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Purpose Permit Supporting Document

Golden Spur Resources Pty Ltd

Job Number: ADV-AU-00288
Date: 3 November 2022

DOCUMENT CONTROL SHEET

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Golden Spur Resources Pty Ltd	
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Job No.	**Revision No.**
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Bellevue Site NVCP Supporting Document	

Authorisations				
Name		**Position**	**Signature**	**Date**
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Approved By	Craig Roberts	Principal Environmental Advisor		02/11/2022

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Executive Summary

The Bellevue Gold Project ("**BGP**" the "**Project**") is a historic gold mining operation located approximately 40 km north of Leinster, in the North-Eastern Goldfields region, within the Shire of Leonora. Golden Spur Resources Pty Ltd ("**Golden Spur**"), a wholly owned subsidiary of Bellevue Gold Limited ("**Bellevue**" or "**BGL**"), is the sole holder of M36/24, M36/25 and M36/299. These tenements granted under the *Mining Act 1978* provide tenure over the deposits collectively known as the BGP. In addition, Giard Pty Ltd (a wholly owned subsidiary of Bellevue) holds M36/660, M36/162, M36/176 and M36/328.

This document has been prepared to support a Native Vegetation Clearing Permit – Purpose Permit to clear vegetation for the purposes of extending existing mines and excavation of new open pits, associated mine dewatering, onsite processing and waste (tailings and waste rock) disposal to support recommencement of mining operations at the Bellevue Gold Project. No mining or processing currently occurs onsite. However, historic underground workings are dewatered to support exploration activities, with the discharge directed to three open pits.

The total project footprint is 338.1 ha, with a total of 279.1 ha of vegetation proposed to be cleared. Studies identified:

- 15 vegetation communities were recorded in the clearing area; none are considered restricted.
- No Threatened Ecological Communities (TECs) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) or *Biodiversity Conservation Act 2016* (WA) (BC Act).
- One Department of Biodiversity, Conservation and Attractions (DBCA) listed Priority Ecological Community (PEC), categorised as Priority 1 - Violet Range (Perseverance Greenstone) Banded Iron Formation ecological community occurs within the Purpose Permit Area. Approximately 336.4 ha (2%) of the PEC overlaps with the Project site layout.
- No flora species listed under the EPBC Act or BC Act.
- Three Priority flora species were recorded in the survey areas:
  - *Grevillea inconspicua* (P4): The maximum percentage impact to has been calculated as 9.2% of the recorded population.
  - *Goodenia lyrata* (P3): The maximum percentage impact to has been calculated as 0.3% of the recorded population.
  - *Hibiscus* sp. Perrinvale Station (P3): There is only one other record in Florabase. This individual was identified in the borefield and can be avoided so that there will be no impact on this species.
- One taxon of 'other' conservation significance, *Eriachne aristidea*, was recorded at two locations. The proposed clearing will not affect the locations where this species was recorded.
- Thirty-six vertebrate species of conservation significance may occur in the survey area, with the majority of these being wetland birds classed as Migratory. The majority of significant species recorded from the desktop assessment are unlikely to be present in the project area or occur only irregularly or as vagrants, and as such are not considered likely to be impacted by the clearing.
- There are three mammals that are considered resident the Kultarr, Long-tailed Dunnart and the Central Long-eared Bat. Habitat loss leading to population decline or fragmentation was found by Bamford *et al*. (2020) to be negligible to minor. Therefore, no significant impacts to terrestrial fauna are expected.
- Six Vegetation and Substrate Associations (VSAs), or environments that provide habitats for fauna, across the study area. Two VSAs with restricted distributions were recorded within the clearing area:
  - Lake Miranda is an ephemeral hypersaline lake that has been previously used for mine water discharge and has high levels of leached contaminants. When flooded, it would support a high number of migratory waterbirds; The VSA covers 239.3 ha of the survey area, with 0.0 ha (0%) proposed to be cleared as part of the Proposed Project, and;
  - Samphire marsh covers 7.2% of the proposed site layout. A total of 1.3 ha (1.0% of the regional distribution) is proposed to be cleared.

An assessment against the ten clearing Principles is provided in **Section 4.** The assessment of the ten clearing principles concludes that the clearing of 279.1 ha of native vegetation within a purpose permit area of 850 ha is not likely to be at variance with any clearing principles.

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1. Introduction

RPM Advisory Services Pty Ltd ("**RPM**") has been engaged by Golden Spur Resources Pty Ltd ("**Golden Spur**" or the "**Client**"), a wholly owned subsidiary of Bellevue Gold Limited ("**Bellevue**") to complete a Purpose Permit Supporting Document (hereafter referred to as the "**Report**") for the Bellevue Gold Project ("**BGP**"). This supporting document provides additional information as referenced in the Native Vegetation Clearing Permit (NVCP) Application form.

1.1 Background

The *Environmental Protection Act 1986* (WA) (EP Act) and *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (WA) require that all land clearing related to mining and mineral exploration activities are approved by the Department of Water and Environmental Regulation (DWER). In accordance with Section 20 of the EP Act, applications relating to mineral and petroleum activities are delegated to the Department of Mine, Industry, Regulation and Safety (DMIRS) for assessment.

This report supports a native vegetation clearing permit (Purpose Permit) for proposed mining activities as defined in **Section 3**. Information is provided to enable assessment of the impacts of the proposed clearing on each of the ten 'Land Clearing Principles' described within Schedule 5 of the EP Act. This document presents the existing ecological information and environmental impact management measures for proposed clearing.

1.2 Proponent

All compliance and regulatory requirements regarding this assessment document should be forwarded by email or post to the following address:

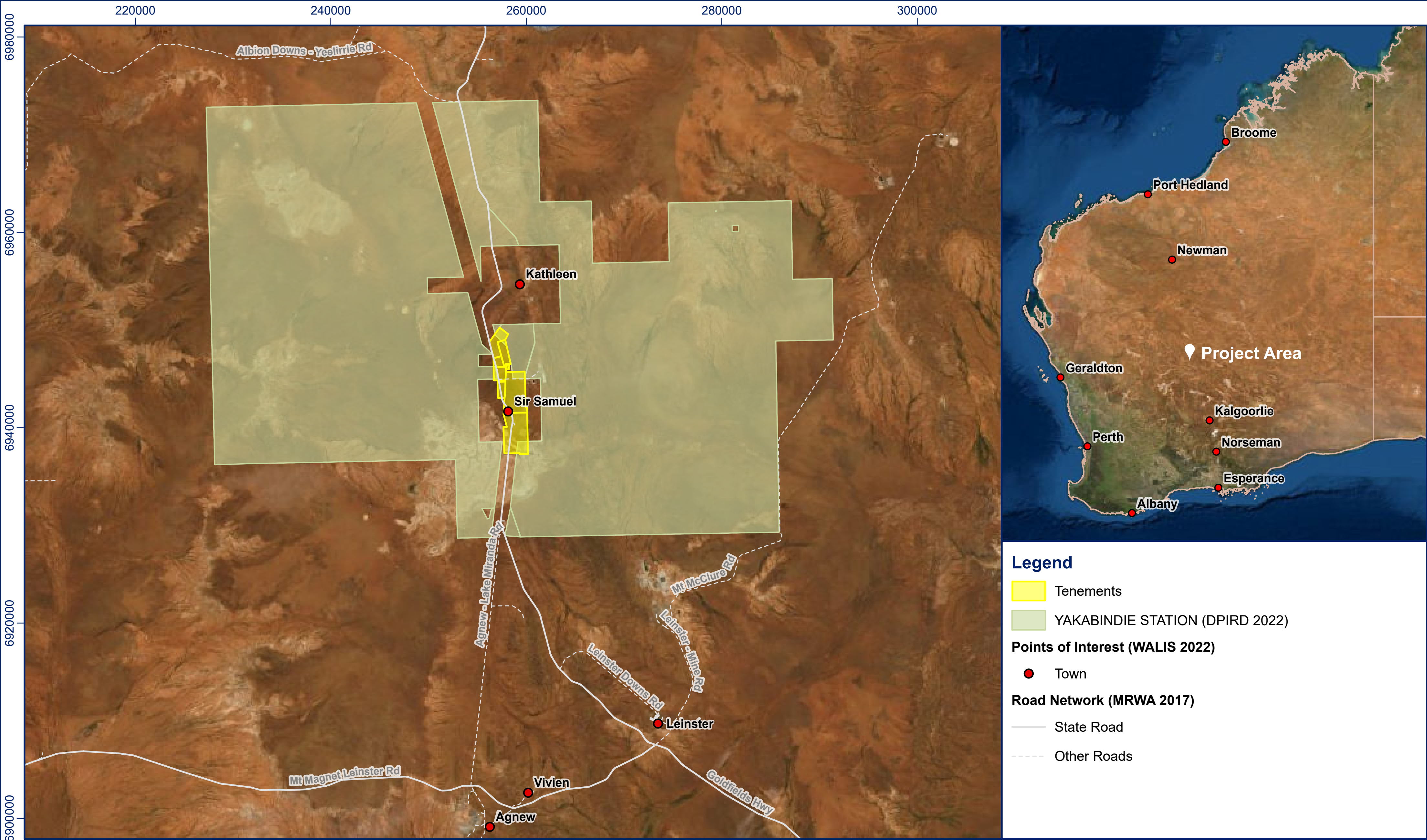
Proponent: Bellevue Gold Limited
Ground Floor, 24 Outram Street
West Perth WA 6005

Contact: Bill Stirling
Title: General Manager - Operations
Phone: 0411 626 974
Email: bstirling@bellevuegold.com.au

1.3 Location and Tenure

The BGP is a historic gold mining operation located within Mineral Field 36 in the Northern Goldfields Region of WA, approximately 40 km north of Leinster within the Shire of Leonora (**Figure 1-1**). The Project is adjacent to the Goldfields Highway that passes through the tenements to the west of the historic Bellevue Mine.

The applicable tenements associated with this Purpose Permit application include M36/24, M36/25 and M36/299 as shown in **Figure 1-2**.



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PROJECT		CLIENT
October 2022	Golden Spur - ESG - Bellevue - Secondary Approvals	BELLEVUE GOLD
Figure 1-1		
ADV-AU-00288	Location Plan	

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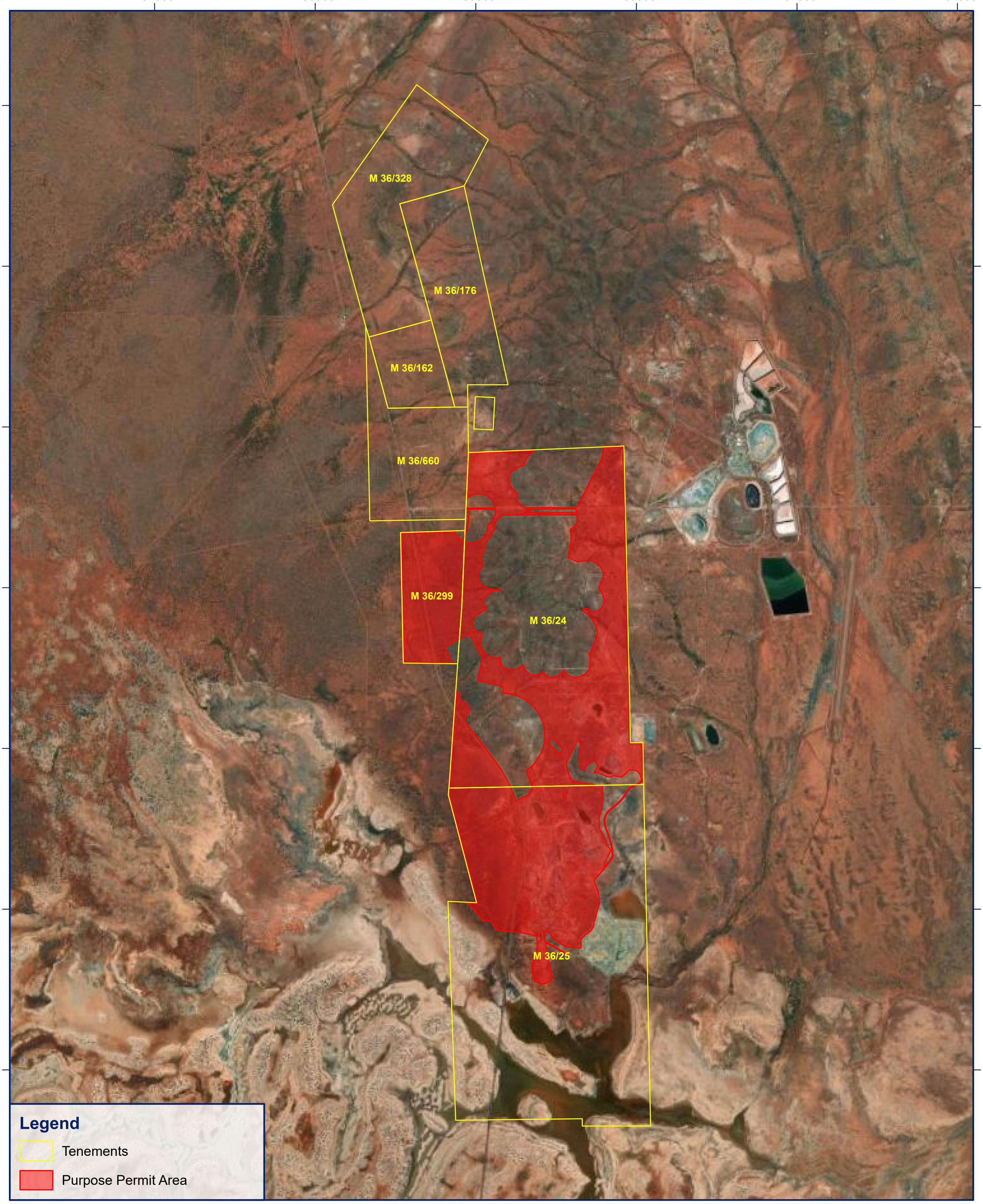

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PROJECT			CLIENT
Golden Spur - ESG - Bellevue - Secondary Approvals			BELLEVUE GOLD
Purpose Permit Application Area			
Figure 1-2	ADV-AU-00288	October 2022	

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2. Environmental Setting

2.1 Regional Setting

The Project is located in the semi-arid Northern Goldfields region of Western Australia, on the fringes of Lake Miranda. The Project lies within the Interim Biogeographic Regionalisation for Australia (IBRA) Murchison bioregion, and within the East Murchison (MUR01) subregion. The region is defined by internal drainage and extensive areas of elevated red desert sandplains within minimal dune development. The salt lake systems are associated with the occluded Paleodrainage system. There are widespread broad plains of red-brown soils and breakaway complexes as well as red sandplains. The vegetation is dominated by Mulga woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrublands (Cowan, 2001).

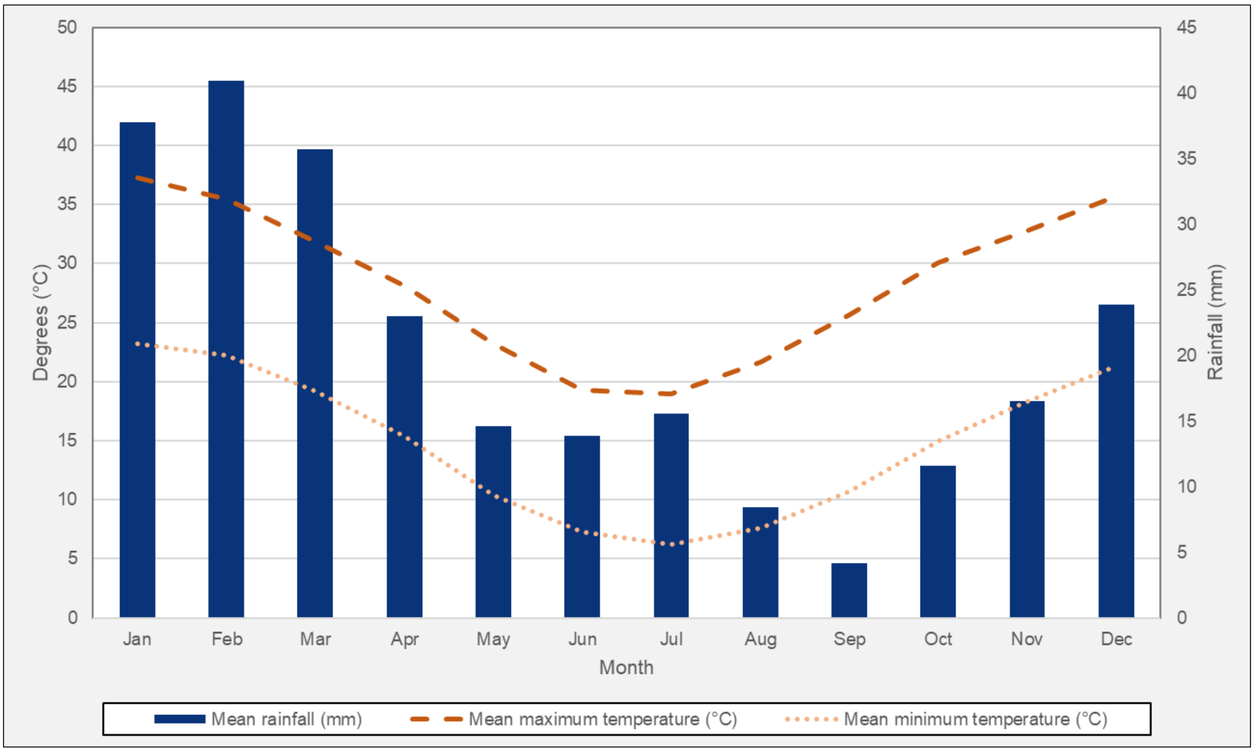
The dominant land uses in the vicinity of the Project are mining, exploration and pastoralism. There are no Environmentally Sensitive Areas (ESAs) declared under Section 51B of the EP Act in the project area.

2.2 Climate

The BGP is located in an area characterised by a semi-arid climate, with warm to hot summers and cool to mild winters. The nearest Bureau of Meteorology (BOM) weather station to the Project is located 43 km southeast at Leinster Aero (Site Number 012314). The mean maximum temperature is 37.3°C in January and mean minimum temperature of 6.2°C in July as shown in **Chart 2-1**.

The average annual rainfall as recorded at Leinster Aero Station is approximately 251.6 mm with an average of 30.9 days of rain per year. Rainfall generally comes from locally generated thunderstorms (during winter) and dissipating tropical cyclones tracking southeast from the Pilbara coast (during summer). The highest average rainfall occurs in February with 40.9 mm and the lowest occurring in September with 4.2 mm.

Chart 2-1: Leinster Aero (Site No. 012314) Climate Data



2.3 Geology, Soils and Landforms

A detailed baseline soil and landform assessment was undertaken by MBS Environmental and provided to BGL in June 2021. This assessment identified several landforms across the BGP including:

- Greenstone Hills and ridges supporting *Acacia* and mixed chenopod shrublands;
- Undulating gravel plains with low stony rises and minor saline plains; supporting groved mulga, bowgada and chenopod shrublands;
- Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks; supporting halophytic shrublands and *Acacia* tall shrublands;
- Broad plains with mantle of ironstone gravel supporting mulga shrublands and grasses; and
- Sandplains supporting *Triodia* grasslands with mallees and *Acacia* shrubs.

These landforms were all determined to be common in the surrounding landscape and as such, any ecological impacts from landform disturbance are not expected to be significant. The closest geoheritage site to the BGP is Lake Teague, which is approximately 190 km to the north and therefore, identified landforms are unlikely to be geoheritage sites.

The soil sampling program undertaken across the BGP identified seven different soil types within the Project area. Red Shallow Loam (DFA Soil Group 522) was the most common soil present across the BGP, accounting for 22 of the 47 logged soil samples. Generally, these soils were loamy with the top 10-40 cm on top of hardpan/bedrock and were found on flat to gently sloping areas with scattered to medium shrub coverage the common vegetation. Soils were typically covered with a dense cover of ferruginous and/or siliceous gravel and stony lag material.

2.4 Hydrogeology

There are two locally occurring aquifers in the region surrounding the BGP including:

- The Fractured Rock Aquifer (developed in the hard rock areas around the BGP); and
- The Carey Paleochannel Aquifer (formed in the now-filled Carey paleovalley to the west and south of the BGP).

The crystalline basement rocks in this region offers low aquifer permeability and storage characteristics. Groundwater occurs mainly within the secondary porosity developed in the weathered lower saprolite horizon and structural defects such as faults, shears zones and fractures. Whilst the BGP lies almost entirely within the Fractured Rock Aquifer, the underground workings and associated dewatering will create a very steep hydraulic gradient between the underground and the adjacent Carey Palaeochannel Aquifer.

2.4.1 Historical Information

The BGP is located on top of a Fractured Rock Aquifer which is known for low yields of fresh to saline groundwater. Dewatering of the underground and open cut operations has been undertaken at Bellevue on several previous occasions, however no historical information on mine progression, mine dewatering rates or groundwater levels were available. Anecdotal reports indicated that low ongoing dewatering inflows (<5 L/s) were easily managed via traditional sump and transfer pipeline infrastructure, although the original source of this information is unknown.

Since the cessation of mining operations and the associated dewatering in 1997, groundwater levels in the underground workings have recovered and equilibrated back to pre-mining levels (460 mAHD). It is not known how rapidly this occurred. In 2019, dewatering of the existing workings commenced and required a minimum pumping rate of 14 L/s to introduce drawdown in the workings.

2.4.2 Groundwater Quality

Groundwater quality in the area is hypersaline with Total Dissolved Solids (TDS) around 100,000 mg/L. At the cessation of mining and dewatering in 1997, Vanguard, Henderson, Westralia, Paris and Prospero pits received surplus water from the nearby Cosmo Nickel Mine, which is more saline. Bellevue pit is understood to not have received water from Cosmo Nickel Mine and is considered the most representative of the original groundwater in the region (RPS, 2018). Historical pH and TDS values have been provided in **Table 2-1** (RPS, 2018).

Table 2-1: Historical pH and TDS records from surrounding Pits

Nearby Pit	Date	pH Value	TDS (mg/L)
Henderson North Pit	Nov-16	7.73	136,000
	Sep-17	7.65	90,400
	Apr-18	7.12	65,600
Westralia Pit	Nov-16	7.11	145,000
	Sep-17	6.5	73,400
	Apr-18	3.5	91,000
Vanguard Pit	Nov-16	7.62	144,000
	Sep-17	7.38	136,000
	Apr-18	7.15	155,000
Paris Pit	Nov-16	6.76	90,400
	Sep-17	5.1	29,300
	Apr-18	7.29	82,600
Prospero Boxcut	Nov-16	7.25	125,000
	Apr-18	7.81	74,100
Bellevue Pit	Nov-16	7.77	33,000
	Apr-18	7.84	17,900

The pre-mining groundwater levels at Bellevue range between 15 to 30 metres below ground level (mbgl), depending on topography, equivalent to approximately 460 metres above height datum (m AHD). The levels indicate a relatively flat groundwater gradient regionally towards the south, which is consistent with the regional groundwater flow direction following the major palaeodrainages (RPS, 2018).

