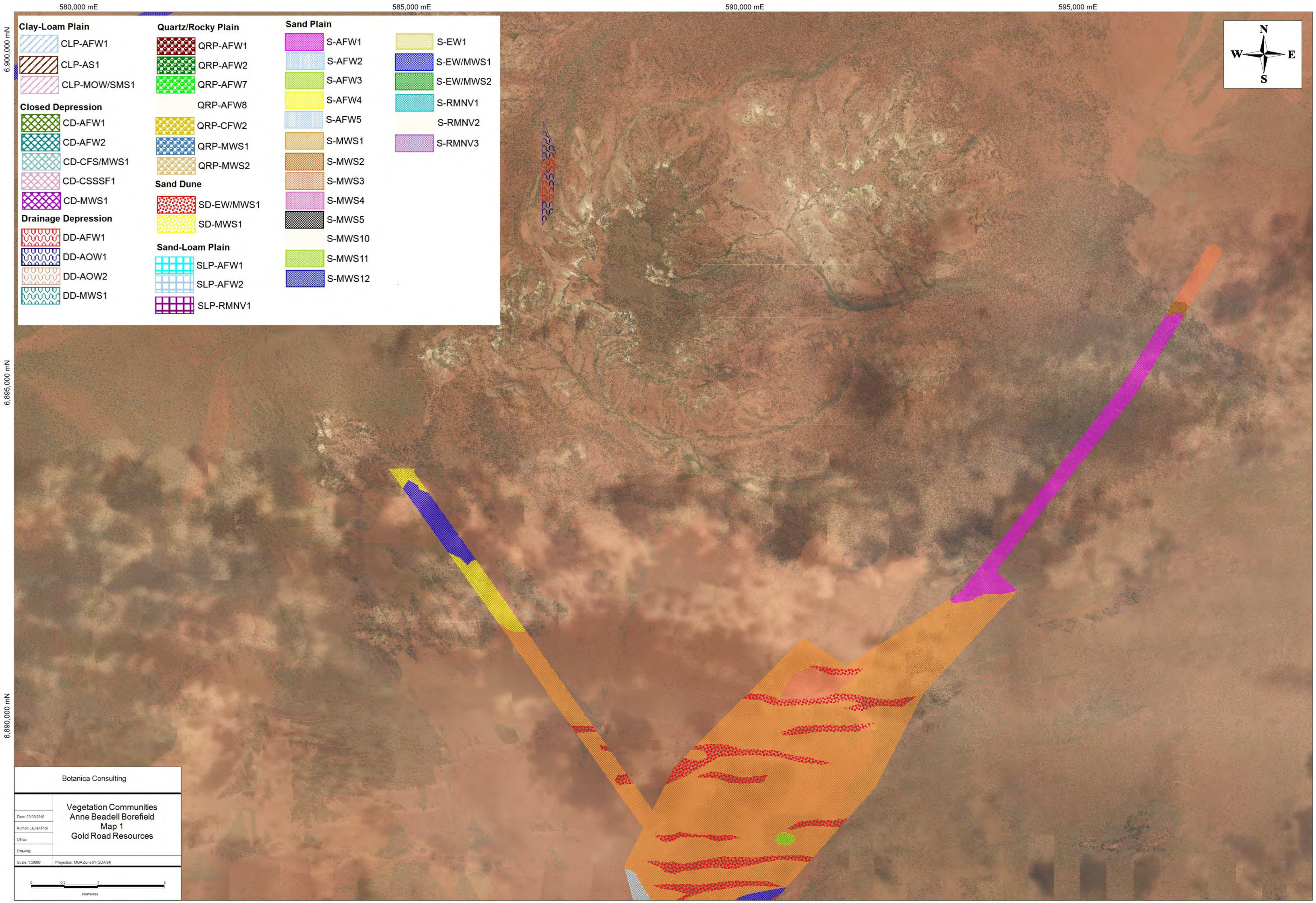


500 mE
550,000 mE
552,500 mE
555,000 mE
557,500 mE
560,000 mE
6,897,500 mN
6,895,000 mN
6,892,500 mN
6,890,000 mN
6,887,500 mN
6,885,000 mN
6,882,500 mN
6,880,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Vegetation Communities
Yeo Borefield Map 3
Gold Road Resources
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres

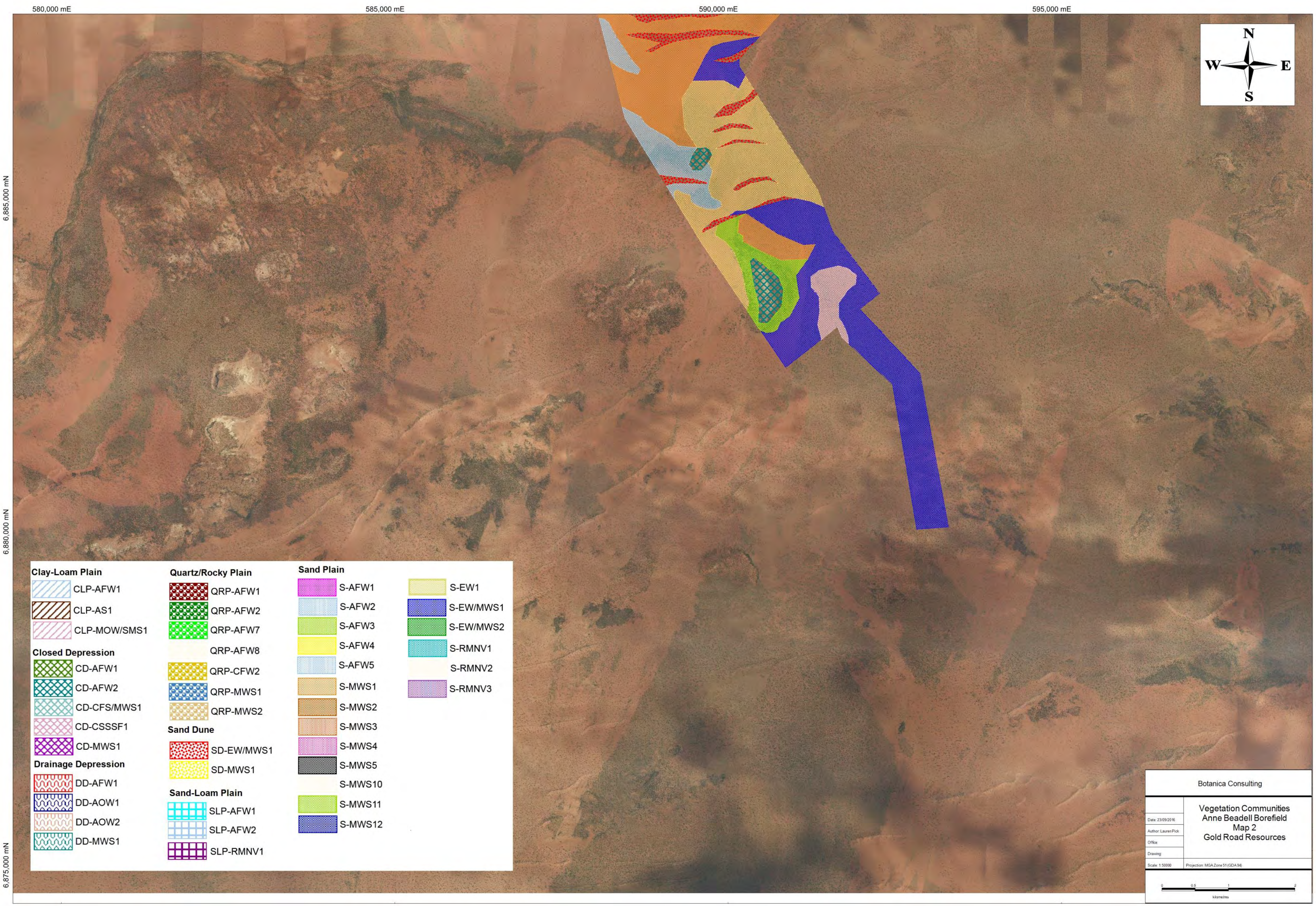

545,000 mE
550,000 mE
555,000 mE
560,000 mE
6,880,000 mN
6,875,000 mN
6,870,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Yeo Borefield Map 4
Gold Road Resources
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres


75,000 mE
577,500 mE
580,000 mE
582,500 mE
585,000 mE
587,500 mE
6,900,000 mN
6,897,500 mN
6,895,000 mN
500 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Access Track Map 1
Gold Road Resources
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres

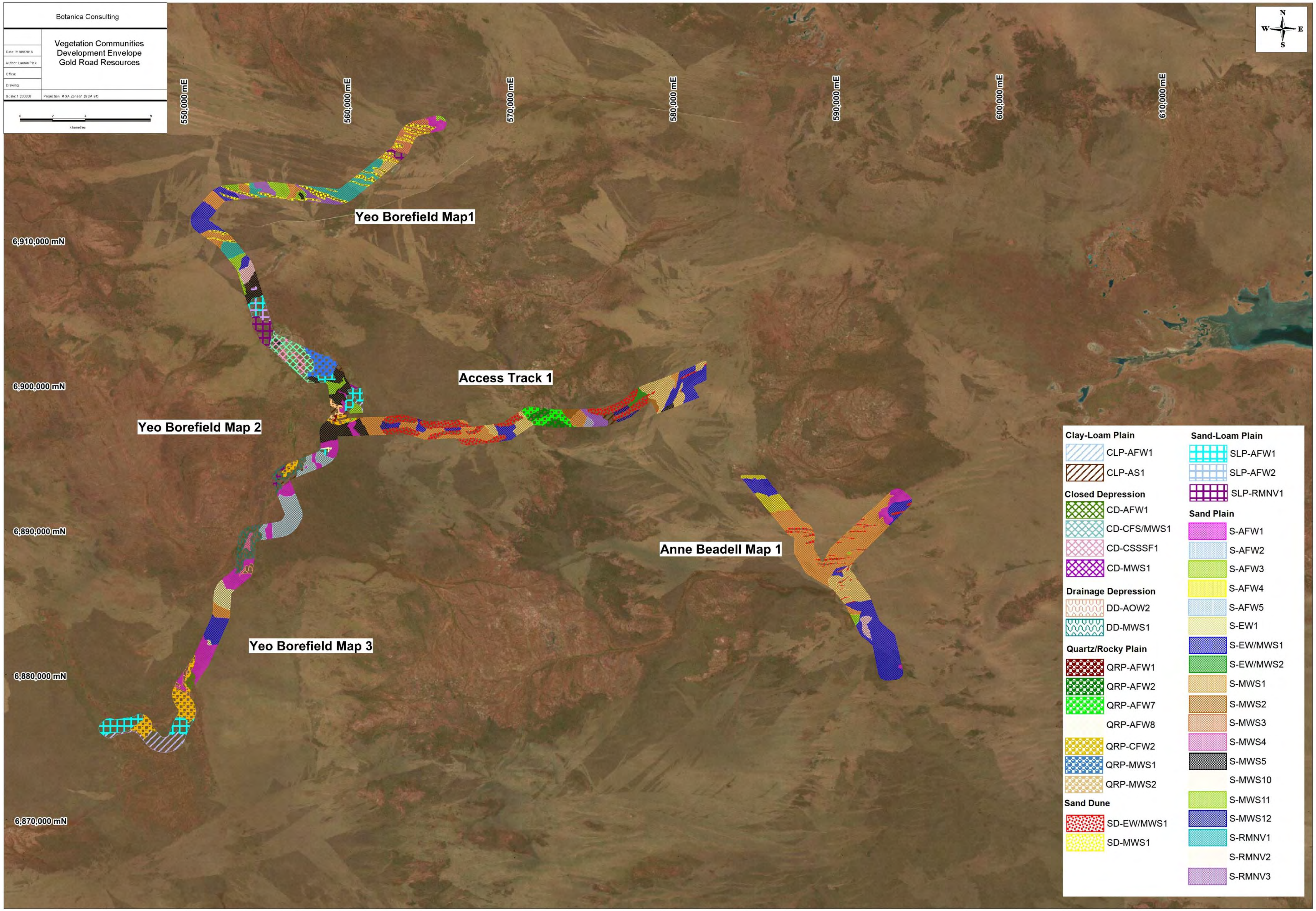

562,500 mE
565,000 mE
567,500 mE
570,000 mE
572,500 mE
575,000 mE
6,902,500 mN
6,900,000 mN
6,897,500 mN
6,895,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Access Track Map 2
Gold Road Resources
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres



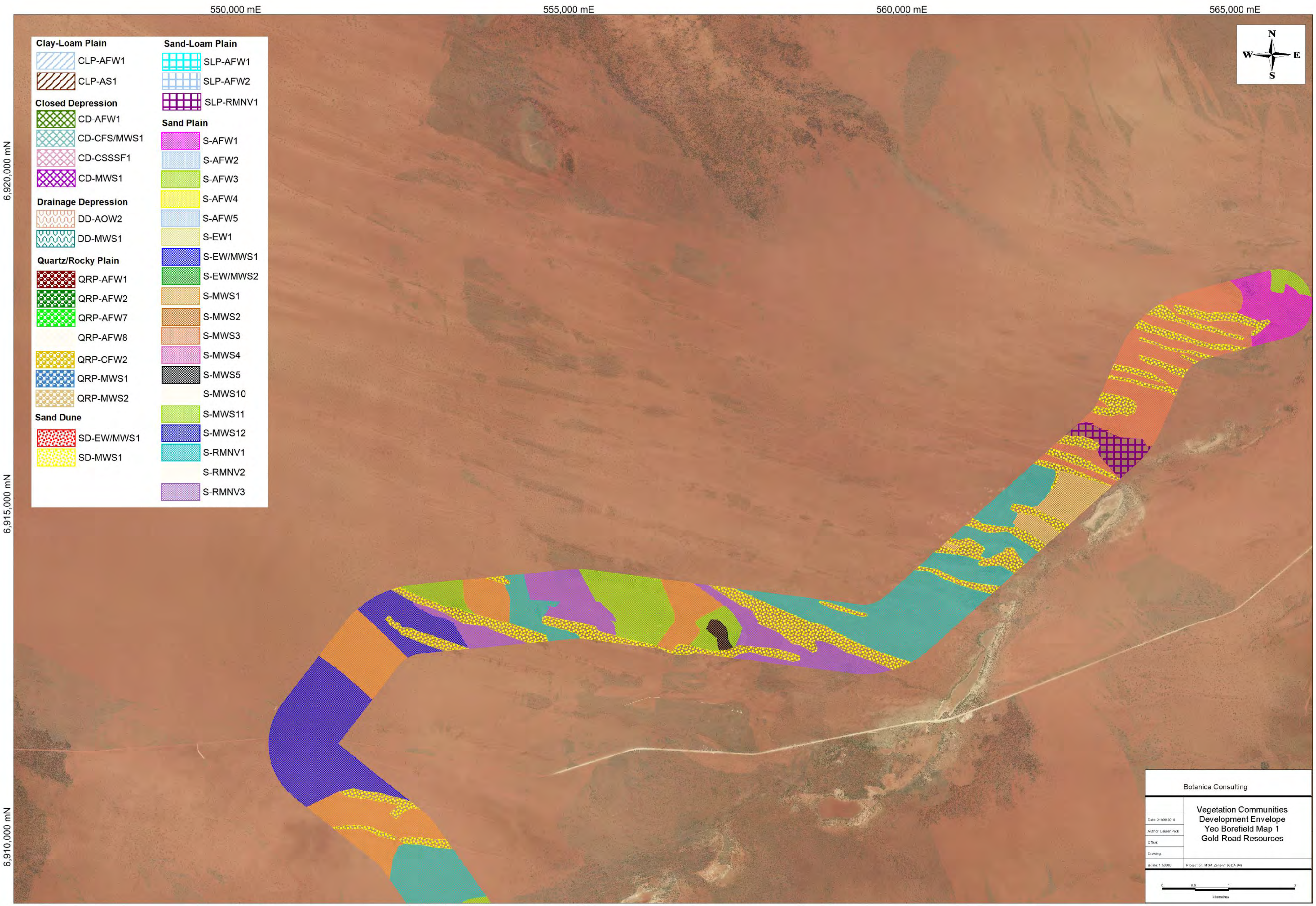
580,000 mE
585,000 mE
590,000 mE
595,000 mE
6,900,000 mN
6,895,000 mN
6,890,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Anne Beadell Borefield
Map 1
Gold Road Resources
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres



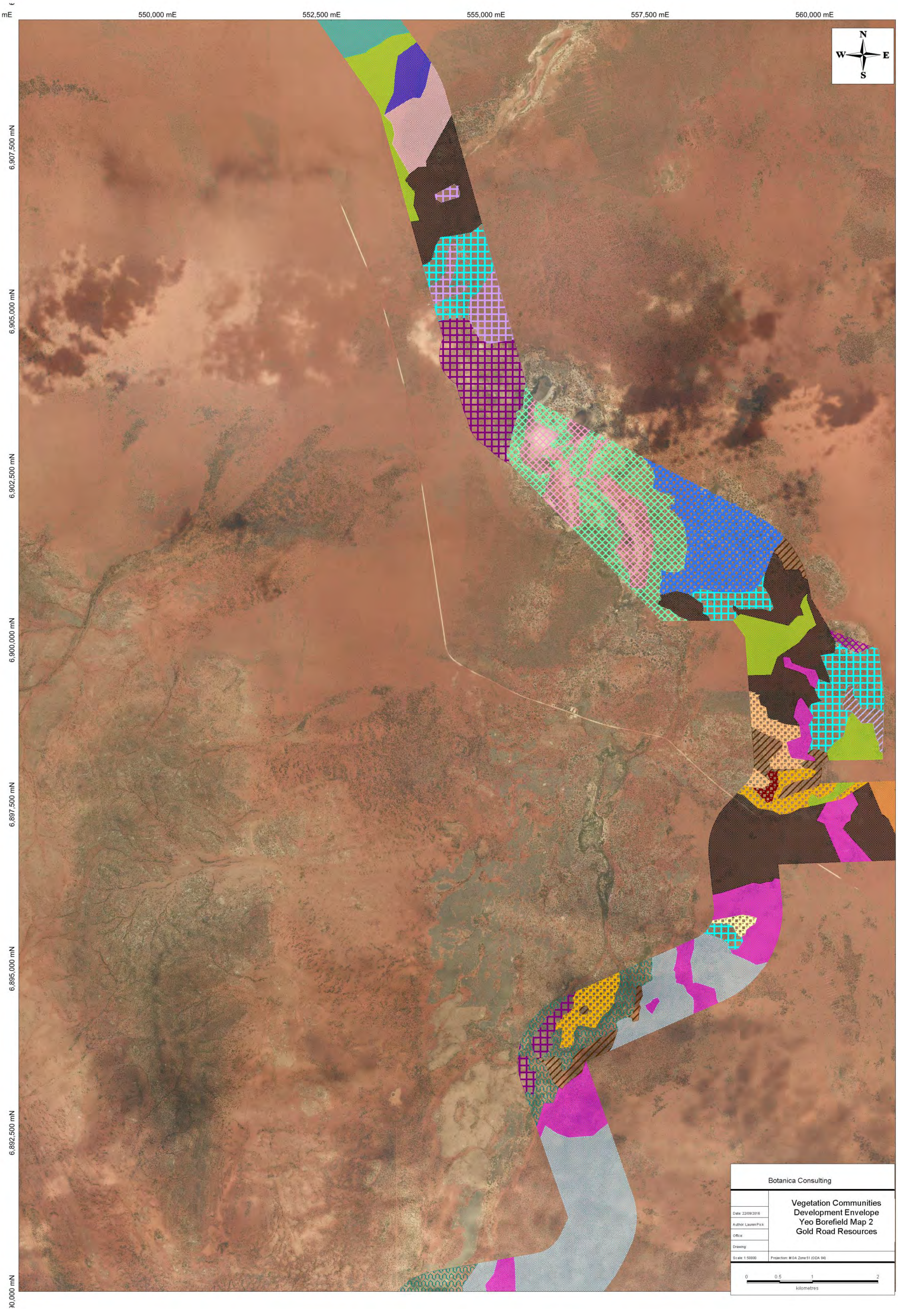
580,000 mE
585,000 mE
590,000 mE
595,000 mE
6,885,000 mN
6,880,000 mN
6,875,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
CLP-MOW/SMS1
Closed Depression
CD-AFW1
CD-AFW2
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AFW1
DD-AOW1
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-EW1
S-EW/MWS1
S-EW/MWS2
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Anne Beadell Borefield
Map 2
Gold Road Resources
Date: 23/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres

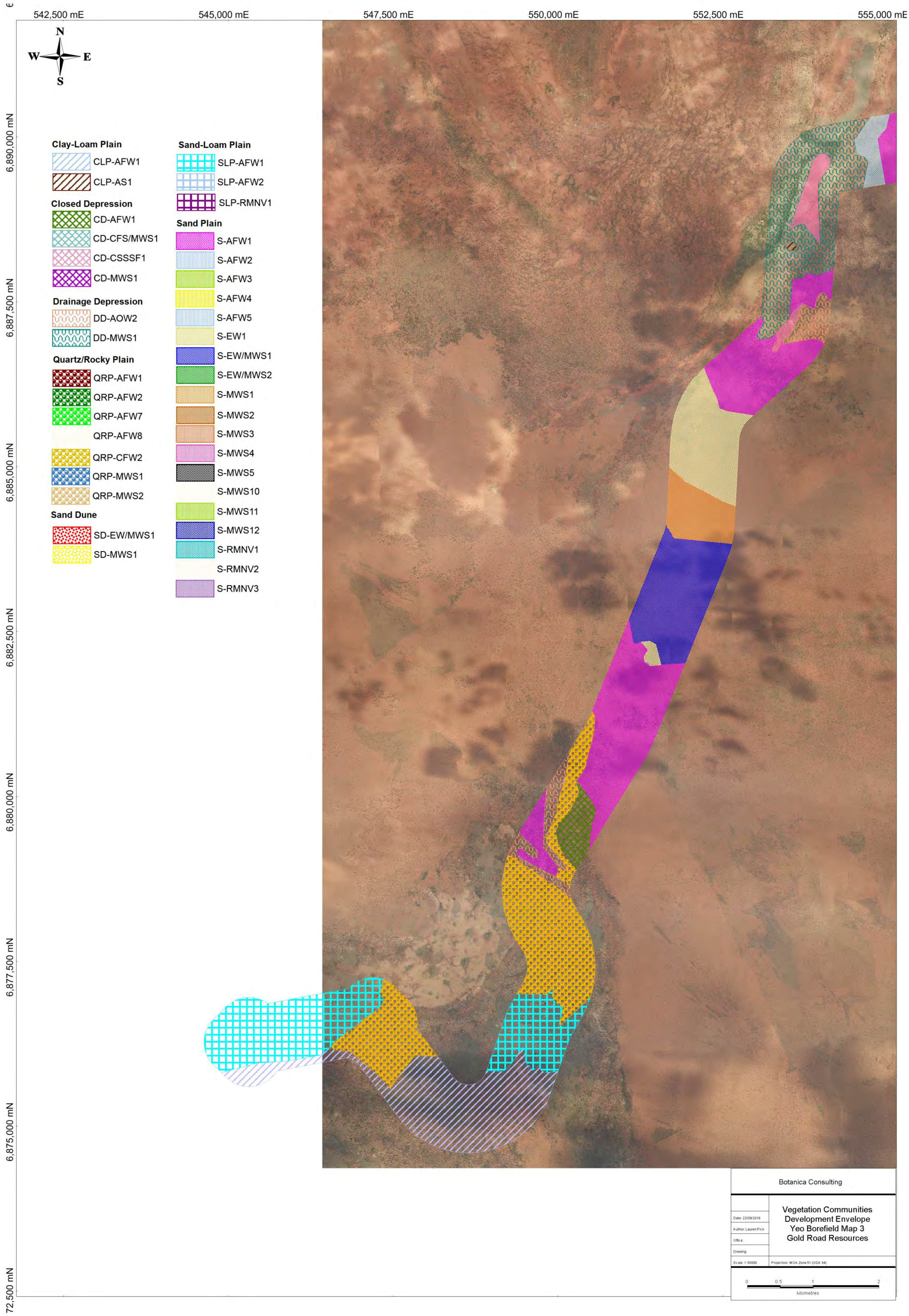


Botanica Consulting
Date: 21/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:200000
Vegetation Communities
Development Envelope
Gold Road Resources
Projection: MGA Zone 51 (GDA 94)
0 2 4 8
kilometres
N
W
E
S
550,000 mE
560,000 mE
570,000 mE
580,000 mE
590,000 mE
600,000 mE
610,000 mE
6,910,000 mN
6,900,000 mN
6,890,000 mN
6,880,000 mN
6,870,000 mN
Yeo Borefield Map1
Access Track 1
Yeo Borefield Map 2
Anne Beadell Map 1
Yeo Borefield Map 3
Clay-Loam Plain
CLP-AFW1
CLP-AS1
Closed Depression
CD-AFW1
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-EW1
S-EW/MWS1
S-EW/MWS2
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-RMNV1
S-RMNV2
S-RMNV3