2.4.3 Groundwater Dependent Ecosystems

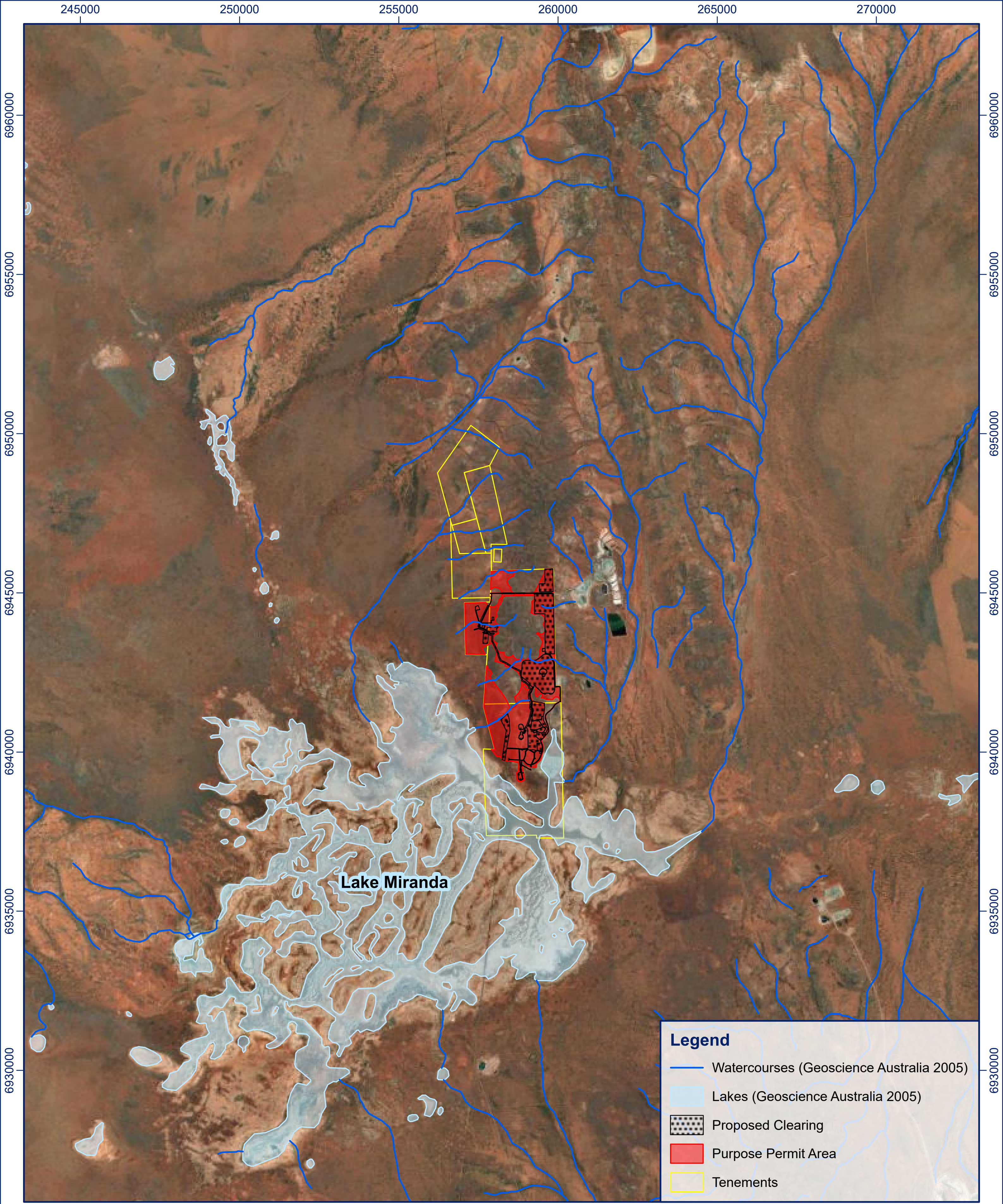
There are no known groundwater dependent ecosystems (GDEs) within the immediate mine area. However, the calcrete deposits at Lake Miranda are listed as a PEC as stygofauna may exist in this area.

2.5 Hydrology

The Project area is situated on a gently undulating landscape consisting of minor ridges, with slopes generally less than 10°, and colluvial flats 50-200 m wide and 10-20 m below the ridges. The area is described as drainage lines, with salt lake features to the south (Lake Miranda), undulating plains to the east and hills to the west. There are no wetlands or permanent surface water features on the site. All streams are ephemeral, driven by the erratic nature of rainfall in the region.

The existing open pits are aligned with the local topographical high of the greenstone belt, which also defines the top of the local surface water catchments in the area (**Figure 2-1**). Drainage near the site is generally to the south towards Lake Miranda (salt lake with periodic inundation driven by seasonal rainfall events). East of the site lies a braided streambed with four major tributes that converge at a point about 2 km east of the southernmost point of the site. Substantial surface run-off occurs following thunderstorms or cyclonic activity, resulting in intermittent and short duration surface water flows in the local drainage lines. Run-off rates during these large rainfall events are generally high.

2D flood modelling determined that whilst the Project could be affected by a 1 in 100-year flood event, the predicted water velocities are typically non-destructive to earth structures and unlikely to impact the BGP. Additional modelling for a 1 in 500-year flood event to account for extreme rainfall events due to climate change. The assessment identified that flood extents would increase by up to 40 m when compared to the 1 in 100-year events, that would impact the BGP. The Water Management Plan describes this type of flood event was very low and that the site topography naturally encourages water to flow away from the Project.



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PROJECT

Golden Spur - ESG - Bellevue - Secondary Approvals

Surface Water Features

Figure 2-1	ADV-AU-00288	October 2022

CLIENT

BELLEVUE GOLD

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2.6 Flora and Vegetation

A Detailed Flora and Vegetation assessment was undertaken by RPS Australia West Pty Ltd (RPS) over the course of five field surveys between August 2018 and October 2019. The survey program involved sampling the full range of vegetation communities and flora within the Project are and was conducted in accordance with:

- Environmental Factor Guideline: Flora and Vegetation (EPA, 2016); and
- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessments (EPA, 2016).

The assessment was undertaken over five field mobilisations (August 2018, October 2018, April 2019, August 2019 and October 2019) and involved sampling the full range of vegetation communities and flora within the survey area. A total of 92 floristic quadrats (20 m x 20 m) and 20 relevés were sampled. All quadrats were sampled twice.

The information presented in this supporting document is a subset of the full report that is provided in **Appendix A**.

2.6.1 Vegetation Communities

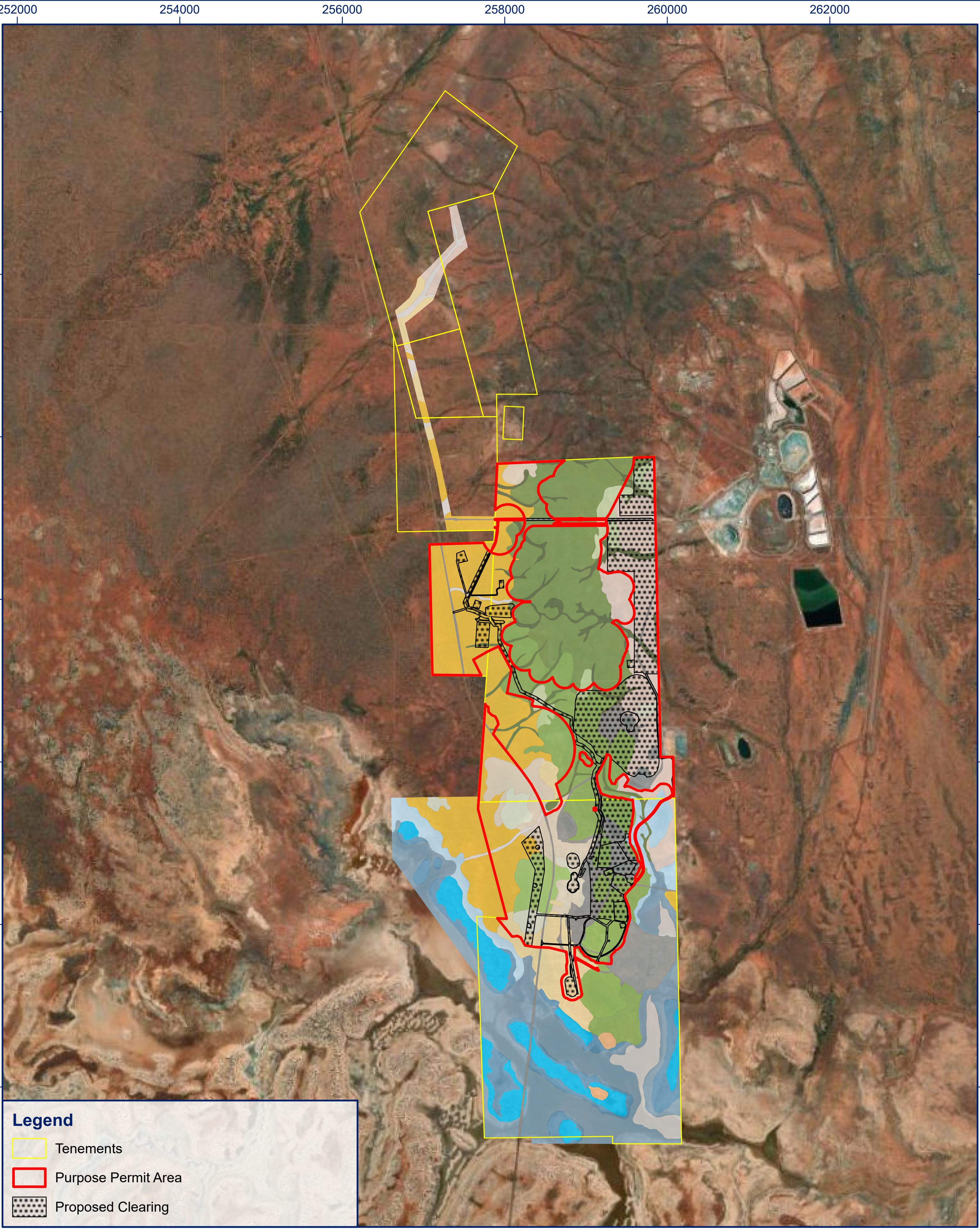
A total of 19 vegetation communities were recorded across the survey area, with 15 occurring in the proposed clearing area as listed in **Table 2-2** and displayed in **Figure 2-2**. A total of 2,256 ha was surveyed of which 279.1 ha of native vegetation is proposed to be cleared within a 338.8 ha project footprint.

Table 2-2: Vegetation Units and Proposed Clearing Area

Veg Unit	Description	Survey Area (ha)	Project Footprint (ha)	Impact (%)
Salt Lake Margins				
L01	*Tecticornia* spp. Open to Closed Low Samphire Shrubland on salt lake margins.	282.1	0	0
L02	*Tecticornia* spp. Open to Sparse Low Samphire Shrubland over *Eragrostis falcata*, *E. pergracilis* Sparse Tussock Grassland on lower slopes of gypsum dunes adjacent to salt lake.	97.8	0	0
Gypsum dunes				
G01	*Cratystylis subspinescens* Mid Sparse Shrubland over *Maireana pyramidata* and *Tecticornia* sp. Low Sparse Chenopod Shrubland over mixed Sparse Tussock Grassland / Forbland on low stony rises adjacent to Samphire shrublands.	70.7	1.6	2.3
G02	*Eucalyptus striaticalyx* and/or *Casuarina pauper* Isolated Clumps of Trees over *Grevillea sarissa* subsp. *bicolor* Tall Sparse Shrubland over *Scaevola spinescens, Lycium australe* and *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and/or *Eragrostis falcata* Sparse Tussock Grassland and *Frankenia* sp. *forbland* on gypsum (kopi) dunes adjacent to salt lake.	111.1	0	0
Stony Plain and lower hill slopes				
H01	*Mulga* spp. Isolated Trees to Low Open Woodland over *Acacia tetragonophylla*, *Eremophila galeata* and *Hakea preissii* Tall Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopod Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland on stony plains and lower hill slopes	31.3	6.7	21.4

Veg Unit	Description	Survey Area (ha)	Project Footprint (ha)	Impact (%)
H02	Mulga spp. and *Acacia doreta* (long phyllode form) Low Open Woodland to Low Isolated Trees over *Senna* sp. Meekatharra Mid Sparse to Open Shrubland on stony plains and lower hill slopes	31.1	11.8	37.9
Stony hill slopes, sours and crests				
H03	*Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens, Enneapogon polyphyllus* and *Aristida contorta* Sparse Tussock Grassland	8.9	1.7	19.1
H04	*Eremophila galeata, E. forrestii* subsp. *forrestii*, *E. exilifolia* and *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Aristida contorta* Open Tussock Grassland on stony hill slopes, spurs and crests	33.4	8.4	25.1
H05	*Acacia fuscaneura* Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Eremophila exilifolia* and *E. forrestii* subsp. *forrestii* Mid Sparse Shrubland over Aristida contorta Sparse Tussock Grassland on stony hill slopes, spurs and crests	50.7	5.5	10.8
H06	*Mulga* spp. and *Acacia doreta* (long phyllode form) Low Open Woodland with Isolated *Eremophila oldfieldii* subsp. *angustifolia* over *A. xanthocarpa* Tall Isolated Shrubs over *Eremophila exilifolia*, *E.forrestii* subsp. *forrestii* and *Senna artemisioides* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and *Maireana* spp. Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests	237.1	81.5	34.4
H07	*Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse to Open Shrubland over *Senna* sp. *Meekatharra* and *S. artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Shrubland on stony hillslopes, spurs and crests	271.3	5.8	2.1
Drainage Lines on stony hills				
H08	*Mulga* spp. Low Open Woodland over *Senna* spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens* and *Cymbopogon ambiguus* Sparse Tussock Grassland	24.7	1.2	4.9
H09	*Mulga* spp. Low Open to Closed Forest over *Acacia xanthocarpa* Tall Sparse to Open Shrubland over *Eremophila exilifolia* and *Senna* spp. Mid to Low Open Shrubland over *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hill slopes	52.2	15.3	29.3
Drainage Lines				
P01	*Mulga* spp. Low Woodland to Low Open Forest over *Eremophila galeata*, *E. serrulata* and *Senna* spp. Mid Sparse to open Shrubland over *Cymbopogon obtectus* and *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hardpan plains.	19.0	0.3	1.6

Veg Unit	Description	Survey Area (ha)	Project Footprint (ha)	Impact (%)
Stony hardpan plains				
P02	*Mulga* spp. Low Open Woodland to Isolated Trees over *Eremophila pantonii* and *E. galeata* Tall Open to Sparse Shrubland over *Senna* sp. Meekatharra Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopods Low Open to Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland in drainage lines on stony hardpan plains.	177.5	101.4	57.1
P03	*Eremophila* spp. Tall Open Shrubland over *Senna* spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland over *Aristida contorta* Sparse Tussock Grassland.	86.4	8.0	9.3
Red Sand dunes				
S01	Mixed Isolated Trees and Shrubs, including *Santalum lanceolatum*, *Rhagodia drummondii*, *Scaevola spinescens* and *Alyogyne pinoniana* over *Aristida holathera* var. *holathera* Open Tussock Grassland on red sand dune crests and slopes.	5.9	0	0
Sand flats and low sandy rises				
S02	*Mulga* spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over a mixed Open Tussock Grassland on sand plains and low undulating sand hills and sandy rises.	93.2	6.6	7.1
Flat sandplains over hardpan				
S03	*Mulga* spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda*, *Monachather paradoxus* and *Eriachne helmsii* Tussock Grassland on sand over hardpan plains.	364.1	23.3	6.4
Cleared/highly modified				
C/M	Highly modified and cleared areas devoid of native vegetation – include roads, tracks, buildings, mining infrastructure, historical pits, processing areas and camps.	162.5	59.7	36.7
Bare scald	Bare areas of mud flats/salt lake devoid of vegetation.	45.0	0	0
Total		**2,256**	**338.8**	**-**



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PROJECT	CLIENT
Golden Spur - ESG - Bellevue - Secondary Approvals	BELLEVUE GOLD
Vegetation Units	
Figure 2-2 · ADV-AU-00288 · October 2022	

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Legend

Vegetation Mapping (RPS 2020)

- Bare scald
- Cleared/Highlight Modified
- G01 - *Cratystylis subspinescens* Mid Sparse Shrubland over *Maireana pyramidata* and *Tecticornia* sp. Low Sparse Chenopod Shrubland over mixed Sparse Tussock Grassland / Forbland on low stony rises adjacent to Samphire shrublands
- G02 - *Eucalyptus striaticalyx* and/or Casuarina pauper Isolated Clumps of Trees over *Grevillea sarissa* subsp. *bicolor* Tall Sparse Shrubland over *Scaevola spinescens*, *Lycium australe* and *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and/or *Eragrostis falcata* Sparse Tussock Grassland and *Frankenia* sp. Forbland on gypsum (kopi) dunes adjacent to salt lake
- H01 - Mulga spp. Isolated Trees to Low Open Woodland over *Acacia tetragonophylla*, *Eremophila galeata* and *Hakea preissii* Tall Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopod Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland on stony plains and lower hill slopes
- H02 - Mulga spp. and *Acacia doreta* (long phyllode form) Low Open Woodland to Low Isolated Trees over *Senna* sp. Meekatharra Mid Sparse to Open Shrubland on stony plains and lower hill slopes
- H03 - *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens*, *Enneapogon polyphyllus* and *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
- H04 - *Eremophila galeata*, *E. forrestii* subsp. *forrestii*, *E. exilifolia* and *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Aristida contorta* Open Tussock Grassland on stony hill slopes, spurs and crests
- H05 - *Acacia fuscaneura* Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Eremophila exilifolia* and *E. forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
- H06 - Mulga spp.and *Acacia doreta* (long phyllode form) Low Open Woodland with Isolated *Eremophila oldfieldii* subsp. *angustifolia* over *A. xanthocarpa* Tall Isolated Shrubs over *Eremophila exilifolia*, *E. forrestii* subsp. *forrestii* and *Senna artemesioides* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and Maireana spp. Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
- H07 - *Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse to Open Shrubland over *Senna* sp. *Meekatharra* and *S. artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Shrubland on stony hillslopes, spurs and crests
- H08 - Mulga spp. Low Open Woodland over Senna spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens* and *Cymbopogon ambiguus* Sparse Tussock Grassland in drainage lines on stony hill slopes
- H09 - Mulga spp. Low Open to Closed Forest over *Acacia xanthocarpa* Tall Sparse to Open Shrubland over *Eremophila exilifolia* and Senna spp. Mid to Low Open Shrubland over *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hill slopes
- L01 - Tecticornia spp. Open to Closed Low Samphire Shrubland on salt lake margins
- L02 - Tecticornia spp. Open to Sparse Low Samphire Shrubland over *Eragrostis falcata*, *E. pergracilis* Sparse Tussock Grassland on lower slopes of gypsum dunes adjacent to salt lake
- P01 - Mulga spp. Low Woodland to Low Open Forest over *Eremophila galeata*, *E. serrulata* and Senna spp. Mid Sparse to open Shrubland over *Cymbopogon obtectus* and *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hardpan plains
- P02 - Mulga spp. Low Open Woodland to Isolated Trees over *Eremophila pantonii* and *E. galeata* Tall Open to Sparse Shrubland over *Senna* sp. Meekatharra Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopods Low Open to Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland in drainage lines on stony hardpan plains
- P03 - Eremophila spp. Tall Open Shrubland over Senna spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hardpan plains
- S01 - Mixed Isolated Trees and Shrubs including *Santalum lanceolatum*, *Rhagodia drummondii*, *Scaevola spinescens* and *Alyogyne pinonia* over *Aristida holathera* var. *holathera* Open Tussock Grassland on red sand dune crests and slopes
- S02 - Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over a mixed Open Tussock Grassland on sand plains and low undulating sand hills and sandy rises
- S03 - Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda*, *Monachather paradoxus* and *Eriachne helmsii* Tussock Grassland on sand over hardpan plains
- Purpose Permit Area
- Proposed Clearing

Scale: 1:60,000
Projection: GDA2020 MGA Zone 51
Created/Reviewed By: HC/CR
Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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PROJECT			CLIENT
Golden Spur - ESG - Bellevue - Secondary Approvals			BELLEVUE GOLD
Vegetation Units (Legend)			
Figure 2-2	ADV-AU-00288	October 2022	

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2.6.2 Vegetation Condition

Vegetation conditions within the survey area ranges from Very Good through much of the intact vegetation (on the stony hills, sandy rises and undulating plains and hardpan flats, drainage lines and on the gypsum dunes and samphire flats adjacent to Lake Miranda) to Completely Degraded on areas of the stony hills and plains subject to historical mining activities including the old tailings storage facility, open pits, waste rock dumps, access roads and exploration camp.

Much of the survey area has been subjected to some level of clearing or disturbance during its mining history, and extant vegetation comprises a range of revegetation ages. Areas recorded for the current assessment of Very Good in condition showed signs of human impact. The EPA (2016) defines Very Good as some relatively slight signs of damage caused by human activities since European settlement. It is likely that much of the hillcrest and slope vegetation has undergone selective felling and clearing of tree species, including mulga and eucalypts, as a source of timber for the construction of buildings and other structures associated with prospecting and mining (RPS, 2020).

2.6.3 Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), or the *Biodiversity Conservation Act 2016* (WA) (BC Act) were identified during the assessment by RPS (2020).

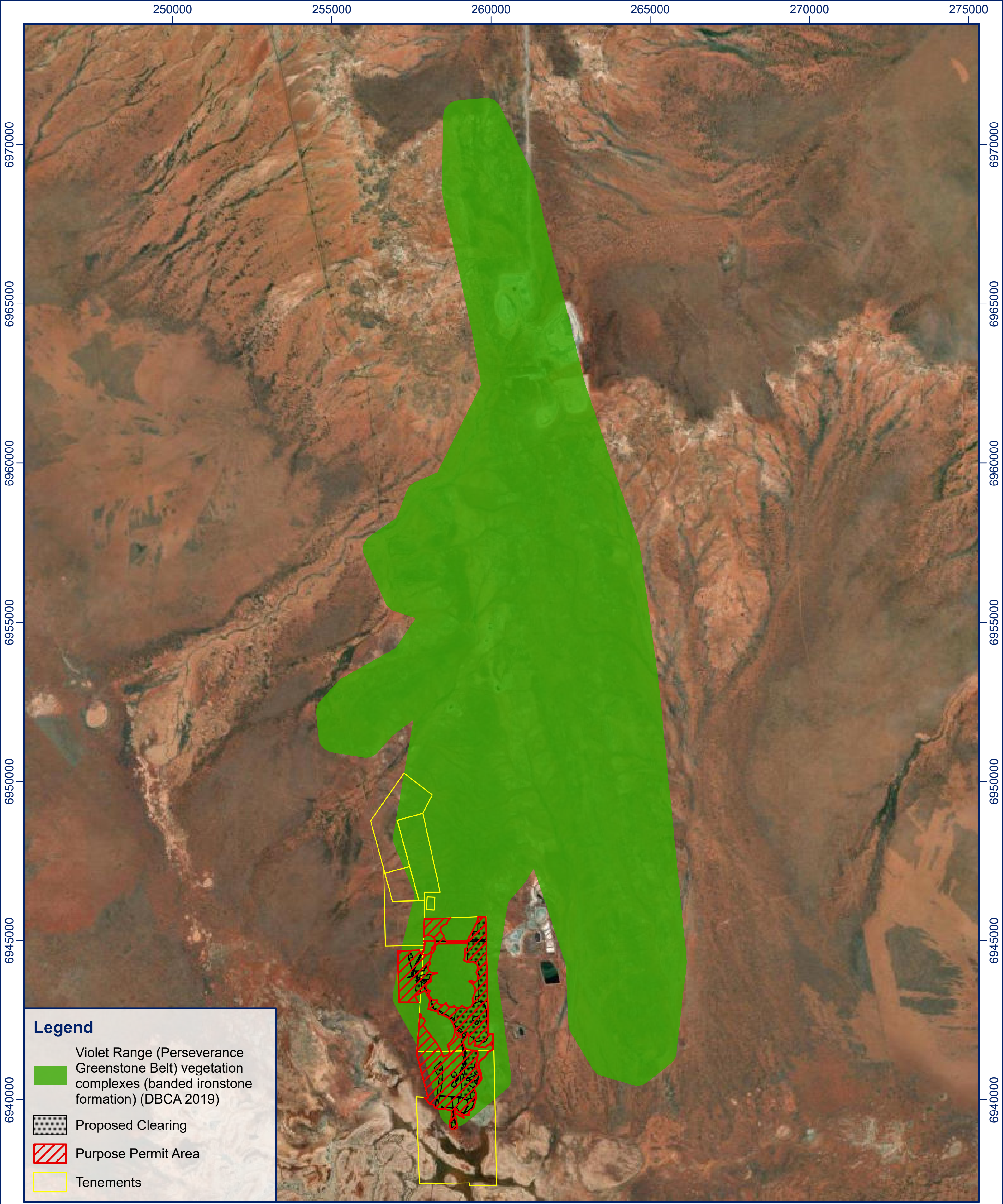
The desktop assessment identified one Department of Biodiversity Conservation and Attractions (DBCA) listed Priority Ecological Community (PEC), categorised as Priority 1 – Violet Range (Perseverance Greenstone) Banded Iron Formation. The PEC occupies a total of 19,249.3 ha across its mapped extent, including a 500 m buffer. The field survey confirmed the presence of the PEC within the Project area with a total of 336.4 ha proposed to be cleared under the Purpose Permit application. The proposed clearing represents 2% of the total PEC mapped extent as shown in **Figure 2-3**.

2.6.4 Conservation Significant Flora

The assessment by RPS (2020) found:

- No flora species listed under the EPBC Act or BC Act were identified.
- A total of three Priority flora species listed by DBCA were recorded:
  - *Grevillea inconspicua* (P4): The maximum percentage impact to has been calculated as 9.2% of the recorded population.
  - *Goodenia lyrata* (P3): The maximum percentage impact to has been calculated as 0.3% of the recorded population.
  - *Hibiscus* sp. Perrinvale Station (P3): There is only one other record in Florabase. This individual was identified in the borefield and can be avoided so that there will be no impact on this species.

One taxon of ‘other’ conservation significance, *Eriache aristidea*, was recorded at two locations. The proposed clearing will not affect the locations where this species was recorded. Locations of Priority flora in relation to the proposed clearing are shown in **Figure 2-4**.



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Projection: GDA2020 MGA Zone 51
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Priority Ecological Community

Figure 2-3	ADV-AU-00288	October 2022

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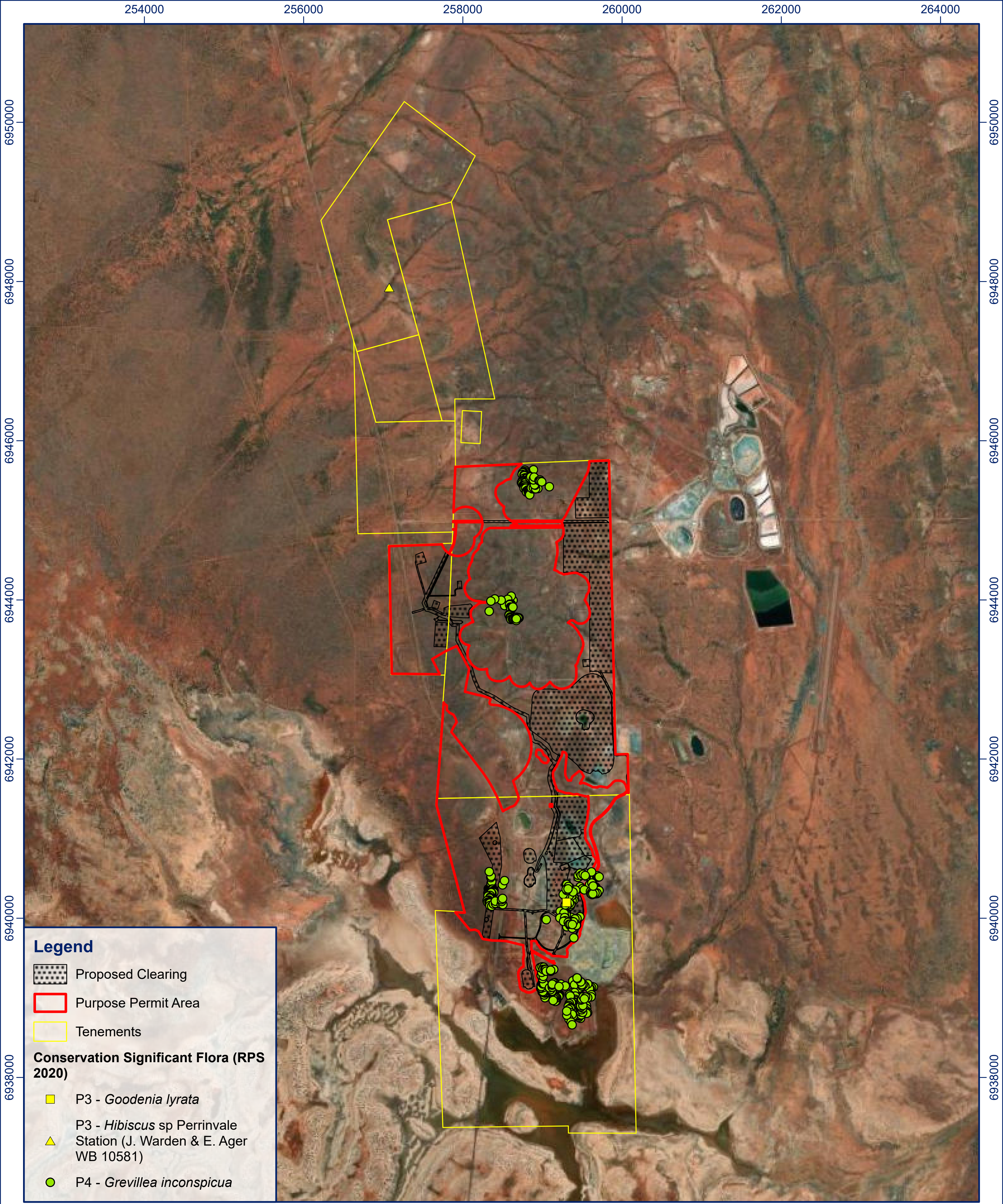

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Scale: 1:60,000
Projection: GDA2020 MGA Zone 51
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Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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PROJECT	CLIENT
Golden Spur - ESG - Bellevue - Secondary Approvals	BELLEVUE GOLD
Conservation Significant Flora Species	

Figure 2-4	ADV-AU-00288	October 2022

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2.6.5 Weeds

A following nine naturalised weed species were recorded for the survey area representing 2.6% of the total flora taxa recorded:

- *Asphodelus fistulosus;*
- *Sonchus oleraceus;*
- *Cuscuta planiflora;*
- *Cucumis myriocarpus;*
- *Salvia verbenaca;*
- *Cenchrus ciliaris;*
- *Cenchrus setiger;*
- *Eragrostis minor; and*
- *Rumex vesicarius.*

These weed species were recorded at low densities throughout much of the vegetation within the survey area (RPS, 2020). None of the weeds recorded were determined to be Declared Pests - s22(2) or Weeds of National Significance (RPS, 2020).

2.6.6 Dieback

Dieback (*Phytophthora* sp.) is a soil-borne water mould that spreads by root-to-root growth amongst host plants and through zoospores which are motile in water and moist soil. The fungus also has two resting structures, chlamydospores and oospores, that are resistant to desiccation and can survive in dry conditions before developing into active zoospores when wet conditions return. Soil movement by vehicles, human activity and terrestrial mammals is also a significant means of dieback spread.

The "vulnerable zone" to dieback is considered to be the area of south-west Australia, west and south of the 400 mm rainfall isohyet. However, several incidences have been recorded in wet conditions to the east of the isohyet, including the Forrestania area (DBCA, 2020). RPS did not record any areas of vegetation suspected of being affected by dieback.

2.7 Vertebrate Fauna and Habitat

A detailed terrestrial fauna and habitat assessment was undertaken by Bamford Consulting Ecologists for the Project in 2018 and 2019. The desktop assessment found the Project may have a moderately rich faunal assemblage with up to ten frogs, 70 reptiles, 153 birds, 28 native mammals and eight introduced mammals. The field investigations confirmed the presence of one frog, 64 birds, eight native mammals and four introduced mammals. The full report is provided as **Appendix B**.

2.7.1 Conservation Significant Fauna

A total of 36 vertebrate species of conservation significance was identified as possibly occurring within the Project area. An assessment of these species and recordings during the field survey are discussed in **Table 2-3**.

Table 2-3: Conservation Significant Fauna

Species	Common Name	Status*	Recorded	Predicted Status
Reptiles				
Liopholis kintorei	Great Desert Skink	Vu/Vu		Vagrant
Aprasia picturata	Black-headed Worm-Lizard	LS		Vagrant
Aprasia repens	Sandplain Worm-Lizard	LS	X	Resident
Birds				
Leipoa ocellata	Malleefowl	Vu/Vu		Irregular, nonbreeding visitor

Species	Common Name	Status*	Recorded	Predicted Status
Lophoictinia isura	Square-tailed Kite	LS		Irregular visitor
Falco hypoleucos	Grey Falcon	Vu		Vagrant
Falco peregrinus	Peregrine Falcon	OSPS		Irregular visitor
Ardeotis australis	Australian Bustard	LS	X	Regular visit
Ardea modesta	Eastern Great Egret	Migratory		Vagrant
Limosa limosa	Black-tailed Godwit	Migratory		Vagrant
Tringa nebularia	Common Greenshank	Migratory	X	Regular visit
Tringa stagnatalis	Marsh Sandpiper	Migratory		Irregular visitor
Tringa hypoleucos	Common Sandpiper	Migratory		Regular visit
Tringa glareola	Wood Sandpiper	Migratory		Regular visit
Calidris ruficollis	Red-necked Stint	Migratory		Regular visit
Calidris melanotos	Pectoral Sandpiper	Migratory		Irregular visitor
Calidris acuminata	Sharp-tailed Sandpiper	Migratory	X	Irregular visitor
Calidris ferruginea	Curlew Sandpiper	Migratory		Vagrant
Charadrius veredus	Oriental Plover	Migratory		Vagrant
Burhinus grallarius	Bush Stone-curlew	LS	X	Regular Visitor
Cacatua leadbeateri	Major Mitchell's Cockatoo	LS		Vagrant
Neophema splendida	Scarlet-chested Parrot	LS		Irregular visitor
Polytelis anthopeplus	Regent Parrot	LS		Irregular visitor
Polytelis alexandrae	Princess Parrot	Vu, P4		Irregular Visitor
Pezoporus occidentalis	Night Parrot	En/CE		Vagrant
Apus pacificus	Fork-tailed Swift	Migratory		Regular Visitor
Amytornis striatus	Striated Grasswren	P4		Vagrant
Acanthiza iredalei	Slender-billed Thornbill (Western)	LS		Regular Visitor
Stipiturus ruficeps	Rufous-crowned Emu wren	LS		Vagrant
Conopophila whitei	Grey Honeyeater	LS		Irregular Visitor
Mammals				
Dasycercus blythi	Brush-tailed Mulgara	P4		Irregular Visitor
Antechinomys laniger	Kultarr	LS		Resident
Sminthopsis longicaudata	Long-tailed Dunnart	P4		Resident
Petrogale lateralis	Black-flanked Rock-Wallaby	En/En		Vagrant
Nyctophilus major tor	Central Long-eared Bat	LS, P3		Resident
Pseudomys desertor	Desert Mouse	LS		Irregular visitor

** EPBC Act/BC Act = CE (Critically Endangered) En (Endangered), Vu (Vulnerable), OSPS (Other Specially Protected Species).*
DBCA = Priority(P)1,2,3,4,5. LS = Locally Significant

The majority of conservation significant species identified from the desktop assessment are unlikely to be present in the Project area or occur only irregularly or as vagrants, and as such are not considered likely to be impacted by the proposed clearing. There are three mammals that are considered resident, including:

- Kultarr – The likelihood of the Kultarr to be present is possible as there is suitable habitat present at the Project site.
- Long-tailed Dunnart – considered a potential resident in the project area, mainly in the rocky environments. Records near Wiluna, approximately 110 km north-northwest of BGP in areas of small rocky hills that are similar to Violet Range.
- Central Long-eared Bat – considered to be a resident in the survey area, likely to favour Mulga areas where suitable tree hollows provide shelter.

Habitat loss leading to population decline or fragmentation was found by Bamford et al. (2020) to be negligible to minor. Therefore, no significant impact to terrestrial fauna is expected.

There are up to ten species of migratory waterbirds that are likely to occur occasionally, potentially in large numbers, on Lake Miranda. At times many lakes in the greater region are flooded, indicating that the birds could be widely dispersed. Several locally significant bird species are considered certain to be present in the survey area. These species are highly mobile, and with populations fluctuations, that may result in under representation in field surveys.

2.7.2 Vertebrate Fauna Habitat

A total of six Vegetation and Substrate Associations (VSAs) were identified across the BGP to describe the types of habitats available to local fauna species. The VSA's recorded within the BGP are displayed in **Figure 2-5** and described as:

- Long-leaf Mulga over shrubs and tussock grass on rocks and loam of undulating hills.
- Broad-leaf Mulga over shrubs and tussocks grass on sandy-loam plains.
- Isolated trees over open shrubland on gypsum soils close to Lake Miranda.
- Samphire marsh in loam clay on margins and across parts of Lake Miranda.
- Lake Miranda.
- Degraded area.

A total of four of the six VSA's recorded were considered well represented in the region. The remaining two VSA's were found to have more restricted distributions being:

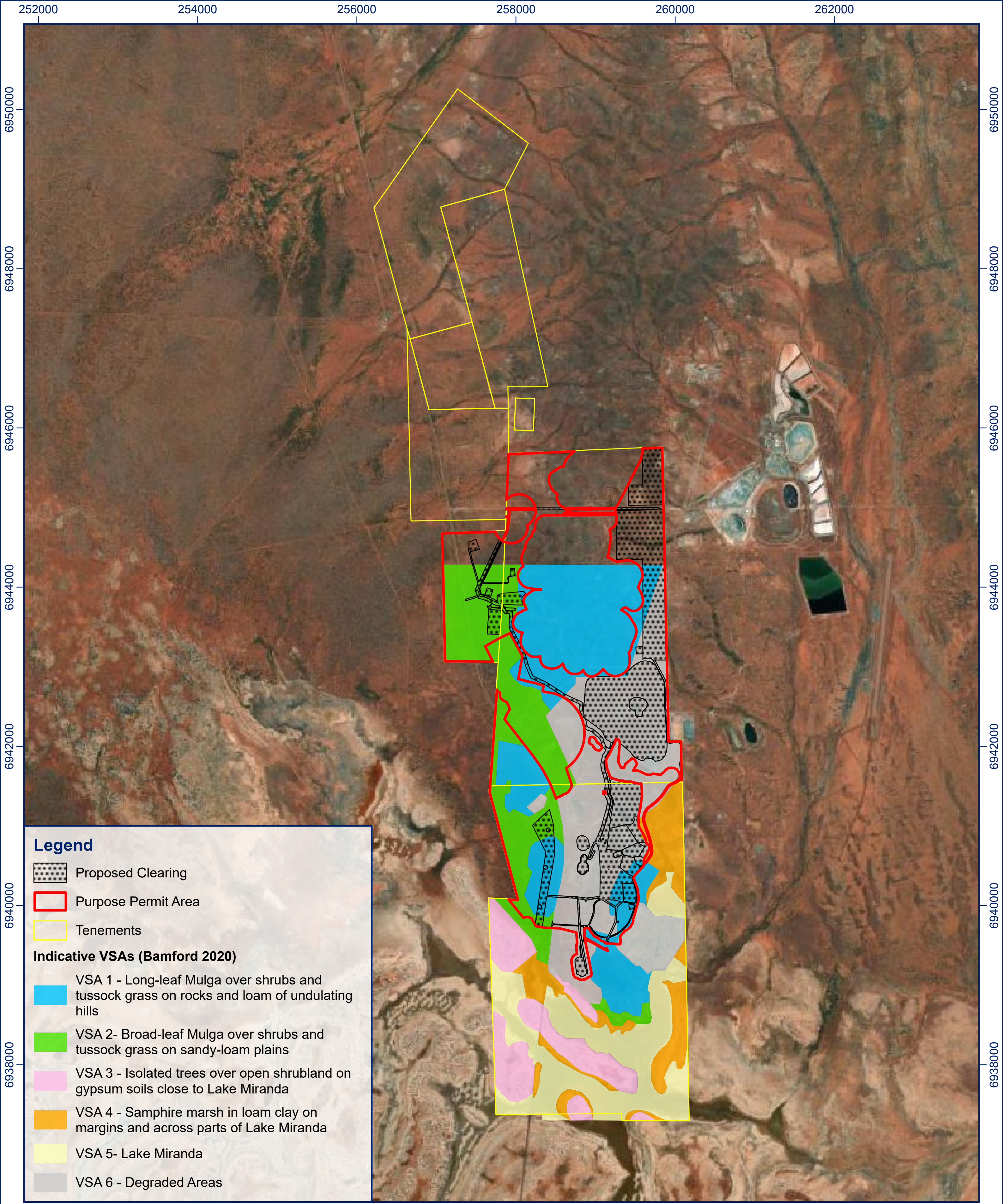
- Lake Miranda – an ephemeral hypersaline lake that has been previously used for mine water discharge and has high levels of leached contaminants. When flooded, it is likely to support a high number of migratory waterbirds. The VSA covers 239 ha of the survey area, of which none are proposed to be cleared as part of this Purpose Permit application.
- Samphire marsh – the total mapped extent is 134.7 ha of which a total of 1.3 ha (1.0% of the regional mapped extent) is proposed to be cleared as under this Purpose Permit application.

2.7.3 Introduced Species

Eight introduced species were identified as having the potential to occur in the Project area:

- House Mouse (*Mus musculus*);
- Dog (*Canis lupus*);
- Fox (*Vulpes vulpes*);
- Cat (*Felis catus*);
- Dromedary Camel (*Camelus dromedarius*);
- European Rabbit (*Oryctolagus cuniculus*);
- Cow (*Bos taurus*); and
- Feral Goat (*Capra hircus*).

Of these, four were recorded during field surveys being the Rabbit, Dog, Cat and Cow.



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Projection: GDA2020 MGA Zone 51
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Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Golden Spur - ESG - Bellevue - Secondary Approvals

Vegetation and Substrate Associations

Figure 2-5	ADV-AU-00288	October 2022

CLIENT

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2.8 Short Range Endemics

One potential conservation significant Short-range Endemic (SRE) was identified as potentially occurring during the vertebrate fauna desktop assessment, Moriarty's Trapdoor Spider (*Kwonkan moriartii*) –DBCA Priority 2 (Bamford et al., 2020).

The field survey, comprising opportunistic searching and by-catch of vertebrate fauna traps, recorded three isopods and eight scorpions (Bamford et al., 2020). One scorpion (*Urodacus* sp.) was noted as a possible SRE but could not be identified to species level. It was recorded from a VSA which is widespread in the region. One isopod may be an SRE due to having only been previously collected in the Lake Miranda area and Lake Way, *Buddelundia labiata*. Lake Way is approximately 65 km north of the Purpose Permit Boundary and Lake Miranda is within the Purpose Permit Boundary, however it will not be impacted by the proposed clearing.

2.9 Subterranean Fauna

A preliminary subterranean fauna species and habitat assessment was undertaken by Invertebrate Solutions from the Project in 2021. The technical memorandum served as a preliminary assessment of records by the Western Australian Museum (WAM) and DBCA. Desktop results for stygofauna and troglofaunal records found in the vicinity of the BGP are limited to calcrete outcrops including Miranda East and Miranda West calcretes. These habitats have not been identified in the Project area.

The absence of stygofauna records from outside of calcrete geology in the Project area would suggest that stygofauna habitat, and therefore stygofauna are generally absent, or present in low abundance. However, it is unknown what sampling intensity has previously been undertaken and it may be due to a paucity of sampling. The groundwater within the BGP is almost saline to hypersaline ranging in salinity from 17,900 mg/L TDS up to 155,000 mg/L in the Vanguard pit, further reducing the likelihood that stygofauna are present within local aquifers. Whilst stygofauna have occasionally been recorded in hypersaline groundwater, this has mostly been associated with aquifers at the edges of salt lakes and the majority of hypersaline waters have not been found to contain stygofauna. Core photos examined for the saturated zone confirm the general absence of suitable fracturing that provides interconnected void space in the rock strata that may provide habitat for stygofauna.

Whilst overlaying colluvium, known as the Mesovoid Shallow Substratum is virtually unsampled, it is increasingly known worldwide to contain troglobiont communities. The colluvium across the BGP however, is dominated by sand and soil which makes the likelihood low that it will contain troglofaunal in this area. Additionally, core photos examined for the unsaturated zone confirm the absence of suitable fracturing that provides interconnected void space in the rock strata that may provide habitat for troglofaunal.

2.10 Heritage and Social Setting

2.10.1 Aboriginal Heritage

The BGP tenements are located within an area of high cultural heritage significance. BGL has recently signed a Native Title Agreement (NTA) with Tjiwarl (Aboriginal Corporation) RNTBC (Tjiwarl AC) as the holder on trust for the Tjiwarl Native Title Holders, being the native title rights and interests holders and traditional owners of the land which hosts the BGP. The NTA ensures that important cultural and heritage considerations have been included in the surface design and layout of the Project, protecting sensitive areas and developing a co-designed Cultural Heritage Management Plan (CHMP) to manage future activities.

The Project area been extensively and thoroughly surveyed for Aboriginal ethnographical and archaeological sites with known sites shown in **Table 2-4**.