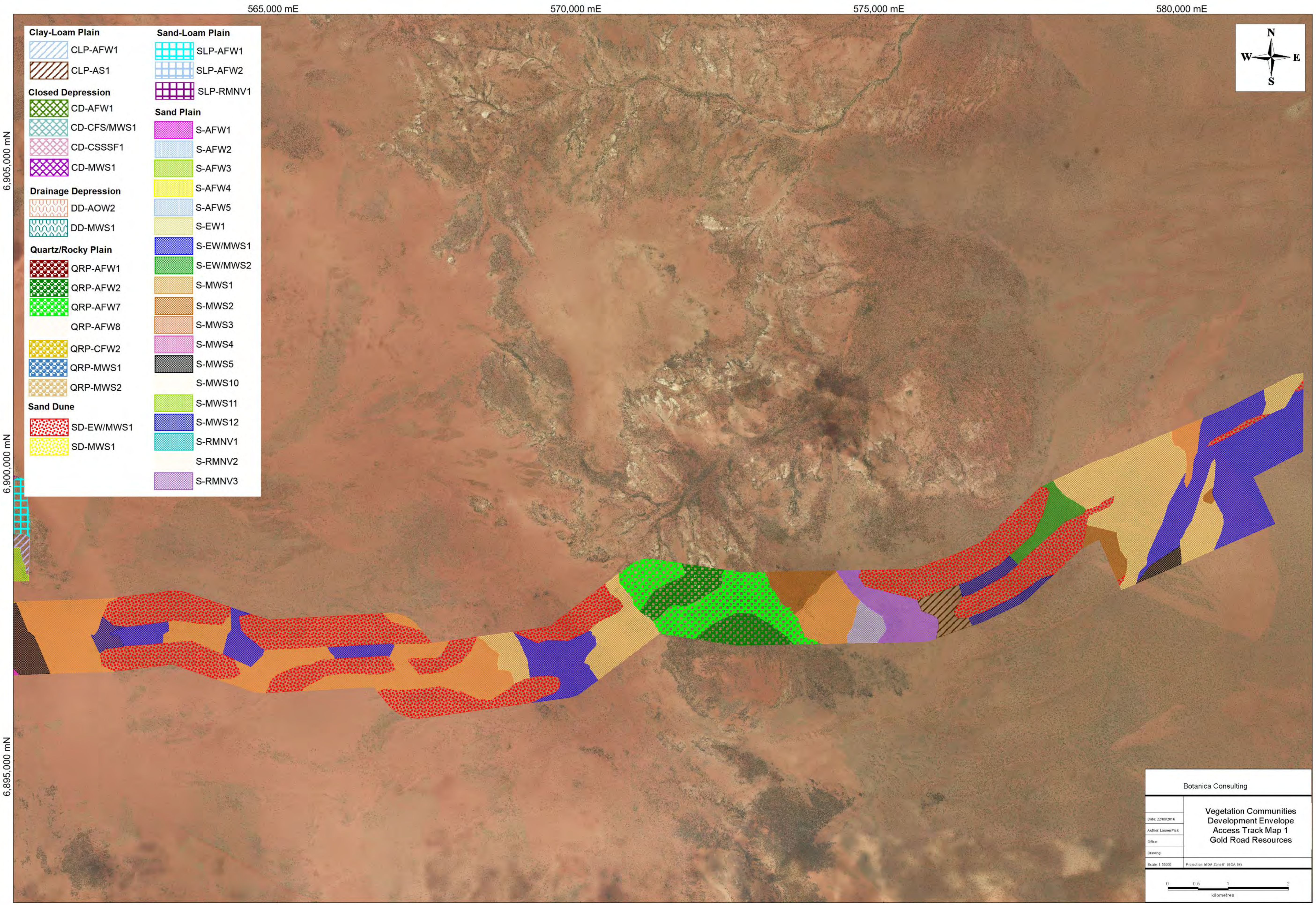


550,000 mE
555,000 mE
560,000 mE
565,000 mE
6,920,000 mN
6,915,000 mN
6,910,000 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
Closed Depression
CD-AFW1
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-EW1
S-EW/MWS1
S-EW/MWS2
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Development Envelope
Yeo Borefield Map 1
Gold Road Resources
Date: 21/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres

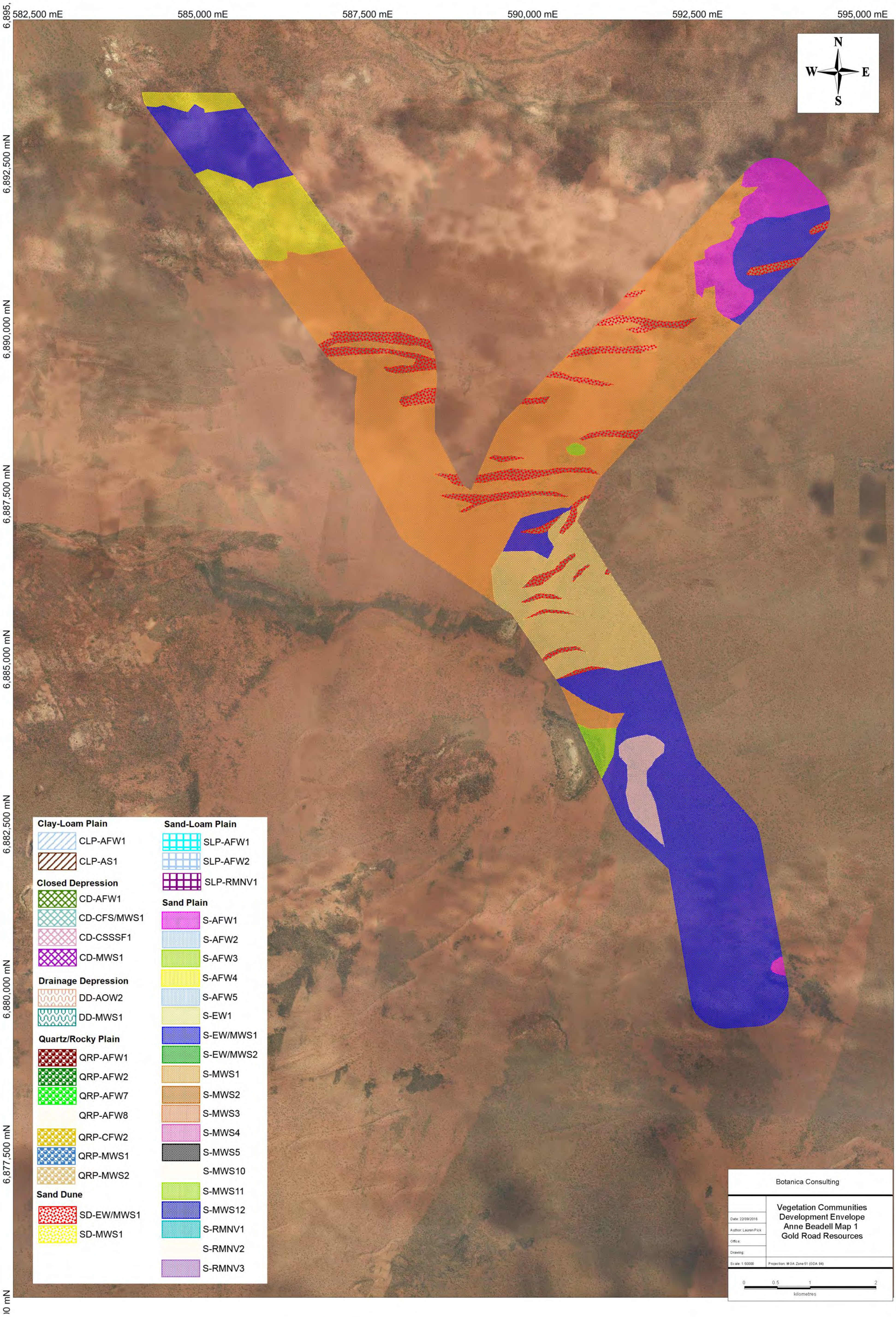

mE
550,000 mE
552,500 mE
555,000 mE
557,500 mE
560,000 mE
6,907,500 mN
6,905,000 mN
6,902,500 mN
6,900,000 mN
6,897,500 mN
6,895,000 mN
6,892,500 mN
N
W
E
S
Botanica Consulting
Vegetation Communities
Development Envelope
Yeo Borefield Map 2
Gold Road Resources
Date: 22/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres



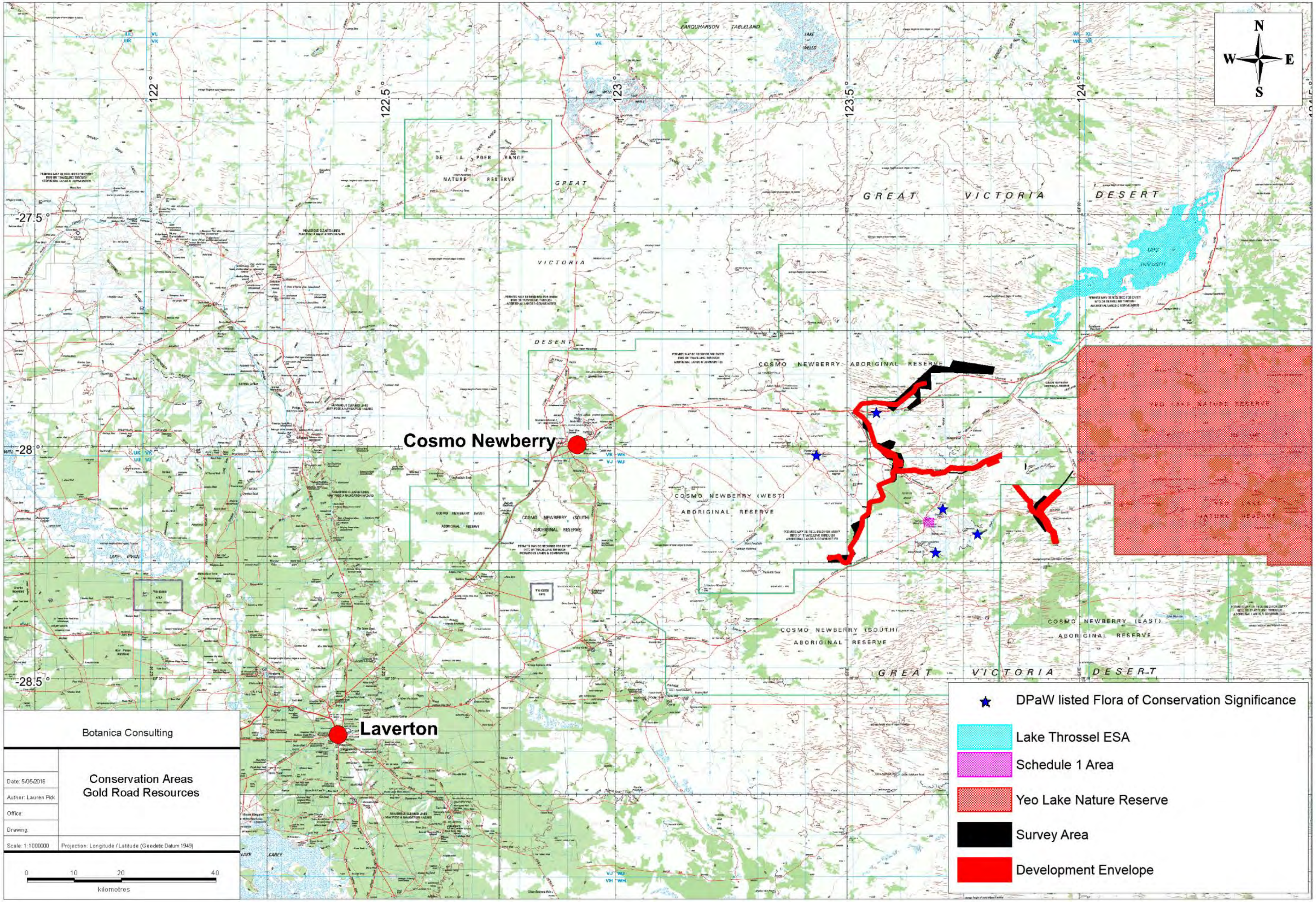
542,500 mE
545,000 mE
547,500 mE
550,000 mE
552,500 mE
555,000 mE
6,890,000 mN
6,887,500 mN
6,885,000 mN
6,882,500 mN
6,880,000 mN
6,877,500 mN
6,875,000 mN
72,500 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
Closed Depression
CD-AFW1
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-EW1
S-EW/MWS1
S-EW/MWS2
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Development Envelope
Yeo Borefield Map 3
Gold Road Resources
Date: 22/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres



565,000 mE
570,000 mE
575,000 mE
580,000 mE
6,905,000 mN
6,900,000 mN
6,895,000 mN
Clay-Loam Plain
CLP-AFW1
CLP-AS1
Closed Depression
CD-AFW1
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-EW1
S-EW/MWS1
S-EW/MWS2
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-RMNV1
S-RMNV2
S-RMNV3
N
W
E
S
Botanica Consulting
Date: 22/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:55000
Vegetation Communities
Development Envelope
Access Track Map 1
Gold Road Resources
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres


582,500 mE
585,000 mE
587,500 mE
590,000 mE
592,500 mE
595,000 mE
6,892,500 mN
6,890,000 mN
6,887,500 mN
6,885,000 mN
6,882,500 mN
6,880,000 mN
6,877,500 mN
N
W
E
S
Clay-Loam Plain
CLP-AFW1
CLP-AS1
Closed Depression
CD-AFW1
CD-CFS/MWS1
CD-CSSSF1
CD-MWS1
Drainage Depression
DD-AOW2
DD-MWS1
Quartz/Rocky Plain
QRP-AFW1
QRP-AFW2
QRP-AFW7
QRP-AFW8
QRP-CFW2
QRP-MWS1
QRP-MWS2
Sand Dune
SD-EW/MWS1
SD-MWS1
Sand-Loam Plain
SLP-AFW1
SLP-AFW2
SLP-RMNV1
Sand Plain
S-AFW1
S-AFW2
S-AFW3
S-AFW4
S-AFW5
S-EW1
S-EW/MWS1
S-EW/MWS2
S-MWS1
S-MWS2
S-MWS3
S-MWS4
S-MWS5
S-MWS10
S-MWS11
S-MWS12
S-RMNV1
S-RMNV2
S-RMNV3
Botanica Consulting
Vegetation Communities
Development Envelope
Anne Beadell Map 1
Gold Road Resources
Date: 22/09/2016
Author: Lauren Pick
Office:
Drawing:
Scale: 1:50000
Projection: MGA Zone 51 (GDA 94)
0
0.5
1
2
kilometres

Appendix 6: Regional map of the Gruyere Borefield survey area including areas of conservation significance



Appendix 7: Vegetation Health Condition Scale adapted from Keighery 1994 and Trudgen 1988 (DPaW/ EPA, 2015)

Vegetation Condition Rating	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
1	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	N/A
2	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
3	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
5	N/A	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
6	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
7	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or ‘parkland cleared’ with their flora comprising weed or crop species with isolated native trees or shrubs.

Compiled by Greg Harewood - December 2015

Recorded (Captured/Sighted/Heard/Signs) = X

Fauna Recorded or Potentially in Region of Survey Area

Gruyere Borefield Project - Gold Road Resources Ltd, Yamarna Station, WA.

Harewood G. (2015a). Fauna Assessment (Level 1) Gruyere Borefield Project. Unpublished report for Gold Road Resources Ltd. December 2015.

Harewood G. (2015b). Fauna Assessment (Level 1) White Cliffs Road Gas Pipeline Option, Gruyere Project. Unpublished report for Gold Road Resources Ltd. December 2015.

Harewood G. (2015c). Fauna Assessment (Level 1) Midline Gas Pipeline Option, Gruyere Project. Unpublished report for Gold Road Resources Ltd. December 2015.

Rapallo Environmental (2015). Fauna Survey of the Gruyere Project Area. Unpublished report for Gold Road Resources Limited. May 2015.

KEC (2014). Sunrise Dam-Tropicana Infrastructure Corridor Fauna Survey. Unpublished report for AngloGold Ashanti. July 2014.

Harewood G. (2014). Fauna Assessmnet (Level 1) Gruyere Project. Unpublished report for Gold Road Resources Ltd. July 2014.

KLA (2012). Fauna Assessment (Level 2) Yamarna Project. Unpublished report for Gold Road Resources Ltd. October 2012.

Harewood G. (2011). Terrestrial Fauna Survey (Level 1) of Yamarna Gold Project (Central Bore, Attila, Alaric, Haul Road and Khan North). Unpublished report for Gold Road Resources Ltd. September 2011.

ecologia (2009). Tropicana Gold Project. Operational Area Vertebrate Fauna Assessment. Unpublished report for Tropicana Joint Venture. February 2009.

DPaW (2015). NatureMap Database Search – Method = 'By Circle'; 123°43' 29'' E, 28°03' 14'' S (40km buffer). Accessed 4 December 2015.

Class / **Family** / *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Amphibia												
Myobatrachidae												
Ground or Burrowing Frogs												
Neobatrachus aquilonius	Northern Burrowing Frog	LC										X
Neobatrachus kunapalari	Kunapalari Frog	LC										X

Neobatrachus sudellae	Sudell's Frog	LC			X
Neobatrachus sutor	Shoemaker Frog	LC	X	X	X
Neobatrachus wilsmorei	Plonking Frog	LC			

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Platyplectrum spenceri	Centralian Burrowing Frog											
Pseudophryne occidentalis	Western Toadlet	LC										
Hylidae Tree or Water-Holding Frogs												
Cyclorana maini	Sheep Frog	LC										X
Cyclorana platycephala	Water-holding Frog	LC										
Reptilia												
Carphodactylidae Knob-tailed Geckos												
Nephrurus laevissimus	Pale Knob-tailed Gecko					X	X				X	X

Class	Common	Conservation			
Nephrurus levis	Smooth Knob-tailed Gecko		X	X	
Nephrurus vertebralis	Midline Knob-tailed Gecko				X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Diplodactylidae												
Geckoes												
Diplodactylus conspicillatus	Fat-tailed Gecko					X	X		X		X	X
Diplodactylus granariensis	Western Stone Gecko										X	
Diplodactylus pulcher	Western Saddled Ground Gecko								X			X
Lucasium damaeum	Beaded Gecko					X	X				X	X
Lucasium squarrosus	Mottled Ground Gecko											
Lucasium stenodactylus	Sand-plain Gecko	LC										
Rhynchoedura ornata	Beaked Gecko					X	X				X	X

Class	Common	Conservation				
Strophurus assimilis	Goldfields Spiny-tailed Gecko			X		
Strophurus ciliaris	Spiny-tailed Gecko					X
Strophurus elderi	Jewelled Gecko		X	X	X	X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Strophurus intermedius	Southern Spiny-tailed Gecko								X			X
Strophurus strophurus	Ring-tailed Gecko					X					X	X
Strophurus wellingtonae	Western-shield Spiny-tailed Gecko	LC										
Gekkonidae Geckoes												
Gehyra purpurascens	Purple Arid Dtella					X	X				X	X
Gehyra variegata	Variegated Dtella					X	X		X	X	X	X
Heteronotia binoei	Bynoe's Gecko					X	X		X		X	X
Underwoodisaurus milii	Barking Gecko											

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Pygopodidae Legless Lizards												
Delma butleri	Unbanded Delma							X			X	X
Delma nasuta	Long-nosed Delma					X	X				X	X
Delma petersoni	Peterson’s Delma						X				X	
Lialis burtonis	Burton’s Legless Lizard					X		X			X	X
Pygopus nigriceps	Hooded Scaly Foot			X		X	X		X		X	X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Agamidae Dragon Lizards												
Caimanops amphiboluroides	Mulga Dragon		X			X			X		X	
Ctenophorus caudicinctus	Ring-tailed Dragon								X			X
Ctenophorus clayi	Collared Dragon										X	X
Ctenophorus cristatus	Bicycle Dragon						X				X	
Ctenophorus fordi	Mallee Sand Dragon						X				X	X
Ctenophorus isolepis	Military Dragon		X			X	X	X			X	X
Ctenophorus nuchalis	Central Netted Dragon		X			X					X	X

Class	Common	Conservation							
Ctenophorus pictus	Painted Dragon						X		X
Ctenophorus reticulatus	Western Netted Dragon				X		X	X	X
Ctenophorus scutulatus	Lozenge-marked Bicycle Dragon		X	X	X	X	X		X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Diporiphora paraconvergens	Grey-striped Western Desert Dragon					X						X
Diporiphora reginae	Red-rumped Two-lined Dragon						X				X	
Gowidon longirostris	Long-nosed Dragon										X	
Moloch horridus	Thorny Devil				X	X	X	X			X	X
Pogona minor	Western Bearded Dragon					X	X				X	X
Tympanocryptis cephala	Pebble Dragon											

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Varanidae Monitor's or Goanna's												
Varanus brevicauda	Short-tailed Pygmy Monitor					X					X	X
Varanus caudolineatus	Stripe-tailed Pygmy Monitor								X			X
Varanus eremius	Pygmy Desert Monitor										X	X
Varanus giganteus	Perentie			X		X	X	X			X	X
Varanus gilleni	Pygmy Mulga Monitor										X	X
Varanus gouldii	Sand Monitor		X		X	X	X		X		X	X
Varanus panoptes	Yellow-spotted Monitor					X	X					

Class	Common	Conservation					
Varanus tristis	Black-headed Monitor		X	X	X	X	X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Scincidae Skinks												
Cryptoblepharus buchananii	Fence Skink											
Cryptoblepharus carnabyi	Spiny-palmed Fence Skink										X	
Ctenotus ariadnae	Ariadna's Ctenotus										X	X
Ctenotus brooksi	Central Wedge-snout Ctenotus					X	X				X	X
Ctenotus calurus	Blue-tailed Skink					X	X				X	X
Ctenotus dux	Narrow-lined Skink					X	X	X			X	X
Ctenotus grandis	Giant Desert Ctenotus										X	X

Class	Common	Conservation						
Ctenotus greeri	Spotted-necked Ctenotus		X		X		X	X
Ctenotus hanloni	Nimble Ctenotus							X
Ctenotus helenae	Dusky Ctenotus			X	X	X	X	X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Ctenotus leae	Centralian Coppertail											X
Ctenotus leonhardii	Leonhardi's Skink					X	X		X		X	X
Ctenotus nasutus	Long-snouted Ctenotus					X						X
Ctenotus pantherinus	Leopard Ctenotus					X	X	X	X		X	X
Ctenotus piankai	Coarse Sands Ctenotus					X						X
Ctenotus quattuordecimlineatus	Fourteen-lined Ctenotus					X	X				X	X
Ctenotus schomburgkii	Barred Wedge-snout Ctenotus					X	X	X			X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation				
Ctenotus severus	Stern Rock Ctenotus					
Ctenotus uber	Spotted Ctenotus		X			
Cyclodomorphus melanops	Eastern Slender Blue-tongue			X	X	X
Egernia depressa	Pygmy Spiny-tailed Skink			X		

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Egernia formosa	Goldfields Crevise Skink											
Eremiascincus pallidus	Pale Sand-swimmer		X			X	X		X		X	
Lerista bipes	Western Two-toed Slider		X			X	X	X			X	X
Lerista desertorum	Great Desert Slider		X	X		X	X		X		X	X
Lerista kingi	Common Mulch Skink											
Lerista taeniata	Ribbon Slider										X	
Lerista timida	Timid Slider				X	X	X				X	
Liopholis inornata	Desert Skink						X		X		X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation				
Liopholis striata	Night Skink		X		X	X
Menetia greyii	Dwarf Skink			X	X	X
Morethia butleri	Woodland Dark-flecked Morethia			X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Proablepharus reginae	Western Soil-Crevice Skink						X				X	
Tiliqua multifasciata	Central Blue-tongue								X		X	X
Tiliqua occipitalis	Western Bluetongue				X		X				X	X
Typhlopidae Blind Snakes												
Anilios bicolor	Dark-spined Blind Snake											
Anilios endoterus	Interior Blind Snake										X	
Anilios hamatus	Northern Hook-snouted Blind Snake											
Anilios margaretae	Buff-snouted Blind Snake	P2										