Table 2-4: AHIS Registered Aboriginal Sites

Tenement	Site ID	Legacy ID	Site Name	Site Type
M36/24	459	W02261	Sir Samuel Camp	Ceremonial, Camp
	38870	-	Wati Kutjarra Old Lore Ground	Ceremonial
	460	W02262	Mother's Camp	Historical
	22277	-	Violet Range 2	Mythological, Natural Feature.
M36/25	464	W02266	Katatjuna	Ceremonial, Mythological
	819	W02164	Mitan	Ceremonial, Mythological, Water Source
	823	W02168	Ngunan	Artefact/Scatter, Ceremonial, Man-Made Structure, Mythological
	1200	W01966	Lake Miranda North	Artefacts/Sactter, Quarry
	1295	W01896	Matintjiti	Artefacts/Scatter, Ceremonial, Mythological
	1376	W01818	Yakabindie S./Pilkari Kutji	Mythological
	1377	Wo1819	Yakabindie S.E./Yulkapa	Mythological
M36/25 and M36/24	22183	-	Vanguard South Scatter 1	Artefacts/Scatter, Other:Grindstone
	1301	W01902	Lake Miranda (Katawili)	Ceremonial, Mythological, Plant Resource
	1304	W01905	Ingkatala	Artefacts/Scatter, Ceremonial, Man-Made Structure, Repository/Cache, Skeletal Material/Burial, Camp.
M36/24, M36/25 and M36/299	2698	W0509	Yakamunti A-B	Mythological
	38870	-	Wati Kutjarra Old Lore Ground	Ceremonial

As a result of consultation with the Aboriginal Consultation Group and additional heritage survey work, heritage sites' locations and cultural values within the Project area are well understood. This has enabled Bellevue to design the Project footprint to avoid all known Aboriginal heritage sites.

2.10.2 Non-Aboriginal Heritage

The historic and abandoned Sir Samuel township is located adjacent to the Project. Gold was discovered in the area in 1895, and the town became an important mining centre from 1897 to 1910, with a State Battery established to treat gold-bearing ore. Infrastructure associated with the Sir Samuel State Battery remains within the Project tenements.

A search of the State Heritage database identified no heritage sites are registered in the Project area. A Crown Reserve covers the area of the historic Sir Samuel State Battery (DPLH, 2020).

2.10.3 Pastoral Lease

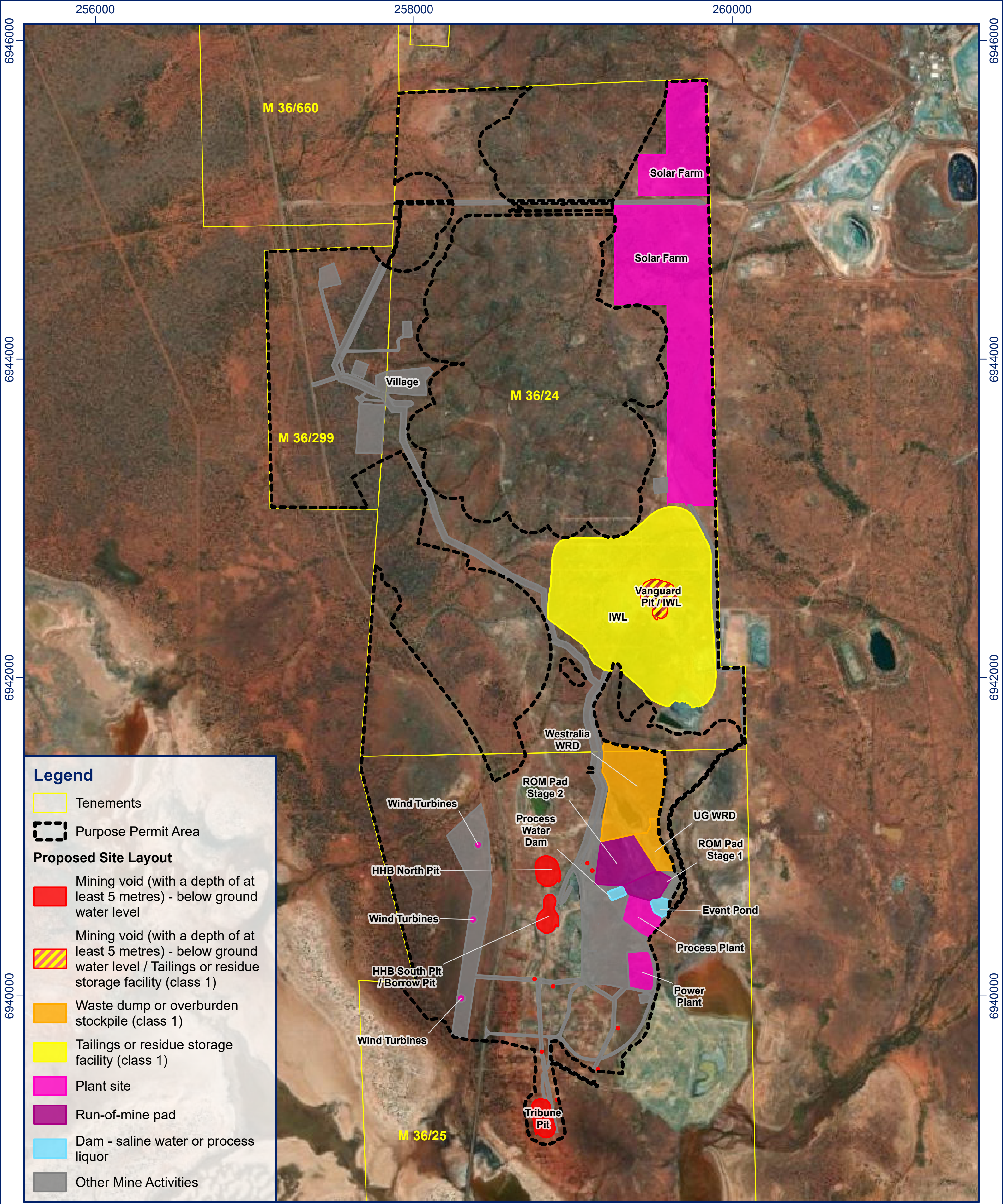
The tenements are within Yakabindie Pastoral Station, which continues to operate and currently runs 1,200 head of cattle. Pastoral infrastructure, such as fences and vehicle tracks, is found throughout the tenements. The Yakabindie homestead is approximately 10 km from the proposed Project, and no noise, dust or light pollution issues are expected.

3. Proposed Land Clearing

The total clearing of native vegetation proposed under this Purpose Permit application is 279.1 ha within a Purpose Permit boundary of 850 ha. The NVCP supports the recommencement of mining at BGP with mine activity areas and associated footprint outlined in **Table 3-1** and shown in **Figure 3-1**.

Table 3-1: Vegetation Disturbance Estimate

Element	Project Footprint (ha)
Event Pond	1.1
HHB North Pit	2.4
HHB South Pit/ Borrow Pit	2.2
Integrated Waste Landform (IWL)	90.7
Other Mine Activities	89.9
Power Plant	3.7
Process Plant	4.2
Process Water Dam	0.7
ROM Pad Stage 1	3.3
ROM Pad Stage 2	8.8
Solar Farm Option 2	95.9
Spray Field	4.9
Tribune Pit	2.7
Underground Waste Rock Dump	3.8
Vanguard Pit / IWL	3.9
Vent Shafts	0.3
Westralia Waste Rock Dump	19.8
Wind Turbines	0.6
Total	**338.9**



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PROJECT			CLIENT
Golden Spur - ESG - Bellevue - Secondary Approvals			BELLEVUE GOLD
Site Layout			
Figure 3-1	ADV-AU-00288	October 2022	

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4. Assessment of Clearing Principles

Clearing applications are assessed against 10 principles as outlined in Schedule 5 of the EP Act. These principles aim to ensure that all potential impacts resulting from the removal of native vegetation can be assessed in an integrated way and applied to all lands throughout Western Australia. The principles address the four main environmental areas of biodiversity significance, land degradation, conservation estate and ground and surface water quality.

Information regarding the potential impact of clearing for mining activities on each of these principles for the project area is provided in **Table 4-1**.

Table 4-1: Native Vegetation Clearing Principles

Clearing Principle	Assessment	Assessed Outcome
Biodiversity Significance		
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	The vegetation to be cleared is not considered to support a high level of biological diversity. Vegetation communities and fauna habitats of the Project are considered common and widespread in the subregion and unlikely to function as refugia. Two restricted VSAs have been identified in the Project area. ▪ Lake Miranda: covers 239 ha of the survey area, with 0.0 ha (0%) proposed to be cleared as part of the Proposed Project and; ▪ Samphire marsh: covers 7.2% of the proposed site layout. A total of 1.3 ha (1.0% of the regional distribution) is proposed to be cleared.	The proposed clearing is unlikely to significantly impact biodiversity at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
b) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Six fauna habitats were identified in the survey area. These were considered to be common and widespread in the local area and extend well beyond the clearing boundary. Conservation significant fauna – eight fauna species of conservation significance listed under legislation or as Priority species by DBCA were considered residents, regular visitors or were observed during the survey: ▪ Common Greenshank (Migratory) – habitat not impacted. ▪ Common Sandpiper (Migratory) - habitat not impacted. ▪ Wood Sandpiper (Migratory) - habitat not impacted. ▪ Sharp-tailed Sandpiper (Migratory)- habitat not impacted. ▪ Red-necked Stint (Migratory) - habitat not impacted. ▪ Fork-tailed Swift (Migratory) – Aerial species unlikely to be impacted. ▪ Long-tailed Dunnart (Priority 4)– Mobile species with widespread distribution and habitat from the Pilbara to the Goldfields. Clearing is unlikely to impact this species significantly. ▪ Central Long-eared Bat (Locally Significant; Priority 3) – Favoured roost sites are typically tree hollows, beneath bark amongst foliage,	The proposed clearing is unlikely to significantly impact the habitat of fauna at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.

Clearing Principle	Assessment	Assessed Outcome
	within riparian habitats. These habitats are widely distributed across Western Australia and South Australia. This species is unlikely to be impacted.	
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No threatened plant taxa protected under state or federal legislation were recorded during flora surveys. Three Priority species listed by DBCA: ▪ *Grevillea inconspicua* (P4): The maximum percentage impact has been calculated as 9.2% of the surveyed populations. Site infrastructure will be located to avoid this species wherever possible. ▪ *Goodenia lyrata* (P3): The maximum percentage impact to has been calculated as 0.3% of the recorded population. ▪ *Hibiscus* sp. Perrinvale Station (P3): There is only one other record in Florabase. This individual was identified in the borefield and can be avoided so that there will be no impact on this species. ▪ One taxon of 'other' conservation significance, *Eriachne aristidea*, was recorded at two locations. The proposed clearing will not affect the locations where this species was recorded.	The proposed clearing is unlikely to significantly impact conservation significant flora at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
d) Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of a TEC.	▪ No TECs were recorded in the Project area. ▪ One PEC, the Violet Range (Perseverance Greenstone) Banded Iron Formation P1 PEC was recorded. ▪ 336.4 ha of the Violet Range (Perseverance Greenstone) Banded Iron Formation P1 PEC will be cleared, representing 2% of the total PEC. ▪ The clearing is not considered a threat to the PEC due to the small percentage impact.	The proposed clearing will not impact TECs, therefore, the proposed clearing is not likely to be at variance with this clearing 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.	Vegetation of the area is not considered a remnant, with limited clearing in a vastly uncleared environment.	The proposed clearing is unlikely to significantly impact remnant vegetation at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing 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.	There are no wetlands or permanent surface water features in the Project area. All drainage lines in the immediate vicinity of the Project are ephemeral and remain dry for most of the year. No vegetation groups were classed as riparian in the clearing area.	The proposed clearing is unlikely to significantly impact watercourses or wetlands at a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle
Land Degradation		
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The proposed clearing of 279.1 ha for the development of the BGP is not likely to cause appreciable further land degradation within the local or regional area. The area utilised for the BGP has a long disturbance history, from historic	The proposed clearing is unlikely to significantly impact land degradation at a local or regional level. Therefore, the proposed clearing is not likely

Clearing Principle	Assessment	Assessed Outcome
	mining and pastoral activities across the region (RPS, 2020). Consequently, most, if not all, of the landforms within the project area can be considered disturbed to various levels of impact. Even areas recorded for the current assessment as Very Good in condition showed signs of human impact. As a result, further disturbances due to planned mining activities are unlikely to cause significant further land degradation and will be implemented with an approved Mining Proposal which will include management measures for erosion, weeds and disease, and rehabilitation (RPS, 2020). Existing areas of disturbance will be utilised where possible, and in areas where clearing is necessary, surface water management measures will be employed (RPS, 2021; **Appendix C**).	to be at variance with this clearing principle.
Conservation Estate		
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.	There is no conservation estate in the immediate vicinity.	The proposed clearing will not impact the environmental values of any adjacent or nearby conservation area. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
Ground and Surface Water Quality		
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	There are only ephemeral watercourses or drainages in the project area. Standard surface management measures will be implemented within the BGP to surface water flows and quality (**Appendix C**). Clearing will not be interacting with groundwater. No GDEs are identified within the immediate project area. The disturbance area is not within a Public Drinking Water Source Area.	The proposed clearing is unlikely to significantly impact the quality of surface or underground water on a local or regional level. Therefore, the proposed clearing is not likely to be at variance with this clearing principle.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	The areas proposed for clearing have relatively flat topographic contours. Sporadic and low rainfall, which is characteristic of the local area, and the generally high soil permeability characteristics, indicated that it is unlikely that clearing will exacerbate or cause a significant incidence of flooding. Measures will be taken to prevent the potential impacts of flooding and surface water pooling. Flood protection bunds are to be established to protect the mining areas and associated infrastructure from localised flooding or water pooling impacts. Additionally, management measures will retain natural surface water flows in these areas.	The proposed clearing is unlikely to cause, or exacerbate, the incidence of flooding. Therefore, the proposed clearing is not likely to be at variance with this clearing principle

5. Environmental Management Measures

Environmental management commitments that will be undertaken during and after the completion of the project are summarised in **Table 5-1**.

Table 5-1: Environmental Management Measures

Environmental Aspect	Commitment Number	Commitment
Clearing and Topsoil Disturbance	Commitment 1	Activities undertaken in a manner that minimizes vegetation clearing and ground disturbance.
	Commitment 2	Clearing areas will be clearing pegged and/or flagged to delineate in the field
	Commitment 3	Vehicles and other equipment will always remain on the designed access routes
	Commitment 4	Vegetation will be cleared and stockpiled for use in rehabilitation.
	Commitment 5	Topsoil will be removed (15-30 cm) and stored in windrows to a maximum.
Surface Water	Commitment 6	Dewatering pipeline – In order to contain any leaks and avoid impacts to vegetation, this pipeline will be constructed in a V-drain with catch-pits installed at low points.
	Commitment 7	A certified engineer will design the embankment in accordance with Australia and New Zealand Committee on Large Dams (ANCOLD) standards
	Commitment 8	A certified engineer will prepare a construction report to verify that the embankment has been constructed according to the design.
	Commitment 9	A geotextile liner will be installed between the mine waste and a low-permeability interface to mitigate piping within the embankment.
	Commitment 10	Embankment piezometers will be installed to monitor the phreatic surface.
	Commitment 11	Embankments will be visually inspected in accordance with the Operating Strategy prepared by the design engineer.
Groundwater	Commitment 12	Two monitoring bores will be installed downstream of the Water Storage Dam to detect any seepage impacts.
Flora	Commitment 13	There are no Threatened flora located close to the clearing.
	Commitment 14	All vehicles and other equipment arriving on site will be inspected and be free of weeds, seeds and soil.
	Commitment 15	In the event that weeds are identified within the Project area and weed control deemed necessary, Bellevue will contact the appropriate department to discuss the appropriate protocols and approval process to conduct weed control on conservation estate.
	Commitment 16	Rehabilitation will be completed in compliance with an approved Mine Closure Plan for the site.
Fauna	Commitment 17	Vehicles will travel at speeds no greater than 40 km/hr within the tenement areas to protect fauna reduce dust and noise.
	Commitment 18	Fauna ladders will be installed on every edge of the dam to facilitate fauna egress and prevent drownings.
	Commitment 19	The dam will be fenced to prevent large fauna ingress and drowning.
Hydrocarbons	Commitment 20	Hydrocarbons or other chemicals will not be stored within 100 m of a drainage line.

Environmental Aspect	Commitment Number	Commitment
	Commitment 21	Spill response kits will be available in all vehicles and the diesel tanker trailer. The spill response kits will be of appropriate type and size, and stock levels will be maintained.
	Commitment 22	All onsite personnel will be trained in spill response.
	Commitment 23	All vehicles and other equipment will be regularly maintained to minimize the chance of leaks and breakdown related spills.
	Commitment 24	Liners and drip trays will be placed under tank filler points on equipment vehicles during on-site refueling to contain potential overfill, tank blowback and minor spills.
	Commitment 25	Liners and drip trays will be used under drill rigs to contain any leaks.
	Commitment 26	Hydrocarbon and chemical waste will be transported offsite for disposal to an approved waste facility.
	Commitment 27	Any contaminated material (e.g. hydrocarbon contaminated soil) will be removed and disposed of at licensed facilities.
	Commitment 28	As required, any spills defined under Section 72 of the *Environmental Protection Act 1986* and *Environmental Protection (Unauthorised Discharges) Regulations 2004* will be reported to DBCA, DWER and DMIRS.
Fire	Commitment 29	During the induction process, all personnel working in the area will be made aware of the risk of bushfires and the precautions necessary to minimize this hazard, including knowledge of escape routes and.
	Commitment 30	All personnel will be trained to use available firefighting equipment and advised on the plan of action in case of a fire.
	Commitment 31	No hot works will be undertaken on Total Fire Ban days as declared by the Department of Fire and Emergency Services (DFES).
Compliance with Legislation	Commitment 32	All required environmental approvals will be in place prior to clearing.

6. Rehabilitation

Rehabilitation is the return of disturbed land to a safe, stable, productive, non-polluting and self-sustaining condition in consideration of beneficial uses of the land. Appropriate rehabilitation will ensure that the long-term impacts of mining in the area are minimised.

Rehabilitation of disturbed areas will generally involve:

- Design of landforms to produce safe and stable slopes.
- Design of landforms to manage water, including construction of water management strategies.
- If required and subject to available material, armouring of final surfaces with cover material to increase surface stability.
- Replacement of available topsoil and vegetation.
- Ripping to break soil compaction and increase water infiltration ability.
- Seeding/planting and fertilising as required.

Rehabilitation, closure monitoring and maintenance programs will be initiated with the objective of ensuring the success of rehabilitation works, demonstrating achievement of completion criteria, and identifying the need for maintenance works as described in the Mine Closure Plan.

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Appendix A.
Flora and Vegetation Survey

DETAILED FLORA AND VEGETATION ASSESSMENT

Bellevue Gold Project

EEN18041.004
Detailed flora and vegetation assessment
Rev 0
12 March 2020

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
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Appendices

SUMMARY

Bellevue Gold Ltd (Bellevue Gold) is currently undertaking an exploration drilling program within mining tenement M3625 for the Bellevue Gold Project (the project). The project is located in the north-eastern Goldfields; approximately 40 kilometres (km) north of the township of Leinster in the Shire of Leonora. The project is situated on and surrounded by pastoral lands and is located on Yakabindie cattle station.

RPS Australia West Pty Ltd (RPS) was commissioned by Bellevue Gold to undertake a detailed flora and vegetation assessment over mining tenements M3625, M3624 and portions of M36/299, M36/535, M36/176, M36/162 and M36/660 (hereafter referred to as 'the survey area'). The survey area is 2,258.26 hectares (ha) in size and encompasses the area where exploration drilling is currently underway and the proposed mining and associated infrastructure footprint.

The results of this detailed flora and vegetation survey assessment may be used to support a Mining Proposal and / or this report is fit for purpose for referral to the Environmental Protection Authority (EPA) under Section 38 the *Environment Protection Act 1986* (EP Act).

Survey objectives and scope of works

The objectives of this detailed flora and vegetation survey were to:

- Identify and characterise the flora and vegetation within the survey area, via provision of a comprehensive flora inventory and vegetation unit and condition mapping.
- Identify the presence and extent of conservation significant flora and ecological communities that are currently listed under the State *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) within the survey area.
- Describe the flora and vegetation values present or likely to be present within the survey area that may be directly or indirectly impacted by the project, including an analysis of the significance of flora and vegetation in local, regional and state contexts.
- Map the location and extent of conservation significant flora and vegetation within the survey area.

The scopes of work undertaken for the flora and vegetation assessment included:

1. A detailed flora and vegetation survey of the intact remnant native vegetation within the survey area
2. A reconnaissance flora and vegetation survey of the remainder of the survey area (disturbed and degraded areas
3. Targeted Threatened and Priority Flora searches of known or potentially suitable habitat for each of the target species within the survey area at the appropriate time (the documented peak flowering time).

The detailed flora and vegetation assessment was undertaken over five field mobilisations (in August 2018, October 2018, April 2019, August 2019 and October 2019) (Table 1). The survey involved sampling the full range of vegetation communities and flora within the survey area. A total of 92 floristic quadrats (20 metre (m) x 20 m) and 20 relevés were sampled. All of the quadrats were sampled twice in accordance with Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

Detailed flora and vegetation survey findings

Flora

A total of 345 vascular flora taxa were recorded for the current survey of which 336 (97.4%) are native, and nine (2.6%) are naturalised alien (weed) species. The taxa recorded represent 48 families and 128 genera.

No Threatened Flora (TF) species listed under the BC Act or the EPBC Act were recorded within the survey area.

Three Priority Flora (PF) species listed by the Department of Biodiversity Conservation and Attractions were recorded within the survey area: *Grevillea inconspicua* (Priority 4); *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (Priority 3); and *Goodenia lyrata* (Priority 3).

One taxon of ‘other’ conservation significance, *Eriachne aristidea,* is considered to be conservation significant based on a geographic range anomaly with this record representing a range extension to the south of its known range.

Nine naturalised alien (weed) species were recorded for the survey area, representing 2.6% of the total flora taxa recorded. These weed species were recorded at low densities throughout most of the more disturbed portions of the survey area, however buffel grass (*Cenchrus ciliaris*) was significantly denser along the verges adjacent to roads and tracks, particularly within the Mulga sand plain vegetation represented by vegetation units S02 and S03. Ruby dock was present in greater densities on the banks of the waste rock dumps and around the open pits in the areas mapped as C/M (Cleared/Modified).

Vegetation

A total of 19 vegetation units were described and mapped for the survey area which covered the full toposequence of vegetation types from hillcrests and slopes, to pediments, plains, drainage lines and salt lake margins throughout the survey area.

The vegetation units were defined from 92 floristic quadrats and 20 relevés which occurred across 13 physiographic units. Vegetation unit mapping was conducted using a combination of aerial photo-interpretation, on-ground confirmation, vegetation structure data, and multivariate analysis of the floristic quadrat data. The hierarchical cluster analysis of the quadrat data determined there to be 20 statistically significant groups of sites based on their floristics, with 17 of the groups defining a unique vegetation unit and two groups further delineated into two vegetation units each based on topography and substrate, because although similar floristically, they differed in structure and occupied different positions in the landscape.