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation		
Anilios waitii	Common Beaked Blind Snake		X	

Boidae

Pythons, Boas

Antaresia stimsoni	Stimson's Python			X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Elapidae Elapid Snakes												
Acanthophis pyrrhus	Desert Death Adder										X	
Brachyurophis approximans	North-western Shovel-nosed Snake					X						
Brachyurophis fasciolata	Narrow-banded Shovel-nosed Snake						X				X	
Brachyurophis semifasciata	Southern Shovel-nosed Snake						X				X	
Demansia psammophis	Yellow-faced Whipsnake						X				X	X
Furina ornata	Moon Snake											
Neelaps bimaculatus	Black-naped Snake										X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Parasuta monachus	Monk Snake			X		X	X
Pseudechis australis	Mulga Snake		X		X	X	X
Pseudechis butleri	Spotted Mulga Snake						

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK =
ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Pseudonaja modesta	Ringed Brown Snake					X			X		X	X
Pseudonaja nuchalis	Gwardar									X	X	
Simoselaps anomalus	Desert Banded Snake					X						X
Simoselaps bertholdi	Jan's Banded Snake		X				X				X	X
Suta fasciata	Rosen's Snake											X
Aves												
Casuariidae Emus, Cassowarries												
Dromaius novaehollandiae	Emu	LC	X	X	X	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation		
Megapodiidae				
Moundbuilders				
Leipoa ocellata	Malleefowl	S3 VU VU A2bce+3ce	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Accipitridae Kites, Goshawks, Eagles, Harriers												
Accipiter cirrocephalus	Collared Sparrowhawk	LC		X							X	X
Accipiter fasciatus	Brown Goshawk	LC	X			X				X		X
Aquila audax	Wedge-tailed Eagle	LC	X			X	X	X	X	X	X	X
Aquila morphnoides	Little Eagle	LC			X		X				X	
Circus assimilis	Spotted Harrier	LC										
Elanus caeruleus	Black-shouldered Kite	LC							X			
Haliastur sphenurus	Whistling Kite	LC				X						

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation		
Hamirostra melanosternon	Black-breasted Buzzard	LC	X	X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Falconidae Falcons												
Falco berigora	Brown Falcon	LC	X	X	X	X	X	X	X	X	X	X
Falco cenchroides	Australian Kestrel	LC	X	X	X	X	X	X	X		X	X
Falco longipennis	Australian Hobby	LC				X	X	X	X	X	X	X
Falco peregrinus	Peregrine Falcon	S7 LC									X	X
Otididae Bustards												
Ardeotis australis	Australian Bustard	LC		X	X		X	X	X		X	X
Turnicidae												

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation				
Button-quails						
Turnix velox	Little Button-quail	LC	X	X	X	X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Charadriidae Lapwings, Plovers, Dotterels												
Charadrius melanops	Black-fronted Dotterel	LC										
Charadrius ruficapillus	Red-capped Plover	LC					X					
Peltohyas australis	Inland Dotterel											
Columbidae Pigeons, Doves												
Geopelia cuneata	Diamond Dove	LC							X	X	X	X
Ocyphaps lophotes	Crested Pigeon	LC	X	X	X	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation									
Phaps chalcoptera	Common Bronzewing	LC	X	X	X	X	X	X		X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Psittacidae Parrots												
Cacatua roseicapilla	Galah	LC	X	X	X	X	X		X		X	
Melopsittacus undulatus	Budgerigar	LC					X		X	X	X	X
Neophema bourkii	Bourke's Parrot	LC				X			X			
Neophema splendida	Scarlet-chested Parrot	LC					X				X	X
Nymphicus hollandicus	Cockatiel	LC				X	X		X		X	
Platycercus varius	Mulga Parrot	LC	X	X		X	X	X	X	X	X	
Platycercus zonarius	Australian Ringneck	LC	X	X	X	X	X	X	X	X	X	

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation
Polytelis alexandrae	Princess Parrot	P4 VU NT

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Cuculidae Parasitic Cuckoos												
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC			X		X			X	X	
Chrysococcyx osculans	Black-eared Cuckoo	LC					X				X	
Cuculus pallidus	Pallid Cuckoo	LC		X	X		X	X		X	X	
Strigidae Hawk Owls												
Ninox novaeseelandiae	Boobook Owl	LC				X	X		X			X
Tytonidae Barn Owls												
Tyto alba	Barn Owl	LC										

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation							
Podargidae Frogmouths									
Podargus strigoides	Tawny Frogmouth	LC	X		X		X	X	X
Caprimulgidae Nightjars									
Eurostopodus argus	Spotted Nightjar	LC	X	X	X	X	X	X	

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Aegothelidae Owlet-nightjars												
Aegotheles cristatus	Australian Owlet-nightjar	LC				X	X		X		X	X
Halcyonidae Tree Kingfishers												
Todiramphus pyrrhopygia	Red-backed Kingfisher	LC	X			X	X	X	X		X	
Meropidae Bee-eaters												
Merops ornatus	Rainbow Bee-eater	S5 Mig JA LC	X				X				X	
Climacteridae Treecreepers												
Climacteris affinis	White-browed Treecreeper	LC									X	

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Maluridae Fairy Wrens, GrassWrens												
Amytornis striatus striatus	Striated Grasswren	P4 LC					X					X
Malurus lamberti	Variegated Fairy-wren	LC	X	X		X		X	X	X		X
Malurus leucopterus	White-winged Fairy-wren	LC	X	X	X		X			X		X
Malurus splendens	Splendid Fairy-wren	LC				X	X				X	
Stipiturus ruficeps	Rufous-crowned Emu-wren	LC										

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class / Family / Species	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Acanthizidae												
Thornbills, Geryones, Fieldwrens & Whitefaces												
Acanthiza apicalis	Broad-tailed Thornbill	LC	X	X		X	X	X	X	X	X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	LC	X				X		X		X	X
Acanthiza robustirostris	Slaty-backed Thornbill	LC			X	X	X	X	X		X	X
Acanthiza uropygialis	Chestnut-rumped Thornbill	LC	X				X	X	X	X	X	X
Aphelocephala leucopsis	Southern Whiteface	LC					X	X	X	X	X	X
Gerygone fusca	Western Gerygone	LC										
Pyrrholaemus brunneus	Redthroat	LC				X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation									
Smicrornis brevirostris	Weebill	LC	X	X	X	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class / Family / *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Pardalotidae Pardalotes												
Pardalotus rubricatus	Red-browed Pardalote	LC				X		X	X			X
Pardalotus striatus	Striated Pardalote	LC	X	X	X		X	X			X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family Species	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Meliphagidae Honeyeaters, Chats												
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	LC	X	X	X	X	X	X	X	X	X	X
Anthochaera carunculata	Red Wattlebird	LC			X		X	X			X	X
Certhionyx niger	Black Honeyeater	LC										
Certhionyx variegatus	Pied Honeyeater	LC								X		
Epthianura aurifrons	Orange Chat	LC			X						X	
Epthianura tricolor	Crimson Chat	LC	X	X	X		X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation										
Lichenostomus plumulus	Grey-fronted Honeyeater	LC	X		X	X	X	X			X	
Lichenostomus virescens	Singing Honeyeater	LC	X	X	X	X	X	X	X	X	X	
Lichmera indistincta	Brown Honeyeater	LC					X				X	
Manorina flavigula	Yellow-throated Miner	LC	X	X	X	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class / Family / *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Phylidonyris albifrons	White-fronted Honeyeater	LC		X	X		X	X		X	X	
Petroicidae Australian Robins												
Microeca fascinans	Jacky Winter	LC				X	X				X	X
Petroica cucullata	Hooded Robin	LC		X		X	X	X	X	X	X	
Petroica goodenovii	Red-capped Robin	LC	X	X	X	X	X	X	X	X	X	X
Pomatostomidae Babblers												
Pomatostomus superciliosus	White-browed Babbler	LC	X	X		X	X	X	X	X	X	X
Cinclosomatidae												

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation					
Whipbirds, Wedgebills, Quail Thrushes							
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush	LC	X		X	X	X
Cinclosoma castanotus	Chestnut Quail-thrush	LC		X			
Psophodes occidentalis	Chiming Wedgebill	LC					