The metabasalt stony hill vegetation within the survey area has the greatest affinity with regional vegetation Community Groups 1 and 4, as defined by Meissner and Wright (2010).

The vegetation units are listed in the table below.

Table 1: Vegetation units

Veg unit	Description
Salt lake margins	
L01	*Tecticornia* spp. Open to Closed Low Samphire Shrubland on salt lake margins
L02	*Tecticornia* spp. Open to Sparse Low Samphire Shrubland over *Eragrostis falcata, E. pergracilis* Sparse Tussock Grassland on lower slopes of gypsum dunes adjacent to salt lake
Gypsum dunes	
G01	*Cratystylis subspinescens* Mid Sparse Shrubland over *Maireana pyramidata* and *Tecticornia* sp. Low Sparse Chenopod Shrubland over mixed Sparse Tussock Grassland / Forbland on low stony rises adjacent to Samphire shrublands
G02	*Eucalyptus striaticalyx* and/or *Casuarina pauper* Isolated Clumps of Trees over *Grevillea sarissa* subsp. *bicolor* Tall Sparse Shrubland over *Scaevola spinescens, Lycium australe* and *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and/or *Eragrostis falcata* Sparse Tussock Grassland and *Frankenia* sp. Forbland on gypsum (kopi) dunes adjacent to salt lake
Stony plains and lower hill slopes	
H01	Mulga spp. Isolated Trees to Low Open Woodland over *Acacia tetragonophylla, Eremophila galeata* and *Hakea preissii* Tall Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopod Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland on stony plains and lower hill slopes
H02	Mulga spp. and *Acacia doreta* (long phyllode form) Low Open Woodland to Low Isolated Trees over *Senna* sp. Meekatharra Mid Sparse to Open Shrubland on stony plains and lower hill slopes
Stony hill slopes, spurs and crests	
H03	*Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens, Enneapogon polyphyllus* and *Aristida contorta* Sparse Tussock Grassland
H04	*Eremophila galeata, E. forrestii* subsp. *forrestii, E. exilifolia* and *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Aristida contorta* Open Tussock Grassland on stony hill slopes, spurs and crests

Veg unit	Description
H05	*Acacia fuscaneura* Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Eremophila exilifolia* and *E. forrestii* subsp*. forrestii* Mid Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
H06	Mulga spp. and *Acacia doreta* (long phyllode form) Low Open Woodland with Isolated *Eremophila oldfieldii* subsp. *angustifolia* over *A. xanthocarpa* Tall Isolated Shrubs over *Eremophila exilifolia, E. forrestii* subsp. *forrestii* and *Senna artemisioides* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and *Maireana* spp. Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
H07	*Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse to Open Shrubland over *Senna* sp. Meekatharra and *S. artemisioide*s subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Shrubland on stony hillslopes, spurs and crests
Drainage lines on stony hills	
H08	Mulga spp. Low Open Woodland over *Senna* spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens* and *Cymbopogon ambiguus* Sparse Tussock Grassland
H09	Mulga spp. Low Open to Closed Forest over *Acacia xanthocarpa* Tall Sparse to Open Shrubland over *Eremophila exilifolia* and *Senna* spp. Mid to Low Open Shrubland over *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hill slopes
Drainage lines on stony hardpan plains	
P01	Mulga spp. Low Woodland to Low Open Forest over *Eremophila galeata, E. serrulata* and *Senna* spp. Mid Sparse to open Shrubland over *Cymbopogon obtectus* and *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hardpan plains
Stony hardpan plains	
P02	Mulga spp. Low Open Woodland to Isolated Trees over *Eremophila pantonii* and *E. galeata* Tall Open to Sparse Shrubland over *Senna* sp. Meekatharra Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopods Low Open to Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland in drainage lines on stony hardpan plains
P03	*Eremophila* spp. Tall Open Shrubland over Senna spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland over *Aristida contorta* Sparse Tussock Grassland
Red sand dunes	
S01	Mixed Isolated Trees and Shrubs including *Santalum lanceolatum, Rhagodia drummondii, Scaevola spinescens* and *Alyogyne pinoniana* over *Aristida holathera* var. *holathera* Open Tussock Grassland on red sand dune crests and slopes
Sand flats and low sandy rises	
S02	Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over a mixed Open Tussock Grassland on sand plains and low undulating sand hills and sandy rises
Flat sandplains over hardpan	
S03	Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda, Monachather paradoxus* and *Eriachne helmsii* Tussock Grassland on sand over hardpan plains

Vegetation condition within the survey area ranged from Very Good throughout much of the intact vegetation (on the stony hills, sandy rises and undulating plains and hardpan flats, drainage lines and on the gypsum dunes and samphire flats adjacent to Lake Miranda), to Completely Degraded on areas of the stony hills and plains subject to historical mining activities including the old tailings storage facility, open pits, waste rock dumps, access roads and exploration camp. Much of the survey area has been subjected to some level of clearing or disturbance at some stage in its mining history, and extant vegetation comprises a range of revegetation ages. There is not much of the survey area which has not been impacted by mining-related activities or modified to some degree over the past century. It is likely that much of the hill crest and slope vegetation has undergone selective felling and clearing of tree species including mulga and eucalypts as a source of timber for construction of buildings and other structures associated with prospecting and mining.

Conservation significance

The conservation significant values identified within the survey area include:

- Five populations of *Grevillea inconspicua* (Priority 4); and one record each of *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (Priority 3) and *Goodenia lyrata* (Priority 3). PF species are not protected under State or Commonwealth legislation
- One species of 'other' conservation significance, *Eriachne aristidea*, which represents a range anomaly
- State-listed Priority 1 Priority Ecological Community (PEC), Violet Range (Perseverance Greenstone) Banded Iron Formation ecological community. The PEC occupies a total of 19,256.21 ha across its mapped extent including its 500 m buffer. Approximately 1,443.69 ha of the PEC's total extent occurs within the survey area which represents 7.5% of the total area of this PEC throughout the region.

Within the survey area, there were no records of:

- TF species listed under the BC Act or the EPBC Act
- Putative new taxa
- Commonwealth-listed or state-listed TECs.

1 INTRODUCTION

1.1 Project background

Bellevue Gold Ltd (Bellevue Gold) is currently undertaking an exploration drilling program within mining tenement M3625 for the Bellevue Gold project (the project). The project is located in the north-eastern Goldfields, approximately 40 kilometres (km) north of the township of Leinster in the Shire of Leonora. The project is situated on and surrounded by pastoral lands and is located on Yakabindie cattle station.

RPS Australia West Pty Ltd (RPS) was commissioned by Bellevue Gold to undertake a detailed flora and vegetation survey over mining tenements M3625, M3624 and portions of M36/299, M36/535, M36/176, M36/162 and M36/660 (hereafter referred to as 'the survey area'). The survey area is 2,255.06 hectares (ha) in size and encompasses the area where exploration drilling is currently underway and the proposed mining and associated infrastructure footprint. The survey area is shown in Figure A.

The results of this detailed flora and vegetation assessment may be used to support a Mining Proposal and / or referral to the Environmental Protection Authority (EPA) under Section 38 the *Environment Protection Act 1986* (EP Act).

1.2 Survey objectives

The objectives of this detailed flora and vegetation survey were to:

- Identify and characterise the flora and vegetation within the survey area, via provision of a comprehensive flora inventory and vegetation unit and condition mapping.
- Identify the presence and extent of conservation significant flora and ecological communities that are currently listed under the state *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) within the survey area.
- Describe the flora and vegetation values present or likely to be present within the survey area that may be directly or indirectly impacted by the project, including an analysis of the significance of flora and vegetation in local, regional and state contexts.
- Map the location and extent of conservation significant flora and vegetation within the survey area.

1.3 Scope of works

The scopes of work undertaken for the flora and vegetation assessment included:

1. A detailed flora and vegetation survey of the intact remnant native vegetation within the survey area
2. A reconnaissance flora and vegetation survey of the remainder of the survey area (disturbed and degraded areas)
3. Targeted Threatened and Priority Flora searches of known or potentially suitable habitat for each of the target species within the survey area at the appropriate time (the documented peak flowering time).

1.3.1 Detailed flora and vegetation survey

The detailed flora and vegetation assessment was undertaken over five field mobilisations (in August 2018, October 2018, April 2019, August 2019 and October 2019) (Table 1). The survey involved sampling the full range of vegetation communities and flora within the survey area. A total of 92 floristic quadrats (20 metre (m) x 20 m) and 20 relevés were sampled. All of the quadrats were sampled twice in accordance with Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) guidance. The locations of the floristic quadrats are shown in Figure B.

The floristic sites and the month in which they were established, sampled and revisited are presented in Table 2.

Table 2: Floristic sites (92 quadrats and 20 relevés) within the survey area and when they were sampled

Floristic site	Site type	Primary survey	Supplementary survey
BGQ01	Quadrat	Aug-18	Oct-18
BGQ02	Quadrat	Aug-18	Oct-18
BGQ03	Quadrat	Aug-18	Oct-18
BGQ04	Quadrat	Aug-18	Oct-18
BGQ05	Quadrat	Aug-18	Apr-19
BGQ06	Quadrat	Aug-18	Apr-19
BGQ07	Quadrat	Aug-18	Oct-18
BGQ08	Quadrat	Aug-18	Apr-19
BGQ09	Quadrat	Aug-18	Oct-18
BGQ10	Quadrat	Aug-18	Apr-19
BGQ11	Quadrat	Aug-18	Oct-18
BGQ12	Quadrat	Aug-18	Oct-18
BGQ13	Quadrat	Aug-18	Apr-19
BGQ14	Quadrat	Aug-18	Apr-19
BGQ15	Quadrat	Aug-18	Oct-18
BGQ16	Quadrat	Aug-18	Oct-18
BGQ17	Quadrat	Aug-18	Oct-18
BGQ18	Quadrat	Aug-18	Oct-18
BGQ19	Quadrat	Aug-18	Oct-18
BGQ20	Quadrat	Aug-18	Oct-18
BGQ21	Quadrat	Aug-18	Apr-19
BGQ22	Quadrat	Aug-18	Apr-19
BGQ23	Quadrat	Aug-18	Apr-19
BGQ24	Quadrat	Aug-18	Apr-19
BGQ25	Quadrat	Aug-18	Apr-19
BGQ26	Quadrat	Aug-18	Oct-18
BGQ27	Quadrat	Aug-18	Apr-19
BGQ28	Quadrat	Aug-18	Apr-19
BGQ29	Quadrat	Aug-18	Apr-19
BGQ30	Quadrat	Aug-18	Oct-18
BGQ31	Quadrat	Aug-18	Oct-18
BGQ32	Quadrat	Aug-18	Oct-18
BGQ33	Quadrat	Aug-18	Oct-18
BGQ34	Quadrat	Aug-18	Oct-18
BGQ35	Quadrat	Aug-18	Apr-19
BGQ36	Quadrat	Aug-18	Apr-19
BGQ37	Quadrat	Aug-18	Apr-19
BGQ38	Quadrat	Oct-18	Apr-19
BGQ39	Quadrat	Oct-18	Apr-19
BGQ40	Quadrat	Oct-18	Apr-19
BGQ41	Quadrat	Oct-18	Apr-19
BGQ42	Quadrat	Oct-18	Apr-19
BGQ43	Quadrat	Oct-18	Apr-19
BGQ44	Quadrat	Oct-18	Apr-19
BGQ45	Quadrat	Oct-18	Apr-19
BGQ46	Quadrat	Oct-18	Apr-19
BGQ47	Quadrat	Oct-18	Apr-19
BGQ48	Quadrat	Oct-18	Apr-19
BGQ49	Quadrat	Oct-18	Apr-19
BGQ50	Quadrat	Oct-18	Apr-19
BGQ51	Quadrat	Oct-18	Apr-19
BGRCG01	Relevé	Aug-18	Revisit not required
BGRCG02	Relevé	Aug-18	Revisit not required
BGRCG03	Relevé	Aug-18	Revisit not required
BGRCG04	Relevé	Aug-18	Revisit not required

Floristic site	Site type	Primary survey	Supplementary survey
BGRCG05	Relevé	Oct-18	Revisit not required
BGRCG06	Relevé	Oct-18	Revisit not required
BGRCG07	Relevé	Oct-18	Revisit not required
BGRCG08	Relevé	Oct-18	Revisit not required
BGRCG09	Relevé	Oct-18	Revisit not required
BGRCG10	Relevé	Oct-18	Revisit not required
BGRKM01	Relevé	Aug-18	Revisit not required
BGRKM02	Relevé	Aug-18	Revisit not required
BGRKM03	Relevé	Aug-18	Revisit not required
BGRKM04	Relevé	Aug-18	Revisit not required
BGRKM05	Relevé	Aug-18	Revisit not required
BGRKM06	Relevé	Aug-18	Revisit not required
BGRKM07	Relevé	Aug-18	Revisit not required
BGRJH01	Relevé	Apr-19	Revisit not required
KVQ01	Quadrat	Aug-19	Oct-19
KVQ02	Quadrat	Aug-19	Oct-19
KVQ03	Quadrat	Aug-19	Oct-19
KVQ04	Quadrat	Aug-19	Oct-19
KVQ05	Quadrat	Aug-19	Oct-19
KVQ06	Quadrat	Aug-19	Oct-19
KVQ07	Quadrat	Aug-19	Oct-19
KVQ08	Quadrat	Aug-19	Oct-19
KVQ09	Quadrat	Aug-19	Oct-19
KVQ10	Quadrat	Aug-19	Oct-19
KVQ11	Quadrat	Aug-19	Oct-19
KVQ12	Quadrat	Aug-19	Oct-19
KVQ13	Quadrat	Aug-19	Oct-19
KVQ14	Quadrat	Aug-19	Oct-19
KVQ15	Quadrat	Aug-19	Oct-19
KVQ16	Quadrat	Aug-19	Oct-19
KVQ17	Quadrat	Aug-19	Oct-19
KVQ18	Quadrat	Aug-19	Oct-19
KVQ19	Quadrat	Aug-19	Oct-19
KVQ20	Quadrat	Aug-19	Oct-19
KVQ21	Quadrat	Aug-19	Oct-19
KVQ22	Quadrat	Aug-19	Oct-19
KVQ23	Quadrat	Aug-19	Oct-19
KVQ24	Quadrat	Aug-19	Oct-19
KVQ25	Quadrat	Aug-19	Oct-19
KVQ26	Quadrat	Aug-19	Oct-19
KVQ27	Quadrat	Aug-19	Oct-19
KVQ28	Quadrat	Aug-19	Oct-19
KVQ29	Quadrat	Aug-19	Oct-19
KVQ30	Quadrat	Aug-19	Oct-19
KVQ31	Quadrat	Aug-19	Oct-19
KVQ32	Quadrat	Aug-19	Oct-19
KVQ33	Quadrat	Aug-19	Oct-19
KVQ34	Quadrat	Aug-19	Oct-19
KVQ35	Quadrat	Aug-19	Oct-19
KVQ36	Quadrat	Aug-19	Oct-19
KVQ37	Quadrat	Aug-19	Oct-19
KVQ38	Quadrat	Aug-19	Oct-19
KVQ39	Quadrat	Aug-19	Oct-19
KVQ40	Quadrat	Aug-19	Oct-19
KVQ41	Quadrat	Aug-19	Oct-19
KVRCG01	Relevé	Aug-19	Revisit not required
KVRBM01	Relevé	Aug-19	Revisit not required

1.3.2 Targeted Threatened and Priority flora surveys

The targeted surveys involved systematic searches of all potentially suitable habitats for target species within the survey area. Significant flora taxa identified as having a moderate or high likelihood of occurring within the survey area (based on proximity of known records and / or presence of suitable habitat) were the focus of the targeted searches. The targeted searches were undertaken during the documented flowering time of the target species.

1.4 Guiding principles and legislative framework

Commonwealth and state legislation pertaining to the conservation of native flora and vegetation include the EPBC Act, the BC Act and the EP Act.

The EP Act is the primary legislation that governs environmental impact assessment and protection in Western Australia. The aim of the EP Act is “to provide for an Environmental Protection Authority, for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with foregoing”.

Section 4A of the EP Act states that the following principles, applicable to native flora and vegetation should be adhered to in order to protect the environment of Western Australia:

1. The Precautionary Principle – Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
2. The Principle of 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.
3. The Principle of the Conservation of Biological Diversity and Ecological Integrity – Conservation of biological diversity and ecological integrity should be a fundamental consideration.

1.4.1 Conservation significant flora

Within Western Australia, Threatened Flora (TF) are listed as such if they are considered to be in danger of extinction, rare or otherwise in need of special protection. These taxa are legally protected under the BC Act. The removal of these taxa or impact to their surroundings is not permitted without prior ministerial approval. The Department of Biodiversity Conservation and Attractions (DBCA) maintains a list of Priority Flora (PF) species, which may be rare or threatened but for which there are either insufficient survey data to determine accurately their status, or which are rare but not currently considered to be threatened. A PF taxon is assigned to one of five priority categories. TF and PF categories are defined in Appendix A, Table A-1.

Many taxa listed as TF under the BC Act have additional protection as they are also listed as TF under one of six threat categories (Extinct, Extinct in the wild, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the EPBC Act. TF taxa are defined as Matters of National Environmental Significance (MNES) under the EPBC Act and penalties apply for any damage to individuals, populations or habitats of these flora. EPBC Act conservation category codes are defined in Appendix A, Table A-2.

1.4.2 Conservation significant vegetation

Under the BC Act and the EP Act, Threatened Ecological Communities (TECs), classified by DBCA in one of the TEC categories (Appendix A, Table A-3) have limited protection. Other ecological communities are classified by DBCA in the category of Priority Ecological Communities (PECs) (Appendix A, Table A-4) pending further survey and/or definition. A subset of the DBCA-listed TECs are also listed and protected as MNES under the EPBC Act. EPBC Act threat categories for TECs are defined in Appendix A, Table A-5.

2 METHODS

2.1 Desktop assessment

RPS undertook a thorough desktop assessment of flora and vegetation within the survey area. This incorporated a review of:

- Available literature including regional and local studies and spatial datasets
- Results of Commonwealth and state government database searches for flora, fauna and ecological communities listed under the EPBC Act, BC Act and listed by the DBCA.

The methods and results of the desktop assessment were initially documented in Desktop Flora and Fauna Assessment - M3624 and M3625 – Bellevue Gold Project (RPS 2018).

2.1.1 Regional and local biological surveys

The desktop assessment included a review of the following regional and local flora and vegetation survey reports:

- *An Inventory and Condition Survey of the north-eastern Goldfields, Western Australia. Technical Bulletin No. 87*. Department of Agriculture, South Perth, Western Australia (Pringle et al. 1994)
- *Flora and vegetation of banded iron formations of the Yilgarn Craton: Perseverance Greenstone Belt* (Meissner and Wright 2010)
- *Flora and Vegetation Assessment of the Mt Keith Satellite Proposal Study Area October 2017* (Western Botanical 2017)
- *Flora and Vegetation Survey of the Proposed Cosmos Nickel Expansion* (Mattiske Consulting Pty Ltd 2004)
- *Flora and Vegetation Survey of the Cosmos Nickel Project, Including the Prospero Expansion Area* (Mattiske Consulting Pty Ltd 2005)
- *Flora and Vegetation Survey of Proposed Mine Extensions and Access Tracks at the Xstrata Cosmos Nickel Project* (Mattiske Consulting Pty Ltd 2008)
- *Flora and Vegetation Survey of Proposed Evaporation Pond Extensions, Cosmos Nickel Project* (Mattiske Consulting Pty Ltd 2011)
- *Yeelirrie Project Flora and Vegetation Survey Baseline Report* (Western Botanical 2011).

2.1.1 Regional data

The review of publicly available broad-scale vegetation mapping and remnant extent data included:

- Interim biogeographical regionalisation of Australia (IBRA) biological subregions within Australia (Environment Australia 2000)
- Vegetation association mapping (Beard 1979)
- Rangeland land system mapping (Pringle et al. 1994)
- Surface geology mapping.

2.1.2 State and Commonwealth Government databases

Interrogation of the following Commonwealth and state databases was undertaken within a 50 km radius of the survey area:

- Commonwealth Department of Agriculture, Water and the Environment’s Protected Matters database for MNES including
  - Listed TECs

  - Listed TF Species
- Western Australian DBCA Threatened and Priority Flora database, and the Western Australian Herbarium (WAH) Specimen database
- Western Australian DBCA TEC/ PEC database.

From the DBCA database search results, a table of significant species and their conservation codes was compiled. Additionally, a risk matrix and likelihood of occurrence table were produced. Species were scored against the following five criteria in order to rank them according to their likelihood of occurring within the survey area based on such factors as proximity of known records and presence of suitable habitat to arrive at an 'initial likelihood or occurrence'. After the final (Spring 2019) field survey the likelihood of occurrence was revised for each species based on the survey results and presented as the 'residual likelihood of occurrence'. The factors considered in assessing likelihood of occurrence were:

- Known records within the survey area
- Known database records of the species within a 5 km radius of the survey area
- Known records within a 20 km radius of the survey area
- Known occurrence of the species within the local government area
- Potential presence of suitable habitat within the survey area.

Each species risk rank is calculated from the sum of factors that apply to it. The resulting 'likelihood of occurrence' ranks are as follows:

- Known
- High (Likely)
- Moderate (Possible)
- Low (Unlikely)
- Negligible (Suitable habitat not present, or, species not recorded during the field survey).

2.2 Field survey

The five field surveys were led by RPS' Managing Botanist Carrie Gill who was supported by a team of experienced, licensed and qualified botanists in the field (Table 3).

Table 3: Botanical team personnel

Personnel	Title	Role	Flora licence
Carrie Gill	Managing botanist (RPS)	Team lead	SOPP No. SL012170 (2017 – 2018) SOPP No. SL012440 (2018 – 2019) Reg. 62 FB62000151 (2019 – 2024)
Julijanna Hantzis	Graduate botanist (RPS)	Field survey	
Cate Tauss	Consultant botanist	Field survey, taxonomy	
Brian Morgan	Consultant botanist	Field survey	
Kelli McCreery	Consultant botanist	Field survey	

2.2.1 Detailed flora and vegetation survey

The five-visit detailed flora survey was undertaken in accordance with Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

The survey methods and sampling quadrat sizes used were based on the requirements for detailed flora and vegetation surveys in the Murchison bioregion as outlined in EPA (2016).

The field survey aimed to sample the full range of flora and vegetation within the survey area by strategically locating the floristic sites (quadrats and relevés) to cover the full toposequence of floristic communities present; from hillcrests, ridges and hill slopes, to pediments, plains, drainage lines and salt lakes and claypans.

The 92 floristic quadrats and 20 relevés were established and sampled in intact mature vegetation in areas of best condition (i.e. an effort was made to avoid areas obviously disturbed by weeds, grazing or past mining, exploration and clearing). However, it must be noted that most of the survey area, including the crests of the taller stony hills, has been impacted to some degree by a long history of gold prospecting, mining, and exploration as well as long-term grazing by livestock. Floristic sites were also positioned to avoid the transition zones between floristic community types and environmental gradients, such as changes in substrate type, aspect or hydrology.