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family Species	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Neosittidae Sitellas												
Daphoenositta chrysoptera	Varied Sittella	LC				X	X				X	
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers												
Colluricincla harmonica	Grey Shrike-thrush	LC			X	X	X	X	X	X	X	X
Oreoica gutturalis	Crested Bellbird	LC	X	X	X	X	X	X	X	X	X	X
Pachycephala rufiventris	Rufous Whistler	LC	X	X	X	X	X	X	X	X	X	X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo												
Grallina cyanoleuca	Magpie-lark	LC					X	X		X		

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation										
			X	X	X	X	X	X				
Rhipidura fuliginosa	Grey Fantail	LC										
Rhipidura leucophrys	Willie Wagtail	LC	X	X	X	X	X	X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family Species	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Campephagidae Cuckoo-shrikes, Trillers												
Coracina maxima	Ground Cuckoo-shrike	LC		X		X			X	X	X	X
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC	X	X	X	X	X	X		X	X	X
Lalage tricolor	White-winged Triller	LC	X				X		X	X		
Artamidae Woodswallows, Butcherbirds, Currawongs												
Artamus cinereus	Black-faced Woodswallow	LC	X	X	X	X	X	X		X	X	X
Artamus minor	Little Woodswallow	LC				X	X					
Artamus personatus	Masked Woodswallow	LC				X	X		X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Cracticidae Currawongs, Magpies & Butcherbirds												
Cracticus nigrogularis	Pied Butcherbird	LC	X	X	X	X	X	X	X	X	X	X
Cracticus tibicen	Australian Magpie	LC	X	X	X	X	X	X	X	X	X	X
Cracticus torquatus	Grey Butcherbird	LC	X	X			X	X	X	X	X	X
Strepera versicolor	Grey Currawong	LC					X	X	X	X	X	X
Corvidae Ravens, Crows												
Corvus bennetti	Little Crow	LC	X	X	X	X	X	X	X		X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation									
Corvus orru	Torresian Crow	LC	X		X	X	X	X	X		X
Ptilonorhynchidae Bowerbirds											
Ptilonorhynchus maculatus	Western Bowerbird	LC		X	X	X					
Motacillidae Old World Pipits, Wagtails											
Anthus australis	Australian Pipit	LC		X		X	X	X	X	X	

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Estrilidae Grass Finches & Mannikins												
Taeniopygia guttata	Zebra Finch	LC	X	X	X	X	X	X	X	X	X	X
Dicaeidae Flowerpeckers												
Dicaeum hirundinaceum	Mistletoebird	LC					X			X	X	
Hirundinidae Swallows, Martins												
Cheramoeca leucosternus	White-backed Swallow	LC	X	X	X		X	X			X	
Hirundo ariel	Fairy Martin	LC				X	X					
Hirundo neoxena	Welcome Swallow	LC					X					

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class	Common	Conservation						
Hirundo nigricans	Tree Martin	LC		X	X			X
Sylviidae Old World Warblers								
Cincloramphus cruralis	Brown Songlark	LC			X	X	X	
Cincloramphus mathewsi	Rufous Songlark	LC	X	X				

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Mammalia												
Tachyglossidae Echidnas												
Tachyglossus aculeatus	Echidna	LC	X	X		X	X			X	X	

Class **Family** *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Dasyuridae												
Carnivorous Marsupials												
Antechinomys laniger	Kultarr	LC										
Dasycercus blythi	Brush-tailed Mulgara	P4 LC					X					X
Ningaui ridei	Wongai Ningaui	LC				X						X
Ningaui yvonneae	Southern Ningaui	LC					X				X	
Pseudantechinus macdonnellensis	Fat-tailed Pseudantechinus	LC										X
Sminthopsis crassicaudata	Fat-tailed Dunnart	LC									X	
Sminthopsis dolichura	Little long-tailed Dunnart	LC					X		X		X	X

Class	Common	Conservation					
Sminthopsis hirtipes	Hairy-footed Dunnart	LC	X	X		X	X
Sminthopsis macroura	Stripe-faced Dunnart	LC			X		X
Sminthopsis ooldea	Ooldea Dunnart	LC		X		X	X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Sminthopsis psammophila	Sandhill Dunnart	S2 EN EN B1+2ab+3ab					X					
Notoryctidae Marsupial Moles												
Notoryctes typhlops	Southern Marsupial Mole	P4 EN A1c+2c	X				X				X	
Burramyidae Pygmy Possums												
Cercartetus concinnus	Western Pygmy-possum	LC										X
Macropodidae Kangaroos, Wallabies												
Macropus fuliginosus	Western Grey Kangaroo	LC	X		X	X	X	X			X	
Macropus robustus	Euro	LC	X	X		X	X	X		X	X	X

Class	Common	Conservation									
Macropus rufus	Red Kangaroo	LC	X	X	X	X	X		X	X	X
Emballonuridae Sheath-tailed Bats											
Taphozous hilli	Hill's Sheathtail-bat	LC									X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Molossidae Freetail Bats												
Austronomus australis	White-striped Freetail-bat	LC		X	X		X	X	X	X	X	
Ozimops petersi	Inland Freetail-bat	LC					X		X		X	
Vespertilionidae Ordinary Bats												
Chalinolobus gouldii	Gould's Wattled Bat	LC				X	X		X		X	
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC				X	X				X	
Nyctophilus major tor	Central Long-eared Bat	P4									X	
Scotorepens balstoni	Inland Broad-nosed Bat	LC				X			X		X	

Class	Common	Conservation				
Vespadelus baverstocki	Inland Forest Bat	LC			X	
Vespadelus finlaysoni	Finlayson's Cave Bat	LC	X	X		X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Muridae Rats, Mice												
Mus musculus	House Mouse	Introduced				X	X		X		X	X
Notomys alexis	Spinifex Hopping-mouse	LC				X	X		X		X	X
Pseudomys bolami	Bolam's Mouse	LC										
Pseudomys desertor	Desert Mouse	LC					X		X		X	X
Pseudomys hermannsburgensis	Sandy Inland Mouse	LC				X	X		X		X	X
Canidae Dogs, Foxes												
Canis lupus	Dingo/Dog	LC/Introduced			X	X	X			X	X	

Class	Common	Conservation								
Vulpes vulpes	Red Fox	Introduced		X		X	X		X	X
Felidae Cats										
Felis catus	Cat	Introduced	X	X	X	X	X	X		X

Class Family *Species*	Common Name	Conservation Status	GH 2015a	GH 2015b	GH 2015c	Rapallo 2015	KEC 2014	GH 2014	KLA 2012	GH 2011	ecologia 2009	DPaW 2015
Equidae Horses												
Equus caballus	Horse	Introduced					X					X
Bovidae Horned Ruminants												
Bos taurus	European Cattle	Introduced	X	X	X	X	X		X	X		
Capra hircus	Goat	Introduced					X	X				
Ovis aries	Sheep	Introduced										
Camelidae Camels												
Camelus dromedarius	Camel	Introduced	X	X	X	X	X	X		X		

Class	Common	Conservation

APPENDIX 7: GOLD ROAD ENVIRONMENTAL POLICY

ENVIRONMENTAL POLICY

Gold Road Resources Limited (**Gold Road** or the **Company**) is committed to the development of a sustainable exploration and mining business in Western Australia that benefits its employees, contractors, suppliers, key stakeholders and the community.

Gold Road acknowledges that it has a responsibility to the environment beyond legal and regulatory requirements.

The Company is committed to reducing or avoiding environmental impacts, proactively managing obligations and continually improving its environmental performance. To achieve these commitments, Gold Road will:

- Comply with relevant environmental legislation and approval conditions
- Regularly monitor and review environmental performance
- Identify and implement opportunities for improvement
- Promote practices, systems, values and behaviours that contribute to environmental sustainability and incorporate these into business decisions
- Promote the reduction of waste, recycling of materials, prevention of pollution and the efficient use of energy and water
- Educate employees and contractors in environmental awareness.

This policy will provide the framework for setting environmental objectives and targets within the business. Gold Road will ensure that resources are allocated to implement and monitor these commitments and legal obligations.

Ian Murray
Managing Director & CEO

Justin Osborne
Executive Director - Exploration and Growth

Dated: 8 August 2016