Survey methodology is also consistent with the regional study undertaken over a much broader survey area in the Perseverance Greenstone Belt by Meissner and Wright (2010) which was conducted in the vicinity of the survey area.

The detailed survey involved:

- Comprehensive quadrat-based flora recording and collection. Bounded 20 m × 20 m quadrats (or quadrats of other dimensions, tailored to characteristics of the vegetation encountered, e.g. narrower transects), were established and sampled in intact, mature vegetation in areas of best condition to provide data for the floristic classification of the vegetation of the survey area. These quadrats were permanently marked with metal pegs to facilitate the supplementary survey
- Collection of information at each quadrat including:
  - Site code
  - Location (GDA94 GPS coordinates)
  - Size, shape and orientation of quadrat
  - Photograph/s from north-west corner
  - Landform and soil description
  - Dominant growth form, height, cover and species for the three traditional strata (upper, mid and ground)
  - Any other location information that might be useful in vegetation classification including slope, aspect, litter, fire history, vegetation/landform/soil correlations
  - Assessment of vegetation and description of disturbances
  - A comprehensive species list (annuals and perennials), including weeds
- Opportunistic collections and relevés or systematic transects to verify that the survey area has been well characterised and important values identified
- Compilation of a comprehensive vascular flora inventory of all flora species recorded within the survey area including weed species
- Vegetation condition mapping using the recommended EPA (2016) scale adapted from Keighery (1994) and Trudgen (1988)
- Floristic classification of the vegetation in the survey area. The conservation value of the communities within the survey area were determined in order to assess the native vegetation values
- Vegetation unit description and mapping using the National Vegetation Information System (NVIS) (ESCAVI 2003). Vegetation types were described to Association (Level V)
- Identification and mapping of areas of ecological importance (e.g. Threatened and Priority Flora, Environmentally Sensitive Areas etc) within the survey area.

2.2.2 Targeted Threatened and Priority flora surveys

Targeted Threatened and Priority flora searches were conducted as part of the detailed survey and aimed to determine the size and extent of all significant flora populations or vegetation in the survey area and to place any impacts into context locally and regionally.

All potentially suitable habitats were systematically searched for target species and communities. Significant flora taxa identified as occurring within or having a moderate or high likelihood of occurring within the survey area (based on proximity of known records and / or presence of suitable habitat) were the target of the searches.

2.3 Data analysis

2.3.1 Taxonomic determinations

Flora specimens were either identified in the field, or collected and identified using the keys, publications and databases of the WAH. Plant specimens were identified in the WAH by consultant taxonomists Sharnya Yates, Frank Obbens and Cate Tauss, and Mike Hislop from the WAH. The samphire identifications were confirmed by Tecticornia specialist Kelly Shepherd at the WAH. Nomenclature was aligned with the current names in FloraBase (WAH 2019).

2.3.2 Vegetation mapping

Vegetation community mapping was conducted using a combination of aerial photo-interpretation, regional and local vegetation mapping, on-ground confirmation, vegetation structure data, and multivariate analysis results. Vegetation types were described to Association (Level V) in accordance with the National Vegetation Information System (NVIS) (ESCAVI 2003) (Appendix A, Table A-6 and Table A-7).

Vegetation condition mapping was conducted using the recommended EPA (2016) scale adapted from Keighery (1994) and Trudgen 1988 (Appendix A, Table A-8).

2.3.3 Multivariate analysis of floristic data

All multivariate data analyses followed the procedures outlined in Clarke and Gorley (2015) and were carried out using the appropriate modules of the PRIMER statistical software package (Plymouth Marine Laboratory-Version 7). Data analyses were conducted using PRIMERv7 modules, including Classification, Similarity Profile Analysis (SIMPROF), and Analysis of Similarity (ANOSIM) (Clarke and Gorley 2015). The analyses aimed to:

1. Compare the floristic composition of the quadrats sampled for the survey area to identify groups of floristically similar sites and therefore define the different floristic communities present.
2. Compare the floristic composition of the quadrats sampled for the current survey to the floristic composition of communities defined by Meissner and Wright (2010) in their regional survey of the Perseverance Greenstone Belt in the Yilgarn Craton which encompasses the survey area.

2.3.3.1 Data preparation

The survey data was reconciled with the Perseverance Greenstone Belt dataset by standardising the names of taxa with those used in the Meissner and Wright (2010) study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded while some infraspecies were reduced to species level. Taxonomic changes made to the survey data for the purpose of these analyses are listed in Table 4. Once the taxonomy had been reconciled the data from the 92 test quadrats was combined with the 50 site Perseverance Greenstone Belt dataset in PRIMERv7.

Table 4: Taxonomic reconciliation undertaken for the current analysis – current nomenclature used in this assessment was aligned (reverted) to the nomenclature used by Meissner and Wright (2010) for the purpose of analysing the combined dataset

Current taxonomy used for this assessment	Meissner and Wright (2010) aligned taxonomy
Acacia aptaneura	*Acacia aneura* var. *tenuis*
Acacia caesaneura	*Acacia aneura* var. *argentea*
Acacia incurvaneura	*Acacia aneura* var. *microcarpa*
Acacia macraneura	*Acacia aneura* var. *macrocarpa*
Acacia fuscaneura	*Acacia aneura* var. *fuliginea*
Acacia ramulosa var. *linophylla*	*Acacia ramulosa*
Acacia xanthocarpa	*Acacia quadrimarginea*
Eremophila forrestii subsp. *forrestii*	*Eremophila forrestii*
Acacia doreta (long phyllode form)	*Acacia grasbyi*
Solanum lasiophyllum	*Solanum cf. lasiophyllum*

In addition to reconciling the taxonomic discrepancies between the test data and regional dataset, annual taxa and singletons (taxa recorded from one quadrat only) were removed from the combined dataset. Removal of annuals and singletons is consistent with treatment of floristic data for other floristic surveys undertaken on banded iron formation (BIF) and greenstone ranges in Western Australia (Meissner and Wright 2010).

2.3.3.2 Classification and similarity profile analysis (SIMPROF)

Floristic quadrat data (presence / absence) derived from the current survey, in the form of a 'species by site' table, were analysed to classify the different floristic communities within the survey area. A resemblance (dissimilarity) matrix of the presence / absence data for the dataset was constructed using the Bray Curtis Similarity Coefficient. A Hierarchical Cluster Analysis was carried out on this matrix using the group average linkage method.

The purpose of classification is to produce a dendrogram that allows patterns (clusters) in the data to be visualised. Dendrograms illustrate the "relatedness" of groups of samples; in this case, based on floristics. A Bray-Curtis similarity matrix of data from the current survey was subjected to hierarchical (group average) assessment to produce a single dendrogram. Further, a "similarity profile" SIMPROF permutation test was carried out at each node of this dendrogram to look for statistically significant clusters in the set of samples (indicated by the black lines on the dendrogram).

After the preliminary analysis of the survey data, the dataset was combined with the regional data from the Meissner and Wright (2010) study and analysed using the same techniques to determine the relationship between the floristic communities present within the survey area and those defined for the regional study.

2.4 Limitations

2.4.1 Field survey

Practitioners who conduct ecological surveys for environmental impact assessment in Western Australia are obliged to report on the limitations and constraints in such studies. Some potential limitations / constraints on surveys may adversely impact on the scientific rigour, completeness or the validity of the survey results. EPA (2016) identifies standard limitations which can limit and constrain the validity of surveys. These limitations / constraints and their relevance to this assessment are presented in Table 5.

Table 5: Survey limitations

Limitation	Relevance	Details
Availability of contextual information at a regional and local scale	No	Numerous surveys have been undertaken in the vicinity of the survey area which provide context for the current assessment. Floristic data for the current assessment was compared to the Meissner and Wright (2010) regional dataset.
Competency and experience of the field team	No	All botanical practitioners are suitably qualified and experienced. The number of years professional experience conducting botanical surveys for Environmental Impact Assessment in Western Australia for each team member are listed below: • Carrie Gill – 12 years • Brian Morgan – 25 years • Kelli McCreery – 20 years • Julijanna Hantzis – 2 years
Proportion of flora and fauna recorded and / or collected, and problems with taxonomic determinations	No	Flora taxa recorded were either identified in the field or collected and identified using the keys and resources of the WAH. The species accumulation curve indicates that the survey effort was excellent with a total of 374 taxa recorded from three years of surveys.
The effort and extent of the survey	No	The assessment was carried out over a total of five site visits with two to three botanists present for each survey. The duration of each survey ranged from five to eight days. The total approximate number of person field days was 80 which was deemed adequate to complete the surveys to the required standard within the survey area boundaries (in accordance with EPA (2016)).

Limitation	Relevance	Details
Access restrictions within the survey area	No	There were no access restrictions to any part of the survey area for the duration of the surveys, however, at the request of the Djiwarl Traditional Owners no ground was disturbed on Long Island or any of the gypsum dunes associated with Lake Miranda. Floristic sites in these areas were not marked with galvanised fence droppers (as is customary). Instead the four corners of each sampling site were marked with a hand-held GPS.
Survey timing, rainfall, season of survey	No	The surveys were undertaken in spring which is the optimal time for Primary floristic surveys in the bioregion in accordance with EPA (2016) guidance. Supplementary surveys were undertaken to resample established quadrats in Spring or Autumn which is prescribed by EPA (2016).
Disturbances that may have affected the results of survey such as fire, flood or clearing	Minor	The survey area encompasses the site of the historic Bellevue Gold Mine which was operational between 1896 and 1997. The site has been severely disturbed by a long history of mining-related activities including vegetation clearing for infrastructure including roads, pits, shafts, the tailings storage facility, waste rock dumps, and the old Sir Samuel Gold Battery and town site, as well as contamination and rubbish dumping. The survey area is located on Yakabindie Station and has been impacted by decades of heavy grazing by livestock. Weed species observed for the survey were predominantly annual species and were widespread but were generally recorded at low densities. Livestock are still present within the survey area with signs of altered vegetation structure throughout the survey area, particularly on the low-lying flats and outwashes where livestock aggregate. Despite these obvious signs of historical disturbance by grazing all the floristic sites were placed in vegetation in Excellent or Very Good condition thus mitigating this limitation somewhat.

2.4.2 Floristic analysis

It is generally accepted that the addition of new sites to a regional dataset to produce a combined classification, may disrupt the original classification of sites (Griffin and Trudgen 2004), the more data that is added, the higher the level of disruption. Analysing each test site separately with the regional dataset is considered a more reliable means of deriving accurate floristic community groups because the addition of a single test site (sample) causes minimal disruption to the dataset.

The use of different statistical analysis software (PRIMERv7 rather than PATN, which was used in the original analysis of the Perseverance Greenstone Belt regional dataset is recognised to cause differences in the hierarchical clustering of the data. This is because the two software programs use a different default beta value in the group-average linkage (UPGMA) clustering routine. Neil Gibson confirmed that it is sometimes difficult to recreate original analysis results exactly because PRIMER does not allow the beta value in the UPGMA algorithm to be changed. PATN uses a value of -0.1 as a default, this parameter is not accessible in PRIMER which uses a default of 0.0 (N. Gibson 2016, pers. comm. 21 November 2016).

Finally, the success of the PRIMERv7 analysis to assign a community type to survey quadrats can be limited to the extent of the type of vegetation in the survey area that was sampled in the Perseverance Greenstone Belt regional survey.

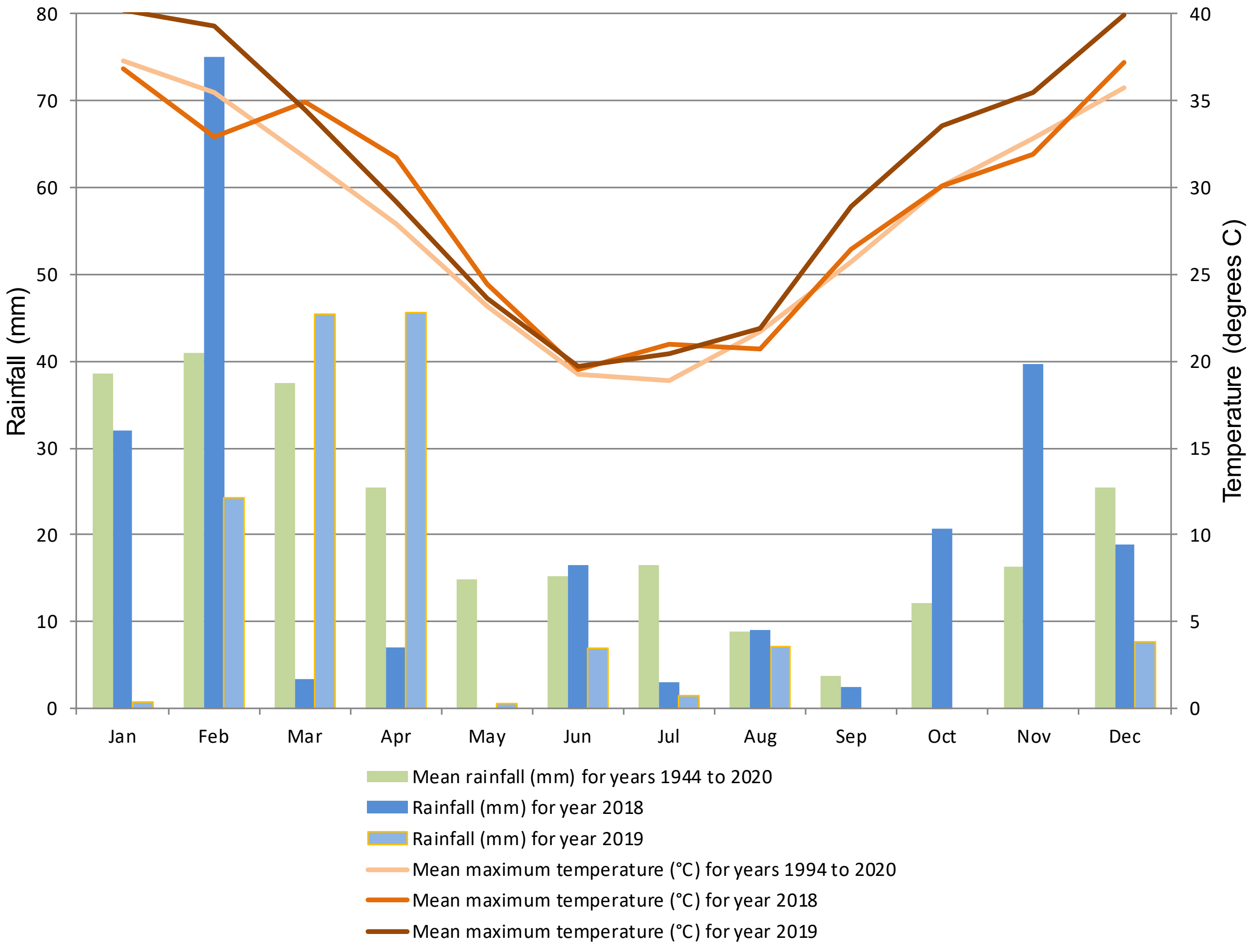
3 EXISTING ENVIRONMENT

3.1 Existing and historical land use

The region in which the survey area lies has historically been exploited for mining, exploration and pastoralism since the early twentieth century (Pringle et al. 1994). Gold was first discovered at the historic mine site in 1895, by Toombs, O'Reilly, Parker and Dightman, a party of prospectors from Cue. A company was floated called the Bellevue Proprietary Ltd in 1896. The Bellevue Gold Mine was one of Australia's highest grade gold mines producing around 800,000oz at 15g/t gold between 1896 and 1997.

3.2 Climate

The climate of the north-eastern Goldfields is generally described as arid, being one of the driest regions of Western Australia (Pringle et al. 1994). The bioclimate of this region as described by Beard (1990) is "Desert: summer and winter rainfall". In this bioclimatic region rainfall is typically erratic but more regular in autumn and early winter than in spring and summer (Pringle et al. 1994). Historical climate data collected at the Leinster Aero weather station (012314) is presented in Graph 1 (Bureau of Meteorology [BoM] 2020).



(Source: BoM 2020)

Graph 1 Mean monthly rainfall (millimetres(mm)) for Leinster Aero weather station (012314) for years 1994 to 2020 and Rainfall Data for 2018 and 2019

3.3 Interim biogeographical regionalisation of Australia

Thackway and Cresswell (1995) describe a system of 85 "biogeographic regions" across Australia, known as the IBRA. The bioregions are delineated on the basis of climate, geomorphology, landform and characteristic flora and vegetation and fauna.

The survey area lies within the Murchison bioregion, and within the East Murchison (MUR01) subregion which is defined by Cowan (2001) as:

Internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. Salt lake systems are associated with the occluded Paleodrainage system. Broad plains of red-brown soils and breakaway complexes as well as red sandplains are widespread. Vegetation is dominated by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and Halosarcia shrublands.

3.4 Rangeland land systems

Land system mapping of the rangelands by the Department of Agriculture and Food, Western Australia and Department of Land and Surveys defines a map unit or land system as “an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation” (Pringle et al. 1994). The survey area intersects seven land systems (Pringle et al. 1994). The land systems are described in Table 6 and shown in Figure C.

Table 6: Land systems represented within the survey area

Land system	Land type	Description
LEONORA	Low hills with eucalypt of acacia woodlands and halophytic undershrubs	Low greenstone hills and stony plains supporting mixed stony chenopod shrublands.
LAVERTON	Hills and ranges with acacia shrublands	Greenstone hills and ridges with acacia shrublands.
ARARAK	Sandy plains with acacia shrublands and wanderrie grasses	Broad plains with mantles of ironstone gravel supporting mulga shrublands with wanderrie grasses.
VIOLET	Stony plains with acacia shrublands and halophytic shrublands	Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved mulga and bowgada shrublands and patchy halophytic shrublands.
CARNEGIE	Salt lakes and fringing alluvial plains with halophytic shrublands	Salt lakes with extensively fringing saline plains, dunes and sandy banks, supporting low halophytic shrublands and scattered tall acacia shrublands; lake beds are highly saline; gypsiferous and mainly unvegetated.
NUBEV	Stony plains with acacia shrublands and halophytic shrublands	Gently undulating stony plains, minor limonitic low rises and drainage floors supporting mulga and halophytic shrublands.
BULLIMORE	Extensive sandplains supporting spinifex hummock grasslands	Generally, very gently sloping to broadly undulating plains of red sand with occasional incidence of near parallel sand ridges.

(Adapted from Pringle et al. 1994)

3.5 Geology, landform and soils

The survey area falls within the Eastern Goldfields Province of the Yilgarn craton, which corresponds physiographically to the Salinaland Plateau of the Yilgarn Plateau Province (Pringle et al. 1994) which is described as:

Sandplains and laterite breakaways; granitic and alluvial plains; ridges of metamorphic rocks and granite hills and rises; calcretes, large salt lakes and dunes along valleys.

Pringle et al. (1994) defined nine land surface types within the north-eastern Goldfields. The survey area intersects five of these. The land surface types within the survey area, the land systems to which they belong, and their characteristic surface geology and landforms are presented in Table 7.

The survey area is located on the Violet Range in the Perseverance Greenstone Belt which Meissner and Wright (2010) describe as being represented by low undulating hills of banded ironstone and basalt.

Table 7: Geology and landforms represented within the survey area

Land surface types	Associated land system	Predominant surface geology	Characteristic landforms
Hills and ridges	Laverton	Greenstone, basalt	Linear hills
	Leonora	Greenstone	Low rounded hills
Erosional surfaces of low relief (<20 m)	Nubev	Limonite on greenstone	Low rises, broad saline alluvial tracts.
	Violet	Limonite on greenstone	Gently undulating gravelly or stony plains
Plains with deeper coarser soils than in hardpan wash plains	Ararak	Alluvium, sand	Plains with mantles of ironstone gravel
Lake country	Carnegie	Alluvium, sand, gypsum	Extensive saline alluvial plains
Sandplains	Bullimore	Sand, minor alluvium	Extensive sandplain

(Adapted from Pringle *et al.* 1994)

3.6 Environmentally sensitive areas (ESAs)

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under section 51B of the EP Act.

The following areas are declared to be ESAs:

- Declared World Heritage property as defined in section 13 of the EPBC Act
- Area that is included on the Register of the National Estate, because of its natural heritage value, under the Australian *Heritage Council Act 2003* of the Commonwealth
- Defined wetland and the area within 50 m of the wetland. Defined wetlands include Ramsar wetlands, conservation category wetlands and nationally important wetlands
- Area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located
- Area covered by a TEC.

There are no ESAs within the survey area.

3.7 Regional vegetation

The survey area lies within the Austin Botanical District of the Eremaean Botanical Province (Beard 1990). The Austin Botanical District covers over 300,000 km^2 and is typified by Mulga (*Acacia aneura*) woodlands on the plains, scrub and shrublands on hills and rises, Mulga and Eremophila shrublands on stony plains, and chenopod communities on duplex soils. Vegetation communities are strongly correlated with landforms and soils (Pringle et al. 1994; Beard 1990).

3.7.1 Beard (1979) vegetation mapping

Beard's 1:250,000 scale vegetation mapping of Western Australia (1979), defines the vegetation within the survey area as belonging to three broad vegetation associations (Table 8). Vegetation Association 39 - Shrublands; mulga scrub, is the most widespread extending across the northern two thirds of the survey area. The southern portion of M3625, which lies within the saline clay pan of Lake Miranda, is mapped as Vegetation Association 125 - Bare areas, salt lakes. In between these two dominant vegetation types within the survey area lies a band of 'transitional' vegetation mapped as Vegetation Association 676 - *Tecticornia* spp. communities in saline areas. Regional vegetation for the survey area is presented in Figure E at the rear of the report.

Table 8: Beard (1979) Vegetation Associations represented within the survey area

System	Vegetation association	Structural description	Description
WILUNA	39	Scrub, open scrub or sparse scrub	Shrublands; mulga scrub
	125	Salt lake, lagoon, clay pan	Bare areas; salt lakes
	676	Succulent steppe; samphire	*Tecticornia* spp. communities in saline areas

The remnant extent and reservation status of these vegetation associations within Western Australia and the East Murchison (MUR01) subregion are presented in Table 9. All three of these vegetation associations have greater than 90% of their pre-European extent remaining within the state and the East Murchison (MUR01) subregion, however, less than 8% of their present extents is protected within the conservation estate.

Table 9: Pre-European extent, current extent and reservation status of vegetation associations within the Western Australian and the East Murchison (MUR01) IBRA subregion

Vegetation association	Area	Pre-European extent (ha)	Present extent (ha) remaining	% of Pre-European extent remaining	% of present extent in secure tenure
39	Western Australia	6,613,567.48	6,602,578.44	99.83	7.24
	MUR01 Subregion	711,328.84	701,934.47	98.68	0
125	Western Australia	3,485,785.49	3,146,487.22	90.27	5.41
	MUR01 Subregion	701,136.94	699,919.75	99.83	0.56
676	Western Australia	2,063,413.95	1,963,881.55	95.18	3.57
	MUR01 Subregion	369,324.84	369,212.07	99.97	0

(Government of Western Australia 2019)

3.7.2 Pringle et al. (1994) habitat types

An Inventory and condition survey of rangelands in the north-eastern Goldfields, Western Australia (which includes the survey area) (Pringle et al. 1994) undertook an ecological habitat assessment that described a total of 36 habitats belonging to 8 habitat groups based on landform, soil type and plant community type. The habitats represented in the Ararak, Bullimore, Carnegie, Laverton, Leonora, Nubev and Violet Land Systems and therefore potentially in the survey area are listed and described in Table 10.

Table 10: Pringle et al. (1994) habitats associated with the Ararak, Bullimore, Carnegie, Laverton, Leonora, Nubrev and Violet land systems and potentially represented in the survey area

Habitat	Landform	Associated species
Upland small bluebush species shrublands (USBS)	Stony plains	Trees: *Acacia aneura* and *Hakea preissii*. Others – *Acacia tetragonophylla, Eremophila platycalyx and E. fraseri* Mid shrubs: *Acacia aneura*, *Acacia ramulosa.* Others- *Rhagodia eremaea* Low shrubs: *Maireana georgei, M. triptera, and Ptilotus obovatus* Other – *Enchylaena tomentosa, Eremophila latrobei, Maireana convexa, Maireana pyramidata, Scaevola spinescens, Sida calyxhymenia, and Solanum lasiophyllum*
Stony ironstone mulga shrublands (SIMS)	Hillslopes and low rises	Tall shrubs: *Acacia aneura.* Other – *Acacia ramulosa, A. tetragonophylla.* Mid shrubs: *Acacia aneura, Eremophila fraseri, Scaevola spinescens* Others – *Cassia helmsii, C. nemophila, C. sturtii, Dodonaea rigida, Eremophila forrestii, Rhagodia eremaea, Scaevola spinescens.* Low shrubs: *Ptilotus obovatus* Other – *Enchylaena tomentosa, Eremophila forrestii, E. georgei, E. latrobei, Maireana convexa, M. georgei, M. triptera, M. villosa, Ptilotus schwartzii, Sida calyxhymenia, Solanum lasiophyllum, Spartothamnella teucriiflora.*
Bladder saltbush low shrublands (BLSS)	Lake margins and below breakaway scarps	Mid shrub: *Cratystylis subspinescens* Low shrub: *Atriplex vesicaria.* Other – *Frankenia spp., Hakea preissii, Maireana atkinsiana, M. georgei, M. glomerifolia, M. pyramidata, M. tomentose, M. triptera, Ptilotus obovatus, and Solanum lasiophyllum.*

Habitat	Landform	Associated species
Stony bluebush mixed shrublands (SBMS)	Footslopes and stony plains	Trees: *Acacia aneura, Casuarina cristata.* Tall shrubs: *Acacia aneura, Hakea preissii.* Others – *Acacia tetragonophylla*. Mid shrubs: *Hakea preissii, Acacia tetragonophylla*. Others – *Cassia nemophila* and *Rhagodia eremaea.* Low shrubs: *Maireana georgei, M. pyramidata, M. triptera* and *Ptilotus obovatus.* Other – *Atriplex bunburyana, Cratystylis subspinescens*
Samphire low shrublands (SAMP)	Fringing bare lake beds	Low Shrubs: *Halosarcia halocnemoides, H. undulata and H. doleiformis.* Other – *Atriplex vesicaria, Cratystylis subspinescens, Disphyma crassifolium, Frankenia* spp., *Hakea preissii, Maireana glomerifolia, M. pyramidata, M. triptera* and *Solanum lasiophyllum*
Mixed chenopod shrublands with Mulga overstoreys (MHHS)	Lake country and wash plains	Trees: *Acacia aneura* Tall shrubs: *Acacia aneura.* Others – *Acacia tetragonophylla, Hakea preissii* Mid shrubs: *Cratystylis subspinescens, Lycium australe, Maireana pyramidata, Acacia ramulosa/linophylla, Acacia tetragonophylla.* Others – *Eremophila scoparia, Grevillea sarissa, Lycium austral, Rhagodia eremaea, Scaevola spinescens.* Low shrubs: *Atriplex vesicaria, Maireana pyramidata, M. triptera.* Others – *Atriplex bunburyana Cassia nemophila Enchylaena tomentose, Eremophila decipiens, E. forrestii, E. maculata, Frankenia* spp., *Gunniopsis quadrifida, Lawrencia squamata, Maireana georgei, Ptilotus obovatus, Rhagodia drummondii, Scaevola spinescens, Solanum lasiophyllum, Spartothamnella teucriiflora*
Mulga shrublands with scattered Chenopod low shrubs (HMCS)	Washplains	Trees: *Acacia aneura* Tall shrubs: *Acacia aneura.* Others – *Acacia tetragonophylla, A. victoriae, Hakea preissii.* Mid shrubs: *Rhagodia eremaea, Acacia tetragonophylla.* Low shrubs: *Maireana pyramidata, M. triptera.* Others – *Atriplex bunburyana, Cassia nemophila, Enchylaena tomentosa, Eremophila margarethae, Frankenia* spp., *Maireana georgei, Ptilotus obovatus, Solanum lasiophyllum.* Perennial grasses: *Stipa elegantissima, Eragrostis ? dielsii*
Sago bush low shrublands (PSAS)	Upslope of Lake country and alluvial plains	Trees: *Acacia aneura* Tall shrubs: *Acacia aneura, A.* sp. (spiny snakewood), *Hakea preissii.* Others – *Acacia tetragonophylla, A. victoriae, Eremophila youngii* ssp. *youngii* Mid shrubs: *Maireana pyramidata, M. sedifolia.* Others – *Eremophila scoparia, Rhagodia eremaea, Scaevola spinescens.* Low shrubs: *Maireana pyramidata,* Others – *Atriplex bunburyana, A. vesicaria, Chenopodium curvispicatum, Cratystylis subspinescens, Enchylaena tomentose, Frankenia* spp., *Halosarcia* spp., *Maireana georgei, M. glomerifolia, M. platycarpa, M. triptera, Ptilotus obovatus, Rhagodia drummondii, Scaevola spinescens, Sida calyxhymenia, Solanum lasiophyllum.*
Sandy bank lake shrublands (SBLS)	Sandy banks	Trees: *Acacia aneura* Tall shrubs: *Acacia aneura* Others – *Acacia tetragonophylla, Eremophila miniata, Melaleuca sheathiana, M. uncinata* Mid shrubs: *Lycium australe, Rhagodia eremaea, Scaevola spinescens.* Low shrubs: *Atriplex bunburyana, Maireana pyramidata, Ptilotus obovatus, Rhagodia drummondii* Others – *Cratystylis subspinescens, Enchylaena tomentosa, Gunniopsis quadrifida, Maireana georgei, M. triptera, Solanum lasiophyllum.* Perennial grasses: *Eragrostis eriopoda, Triodia basedowii* Other – *Eriachne helmsii, Monachather paradoxa, Thyridolepis mitchelliana/multiculmis*

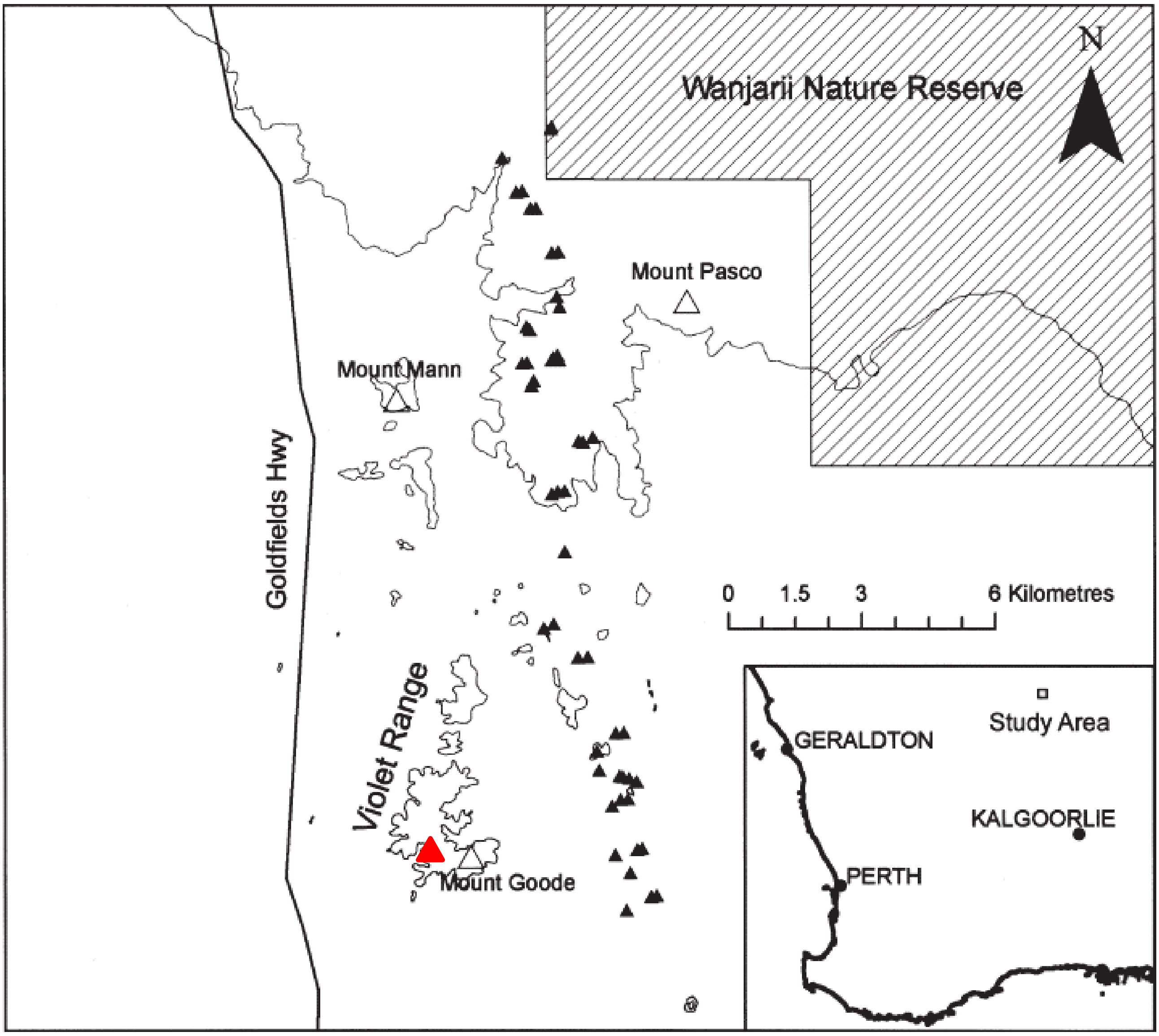
3.7.3 Local vegetation mapping

Previous flora and vegetation studies undertaken by Mattiske Consulting Pty Ltd (Mattiske) between 2004 and 2011 for the Cosmos Nickel project (which included tenements M36/24 and M36/25) recorded and mapped 15 vegetation communities throughout the Cosmos survey area and surrounds including:

- Five mulga woodland communities - occurring on the lower slopes, stony plains and drainage lines
- Two other acacia woodland communities - occurring on rocky hills and ridges
- Three halophytic shrubland communities - occurring on the saline margins and alluvial plains adjacent to Lake Miranda
- Five non-halophytic shrubland communities - occurring on the foot slopes and plains.

3.7.4 Flora and vegetation of the Perseverance Greenstone Belt

A regional study of the flora and vegetation of the banded iron formations of the Yilgarn Craton: Perseverance Greenstone Belt was undertaken by Meissner and Wright (2010) over and area in the Eastern Goldfields Geological Province which encompasses the survey area. The study focussed on the floristic communities associated with the basalt and BIF hills on the greenstone belt. The study identified four significant community groups, two of which were associated with the crests and slopes of basalt hills and two were associated with BIF hills. The closest regional study sites are located approximately 5 km to the east of the survey area (Figure 1). The four community types defined for this study correspond with the stony ironstone mulga shrublands (SIMS) described by Pringle et al. (1994).



(Source: Meissner and Wright 2010)

Figure 1: Perseverance Greenstone Belt floristic sites (black triangles) and Bellevue Gold survey area (red triangle)

4 SURVEY RESULTS

4.1 Desktop assessment

4.1.1 Database searches

4.1.1.1 Threatened and Priority flora database search results

Searches of the DBCA Threatened and Priority Flora database and the WAH Specimen database were undertaken within a 50 km radius of the survey area boundary.

A total of 16 species of conservation significance were found to occur within the search radius comprising one Threatened flora species, two Priority 1, one Priority 2, seven Priority 3 and five Priority 4 flora taxa. One species, *Atriplex yeerlirrie*, is listed as Endangered under the EPBC Act.

The list of significant species and their conservation codes retrieved from the databases for the search area, and their assessed 'likelihood of occurrence' are presented in Appendix B. These species were the focus of the targeted flora searches which were undertaken as part of the detailed assessment. Refer to Appendix B for the rationale behind the assessment of 'likelihood of occurrence' for each species.

Conservation significant species records in the vicinity of the survey area derived from the database searches are shown in Figure F.

4.1.1.2 Threatened and Priority ecological communities database search results

Searches of the DBCA TEC/PEC database were undertaken within a 50 km radius of the survey area boundary.

Three records of one TEC (Depot springs stygofauna community) were found to occur within the search radius.

A total of 10 records of eight PECs were found to occur within the search radius comprising Kaluwiri Calcrete (one record), Lake Miranda East Calcrete (three records), Lake Miranda West Calcrete (one record), Yakabindi Calcrete (one record), Yandal Calcrete (one record), Albion Downs Calcrete (one record), Barwidgee Calcrete (one record), and Violet Range (Perseverance Greenstone) BIF (one record) (Table 11). None of these ecological communities are listed as protected under the EPBC Act.

A large proportion of the survey area intersects the Violet Range (Perseverance Greenstone) BIF PEC record (1,443.69 ha), and a portion of the south eastern section of survey area intersects the Lake Miranda East Calcrete PEC record (Figure G).

Table 11: TEC and PEC records within a 50 km radius of the survey area

Tec/pec	Description	BC Act status*	EPBC Act status†	Buffer (m)
Depot Springs	Depot Springs stygofauna community	Vulnerable	-	2000
Lake Miranda East Calcrete	Lake Miranda east calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station	Priority 1	-	2000
Lake Miranda West Calcrete	Lake Miranda west calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station	Priority 1	-	2000
Yakabindi Calcrete	Yakabindie calcrete groundwater assemblage type on Carey palaeodrainage on Yakabindie Station	Priority 1	-	2000
Yandal Calcrete	Yandal calcrete groundwater assemblage type on Carey palaeodrainage on Yandal Station	Priority 1	-	2000
Albion Downs Calcrete	Albion Downs calcrete groundwater assemblage type on Carey palaeodrainage on Albion Downs Station	Priority 1	-	2000
Barwidgee Calcrete	Barwidgee calcrete groundwater assemblage type on Carey palaeodrainage on Barwidgee Station	Priority 1	-	2000

Tec/pec	Description	BC Act status*	EPBC Act status†	Buffer (m)
Kaluwiri Calcrete	Kaluwiri calcrete groundwater assemblage type on Raeside palaeodrainage on Kaluwiri Station. Unique assemblages of invertebrates have been identified in the groundwater calcretes	Priority 1	-	2000
Violet Range (Perseverance Greenstone) BIF	Violet Range (Perseverance Greenstone Belt) vegetation complexes (banded ironstone formation)	Priority 1	-	500

* *Biodiversity Conservation Act 2016* (Source: WAH 2019)

† Additional protection under the EPBC Act 1999.

4.2 Field survey

4.2.1 Flora

4.2.1.1 Flora statistics

A total of 345 vascular flora taxa were recorded for the current survey of which 336 (97.4%) are native, and 9 (2.6%) are naturalised alien (weed) species. The list of taxa recorded for the survey area is presented in Appendix C. Species recorded by quadrat are presented in Appendix D, and detailed quadrat and relevé data are presented in Appendix E.

The taxa recorded represent 48 families and 128 genera. The families represented by the greatest number of taxa are presented in Table 12. The genera represented by the greatest number of taxa are presented in Table 13.

Table 12: Dominant families within the survey area

Family	No. of taxa
CHENOPODIACEAE	76
FABACEAE	45
POACEAE	43
ASTERACEAE	29
MALVACEAE	29
SCROPHULARIACEAE	20
ZYGOPHYLLACEAE	14
AMARANTHACEAE	13

Table 13: Dominant genera within the survey area

Genus	No. of taxa
Maireana	22
Acacia	22
Eremophila	20
Sclerolaena	16
Tecticornia	15
Senna	14
Ptilotus	12
Sida	12
Eragrostis	11

Of the 22 Acacia species recorded 13 were Mulga species, hybrids or variants, and included: *Acacia aneura, A. aptaneura, A. ayersiana, A. caesaneura, A. caesaneura* (narrow phyllode variant)*, A. craspedocarpa, A. craspedocarpa* hybrid*, A. fuscaneura, A. macraneura, A. minyura, A. minyura* hybrid*, A. mulganeura,* and *A. pteraneura.*

4.2.1.2 Ambiguous or unresolved taxonomic determinations

There were a number of taxa that could not be identified to species level due to inadequate fruiting or flowering material available at the time of the surveys. These taxa are labelled “sp.”.

There were a couple of dominant Acacia species whose identities were initially somewhat ambiguous due to the absence of adequate fruiting material. The first of these species, finally resolved to be *Acacia doreta* (long phyllode form), was difficult to discern from the closely related *Acacia grasbyi*. These species can generally be distinguished from each other by their different geographic ranges, and by their differing pod characteristics and seed size. However, the survey area lies at the intersection of the two taxa’s range limits with *A. grasbyi* extending west to the coast and *A. doreta* extending east into the Northern Territory and South Australia, so discerning them based on their distribution was not possible as they both occur in the region. Some of the specimens collected had shorter (30 to 50 mm long) phyllodes and exhibited a multi-stemmed, more ‘shrubby’ habit (characteristics of *A. doreta*), while others had longer (60 to 80 mm long) phyllodes, and were generally taller and single-stemmed (characteristics more typical of *A. grasbyi*), however, as Maslin (2014) stated, “phyllode and habit characters alone will not always distinguish them, and in the absence of pods they can be difficult to separate”. To confound things further Western Botanical (2017) recorded *Acacia* aff. *doreta* (narrow pod form) (G. Cockerton & S. Cockerton WB38633), which had previously been reported as *Acacia grasbyi* between Leinster and Mount Keith, and had affinities to *A. doreta*, although several characters differed to both it and *A. grasbyi*. After discussions with Geoff Cockerton it was concluded that the taxon recorded for the current assessment is equivalent to *Acacia* aff. *doreta* (narrow pod form) (G. Cockerton & S. Cockerton WB38633) which Geoff referred to as *Acacia doreta* (long phyllode form) (Pers. comm. Geoff Cockerton, January 2020). The regional study undertaken by Meissner and Wright (2010), which identified the Violet Range PEC (which intersects with the survey area) recorded only *A. grasbyi* because their 2010 study was undertaken before Maslin described *A. doreta* as a separate taxon, and before Geoff Cockerton recognised this variant, so for the multivariate analysis of the dataset against the regional Meissner and Wright (2010) as part of the taxonomic reconciliation, the species was called *Acacia grasbyi* to ensure compatibility between the datasets.

Acacia xanthocarpa was the other species recorded within the survey area which appeared to differ somewhat from its formal description by Cowan and Maslin (1995); the phyllodes of the specimens collected for the current assessment were generally longer (up to 130 mm long) than the described range of 60 to 95 mm, phyllodes were semi-terete or compressed rather than terete, and the densely hairy pods were generally narrower (7 to 10 mm wide) than the described range of 8 to 15 mm. Additionally, all but two of the collected specimens had red resinous phyllode margins (not typical of the species as it is described by Cowan and Maslin (1995)), these two non-resinous phyllode specimens had no pods or flowers and so were called ‘Acacia ? xanthocarpa’. Using the Wattle Lucid Key, the specimens keyed out more closely to *Acacia quadrimarginea* in terms of pod and phyllode dimensions than to *A. xanthocarpa. A. quadrimarginea* also has red resinous phyllode margins like the specimens collected; the densely velvety golden pods, however, were typical only of *Acacia xanthocarpa*. Western Botanical (2017) also reported collections around Mt Keith not far from the survey area, that did not fit either of these species descriptions and suggested that there may be hybridisation occurring between these, or other species, and that the *Acacia xanthocarpa* complex required a thorough review. A visit to the vaults at the WAH revealed that there were numerous *Acacia xanthocarpa* specimens similar in their phyllode and pod characteristics to our specimens suggesting that the identification, in lieu of a review of the complex, was likely correct. It should be noted that Meissner and Wright (2010) recorded *A. quadrimarginea* but not *A. xanthocarpa* in any of their Violet Range PEC sites, so for the purpose of analysing the test data against the regional dataset *A. xanthocarpa* was changed to *A. quadrimarginea* to ensure compatibility of the data for the analysis.

4.2.1.3 Field survey effort

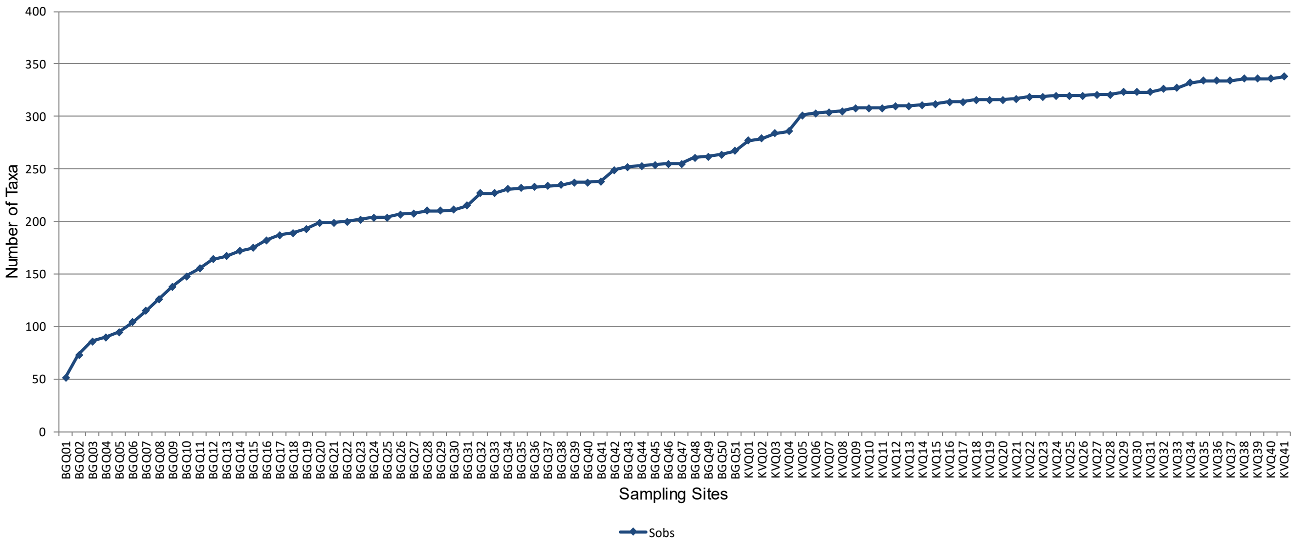
Species accumulation plots were generated for the survey site data using PRIMERv7 SPEC-ACCUM (Graph 2). This expressed the number of species recorded for the field surveys as a function of effort (i.e. number of sites sampled).

Initially, the analysis was run on the dataset in the order that the floristic quadrats were sampled in the field (i.e. chronologically) using the ‘Sobs’ index. This generated a ‘stepped’ curve showing the actual cumulative number of taxa recorded as each subsequent floristic site was sampled (Graph 2).

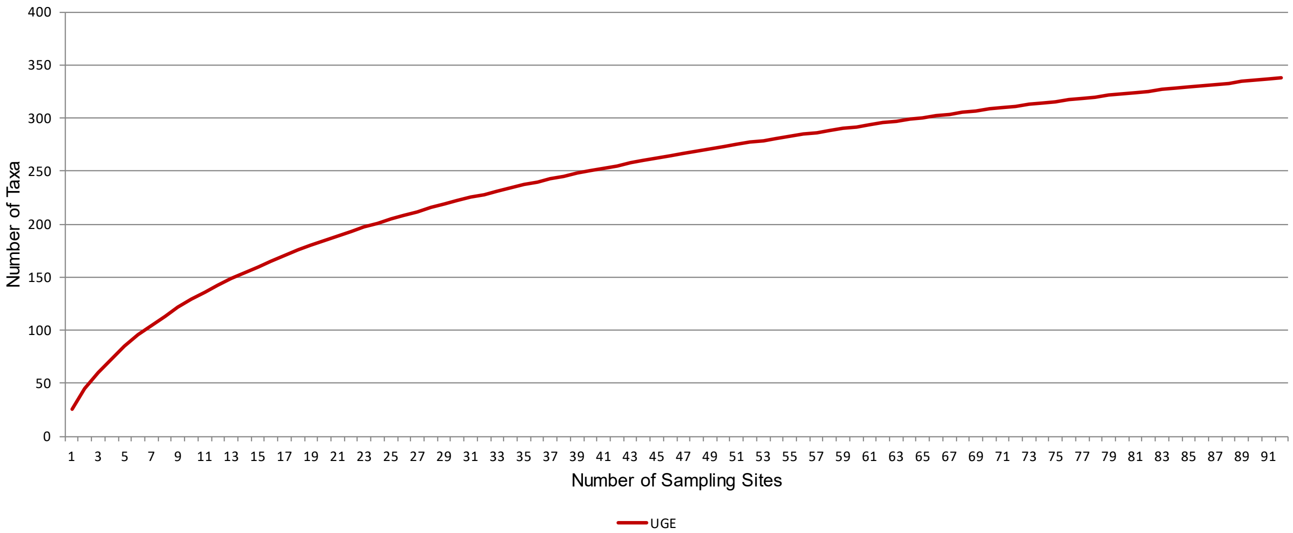
A second analysis was undertaken using the ‘UGE’ index to generate a smooth curve which was derived from the means of repeated re-sampling of all pooled samples (Graph 3). This curve represents the ‘statistical expectation’ for the curve shown in Graph 2.

The curves demonstrate that a total of 338 taxa were recorded for the 92 quadrats. The shape of the curve indicates that fewer new species were recorded with the sampling of each additional site and that the number of sites that would have to be sampled to reach the asymptote (theoretical maximum) would be prohibitively large.

It was concluded that the survey effort for the current field survey was very good. It should also be noted that an additional seven taxa were recorded at relevés and from opportunistic collections bringing the actual total to 345.



Graph 2 Species accumulation curve (Sobs index)



Graph 3 Species accumulation curve (UGE index)

4.2.1.4 Flora of conservation significance

No TF species listed under the BC Act or the EPBC Act were recorded within the survey area.

Three PF species listed by the DBCA were recorded within the survey area: *Grevillea inconspicua* (Priority 4); *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (Priority 3); and *Goodenia lyrata* (Priority 3).

4.2.1.4.1 *Grevillea inconspicua* (P4)

Grevillea inconspicua is an intricately branched, spreading shrub growing to 2 m high (Plate 1 and Plate 2). Flowers are white/pink-white and flowering occurs from June to August. The species occurs on loam and gravel along creek lines and drainage lines on rocky outcrops and stony hills (Plate 3 and Plate 4). The species occurs in the Eremaean Botanical Province, in the Murchison (MUR) IBRA bioregion (WAH 2019) and is associated with outcropping/subcropping metabasalts in the Bevon and Violet Land Systems within the Violet Range PEC. Western Botanical (2017) observed that significant populations of this species are associated with the Violet Range.

Prior to the current assessment *G. inconspicua* was known from one location within M3625 (Lat. -27.638964; Long. 120.551959) where 162 individuals were recorded in 1992 along a 600 m stretch of the Leinster-Wiluna Road adjacent to the Bellevue mine site, and another location within M3624 (Lat. -27.609519; Long. 120.553625) where 20 individuals were recorded in 1991 at the Bellevue mine site camp. During the five surveys associated with this assessment additional populations of this species were recorded on five stony hills within the survey area with between 50 and several hundred individuals recorded at each location, with a total of 751 individuals recorded within the survey area.

The location of *G. inconspicua* records within the survey area and the dates they were recorded and mapped are presented in Figure H.

(Photo: K. McCreery)

Plate 1: *Grevillea inconspicua*

(Photo: K. McCreery)

Plate 2: *Grevillea inconspicua*

Plate 3: *Grevillea inconspicua* habitat within the survey area

Plate 4: *Grevillea inconspicua* habitat within the survey area

4.2.1.4.2 *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (P3)

Hibiscus sp. Perrinvale Station (J. Warden & E. Ager WB 10581) is known from one record on a hilltop on a banded iron ridge near the eastern shore of Lake Barlee, which lies approximately 200 km to the southwest of the survey area.

Within the survey area the species was recorded at one floristic site (KVQ05) located in a drainage line on a stony hardpan plain at Kathleen Valley at the northern end of the survey area. The vegetation comprised *Acacia craspedocarpa* and *A. aptaneura* Low Woodland over *A. tetragonophylla* Sparse Tall Shrubland over *Eremophila serrulata, A. xanthocarpa* and *Senna artemisioides* subsp*. x artemisioides* Open Shrubland over *Themeda triandra, Cymbopogon obtectus* and *Aristida contorta* Tussock Grassland. The location of this record is shown in Figure H.

Plate 5: *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) habitat within the survey area (KVQ05)

4.2.1.4.3 *Goodenia lyrata* (P3)

Goodenia lyrata is a prostrate herb with yellow flowers appearing in August. It occurs on red sandy loam on the slopes of low stony hills, on hardpan plains and near claypans (WAH 2020b).

Within the survey area the species was recorded at one floristic site (BGQ15) located on the slopes of a low stony hill. The vegetation comprised *Acacia doreta* (long phyllode form) and *A. fuscaneura* Low Open Woodland over *Senna glaucifolia, Ptilotus obovatus, Eremophila exilifolia* Mid Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland. This record represents a range extension to the south west for the species. The location of this record is shown in Figure H.

Plate 6: ***Goodenia lyrata*** **habitat within the survey area (BGQ15)**

4.2.1.5 Flora of other conservation significance

There are a number of other criteria (apart from the Commonwealth and Western Australian criteria of TF and PF species) under which flora taxa (i.e. species, sub-species and varieties) may have high conservation significance (EPA 2016).

These taxa include those that are confined to scarce or refugial habitats; form uncommon, regionally significant populations; have significant geographical ranges; and undescribed taxonomic entities. EPA (2016) refers to such taxa as "other taxa of conservation significance".

One taxon, *Eriachne aristidea*, recorded within the survey area is considered to be conservation significant based on a geographic range anomaly with this record representing a range extension to the south of its known range.

4.2.1.6 Introduced flora (weeds)

Nine naturalised alien (weed) species were recorded for the survey area, representing 2.6% of the total flora taxa recorded. These weed species were recorded at low densities throughout much of the vegetation within the survey area. The species recorded and the number of sites they were recorded in are presented in Table 14.

Table 14: Weed species recorded within the survey area

Family	Name	Number of sites	% of sites
ASPHODELACEAE	*Asphodelus fistulosus*	3	2.70
ASTERACEAE	*Sonchus oleraceus*	6	5.40
CONVOLVULACEAE	*Cuscuta planiflora*	1	0.90
CUCURBITACEAE	*Cucumis myriocarpus*	2	1.80
LAMIACEAE	*Salvia verbenaca*	2	1.80
POACEAE	*Cenchrus ciliaris*	1	0.90
POACEAE	*Cenchrus setiger*	6	5.40
POACEAE	*Eragrostis minor*	1	0.90
POLYGONACEAE	*Rumex vesicarius*	2	1.80

4.2.1.6.1 Declared pests and Weeds of National Significance

The Western Australian Organism List database was searched to determine the legal status of each weed recorded, and any control requirements that may apply under the *Biosecurity and Agriculture Management Act 2007*. None of the weeds recorded were determined to be Declared Pests - s22(2) or Weeds of National Significance.

4.2.2 Vegetation

4.2.2.1 Vegetation units

A total of nineteen vegetation units were described and mapped for the survey area which covered the full toposequence of vegetation types from hillcrests and slopes, to pediments, plains, drainage lines and salt lake margins throughout the survey area.

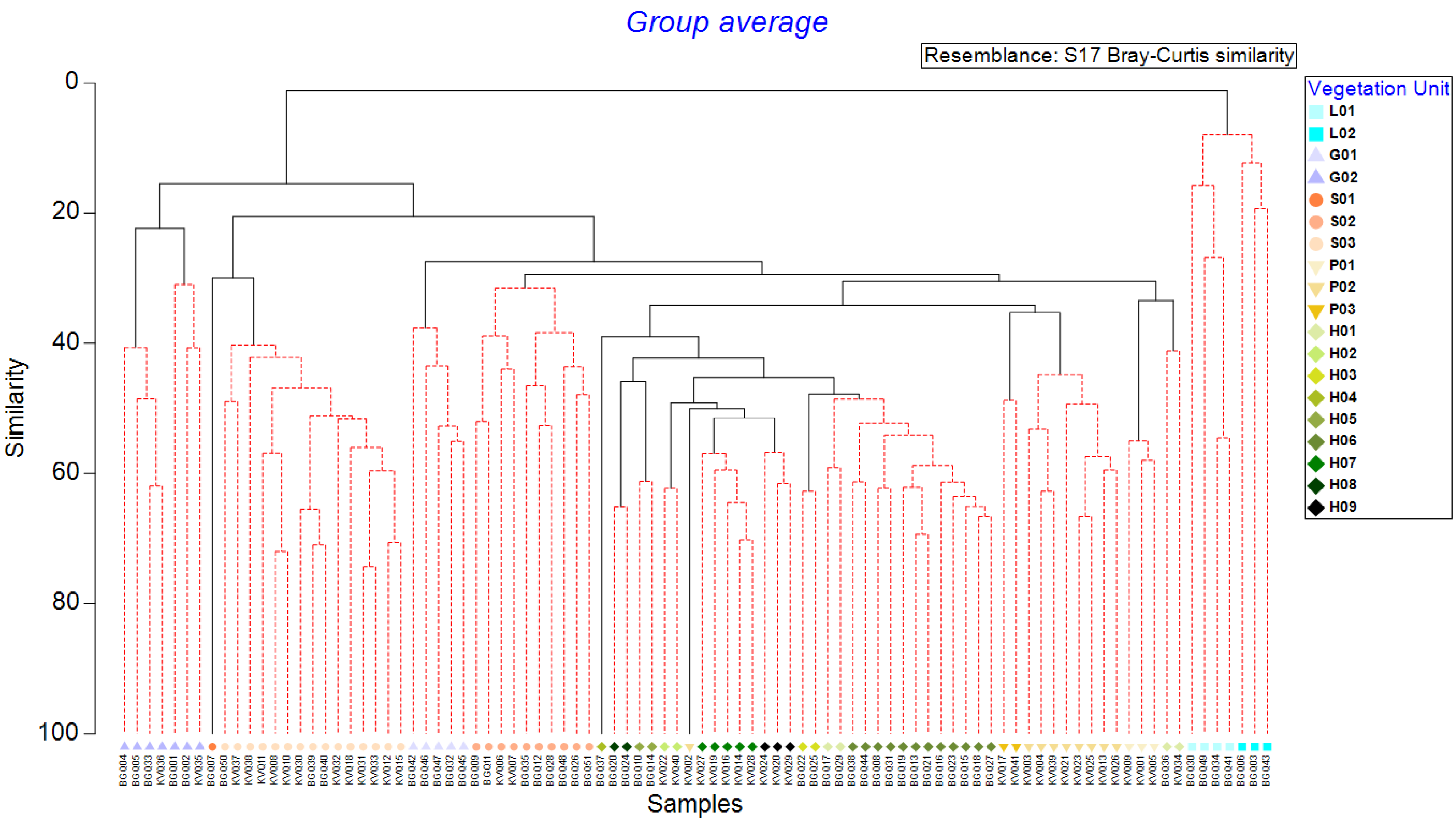
The vegetation units were defined from 92 floristic quadrats and 20 relevés which occurred across 13 physiographic units. As stated in methods (Section 2.3.2) vegetation unit mapping was conducted using a combination of aerial photo-interpretation, on-ground confirmation, vegetation structure data, and multivariate analysis of the floristic quadrat data. The hierarchical cluster analysis of the quadrat data determined there to be 20 statistically significant groups of sites based on their floristics (denoted by the black lines in the dendrograms), with 17 of the groups defining a unique vegetation unit and two groups further delineated into two vegetation units each based on topography and substrate, because although similar floristically, they differed in structure and occupied different positions in the landscape.

The hierarchical cluster diagrams (dendrograms) showing the relationship between all the floristic sites by vegetation unit are shown in Graph 2.

Ten of the vegetation units described for the survey area comprised Mulga communities on sand plains, stony hardpan plains, stony hills and drainage lines. These communities generally consisted of complex mosaics of mixed Mulga species with a total of ten distinct Mulga taxa and three hybrid entities recorded for this survey. As Bruce Maslin observed (WAH 2019a) “Most Mulga entities are extremely variable, their taxonomic boundaries vague, and identification of the different types is extremely difficult. The situation is further complicated by the existence of numerous hybrids and other entities of unknown taxonomic affinity. The variation observed in Mulga occurs both within and between populations”. Because of the complexity of these Mulga communities across the survey area, and the fact that all but one Mulga vegetation unit consisted of a mosaic of two to several Mulga entities, the descriptions refer to the species collectively as “Mulga spp.” There were, however, different distribution patterns observed across the range of physiographic units and within vegetation units, for example, *Acacia caesaneura* and *A. ayersiana* were generally restricted to the sand plains, flats and low sandy rises, while *A. pteraneura, A. fuscaneura, A. craspedocarpa. A. macraneura* and *A. minyura* occurred predominantly on the stony hillslopes and drainage lines on stony hills and plains. *A. aneura* and *A. aptaneura* were recorded across a broader range of habitats and landforms.

Two additional mapping units were defined and mapped for the highly modified portions of the survey area (including roads, tracks, buildings, mining infrastructure, historical pits, processing areas and camps), and the area in the centre of salt lake that is devoid of vegetation.

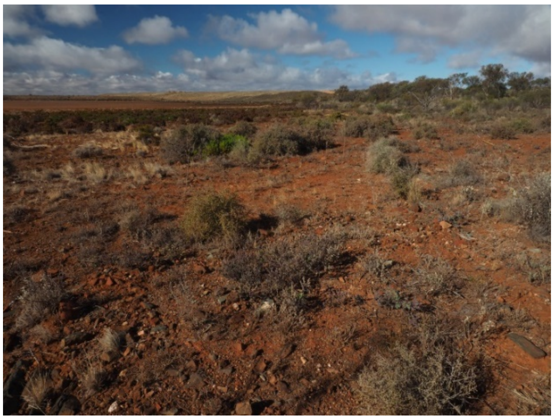
The vegetation unit mapping is presented in Figures I-1 to I-6.



Graph 1: Classification dendrogram showing grouping of survey quadrats and resulting 19 vegetation units

A description of the vegetation units, their extent (ha) within the survey area, and the floristic sites representative of each of them is presented in Table 15.

Table 15: Vegetation units defined and mapped for the survey area

	Vegetation unit		Extent (ha)	Floristic sites
Salt lake margins				
	L01	*Tecticornia* spp. Open to Closed Low Samphire Shrubland on salt lake margins	282.15	BGQ30 BGQ34 BGQ39 BGQ41
	L02	*Tecticornia* spp. Open to Sparse Low Samphire Shrubland over *Eragrostis falcata, E. pergracilis* Sparse Tussock Grassland on lower slopes of gypsum dunes adjacent to salt lake	97.72	BGQ03 BGQ06 BGQ43
Gypsum dunes				
	G01	*Cratystylis subspinescens* Mid Sparse Shrubland over *Maireana pyramidata* and *Tecticornia* sp. Low Sparse Chenopod Shrubland over mixed Sparse Tussock Grassland / Forbland on low stony rises adjacent to Samphire shrublands	70.63	BGQ32 BGQ42 BGQ45 BGQ46 BGQ47

	Vegetation unit		Extent (ha)	Floristic sites
	G02	*Eucalyptus striaticalyx* and/or *Casuarina pauper* Isolated Clumps of Trees over *Grevillea sarissa* subsp. *bicolor* Tall Sparse Shrubland over *Scaevola spinescens, Lycium australe* and *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and/or *Eragrostis falcata* Sparse Tussock Grassland and *Frankenia* sp. Forbland on gypsum (kopi) dunes adjacent to salt lake	111.08	BGQ01 BGQ02 BGQ04 BGQ05 BGQ33 KVQ35 KVQ36
Stony plains and lower hill slopes				
	H01	Mulga spp. Isolated Trees to Low Open Woodland over *Acacia tetragonophylla, Eremophila galeata* and *Hakea preissii* Tall Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopod Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland on stony plains and lower hill slopes	31.24	BGQ17 BGQ29 BGQ36 KVQ34
	H02	Mulga spp. and *Acacia doreta* (long phyllode form) Low Open Woodland to Low Isolated Trees over *Senna* sp. Meekatharra Mid Sparse to Open Shrubland on stony plains and lower hill slopes	31.06	KVQ22 KVQ40
Stony hill slopes, spurs and crests				
	H03	*Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens, Enneapogon polyphyllus* and *Aristida contorta* Sparse Tussock Grassland	8.83	BGQ22 BGQ25

	Vegetation unit		Extent (ha)	Floristic sites
	H04	*Eremophila galeata, E. forrestii* subsp. *forrestii, E. exilifolia* and *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Aristida contorta* Open Tussock Grassland on stony hill slopes, spurs and crests	33.34	BGQ37
	H05	*Acacia fuscaneura* Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Eremophila exilifolia* and *E. forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests	50.63	BGQ10 BGQ14
	H06	Mulga spp. and *Acacia doreta* (long phyllode form) Low Open Woodland with Isolated *Eremophila oldfieldii* subsp. *angustifolia* over *A. xanthocarpa* Tall Isolated Shrubs over *Eremophila exilifolia, E. forrestii* subsp. *forrestii* and *Senna artemisioides* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and *Maireana* spp. Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests	237.02	BGQ08 BGQ13 BGQ15 BGQ16 BGQ18 BGQ19 BGQ21 BGQ23 BGQ27 BGQ31 BGQ38 BGQ44
	H07	*Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse to Open Shrubland over *Senna* sp. Meekatharra and *S. artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Shrubland on stony hillslopes, spurs and crests	271.29	KVQ14 KVQ16 KVQ19 KVQ27 KVQ28

	Vegetation unit		Extent (ha)	Floristic sites
Drainage lines on stony hills				
	H08	Mulga spp. Low Open Woodland over *Senna* spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens* and *Cymbopogon ambiguus* Sparse Tussock Grassland	24.60	BGQ20 BGQ24
	H09	Mulga spp. Low Open to Closed Forest over *Acacia xanthocarpa* Tall Sparse to Open Shrubland over *Eremophila exilifolia* and *Senna* spp. Mid to Low Open Shrubland over *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hill slopes	52.13	KVQ20 KVQ24 KVQ29
Drainage lines on stony hardpan plains				
	P01	Mulga spp. Low Woodland to Low Open Forest over *Eremophila galeata, E. serrulata* and *Senna* spp. Mid Sparse to open Shrubland over *Cymbopogon obtectus* and *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hardpan plains	18.93	KVQ01 KVQ05 KVQ09
Stony hardpan plains				
	P02	Mulga spp. Low Open Woodland to Isolated Trees over *Eremophila pantonii* and *E. galeata* Tall Open to Sparse Shrubland over *Senna* sp. Meekatharra Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopods Low Open to Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland in drainage lines on stony hardpan plains	177.48	KVQ02 KVQ03 KVQ04 KVQ13 KVQ21 KVQ23 KVQ25 KVQ26 KVQ39

		Vegetation unit	Extent (ha)	Floristic sites
	P03	*Eremophila* spp. Tall Open Shrubland over Senna spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland over *Aristida contorta* Sparse Tussock Grassland	86.38	KVQ17 KVQ41
Red sand dunes				
	S01	Mixed Isolated Trees and Shrubs including *Santalum lanceolatum, Rhagodia drummondii, Scaevola spinescens* and *Alyogyne pinoniana* over *Aristida holathera* var. *holathera* Open Tussock Grassland on red sand dune crests and slopes	5.86	BGQ07
Sand flats and low sandy rises				
	S02	Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over a mixed Open Tussock Grassland on sand plains and low undulating sand hills and sandy rises	93.16	BGQ09 BGQ11 BGQ12 BGQ26 BGQ28 BGQ35 BGQ48 BGQ51 KVQ06 KVQ07

	Vegetation unit		Extent (ha)	Floristic sites
Flat sandplains over hardpan				
	S03	Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda, Monachather paradoxus* and *Eriachne helmsii* Tussock Grassland on sand over hardpan plains	364.09	BGQ39 BGQ40 BGQ50 KVQ08 KVQ10 KVQ11 KVQ12 KVQ15 KVQ18 KVQ30 KVQ31 KVQ32 KVQ33 KVQ37 KVQ38
Cleared / highly modified				
	C/M	Highly modified and cleared areas devoid of native vegetation - includes, roads, tracks, buildings, mining infrastructure, historical pits, processing areas and camps	162.48	N/A
	Bare scald	Bare areas of mud flats / salt lake devoid of vegetation	44.96	N/A

4.2.2.2 Multivariate analysis of floristic data

4.2.2.2.1 Data compatibility

Floristic data from the 92 quadrats sampled for the assessment were considered compatible with the Perseverance Greenstone Belt regional dataset due to consistencies in quadrat size (20 m × 20 m), nomenclature, species-richness (indicative of sampling effort) and vegetation condition between the test sites and the regional dataset.

4.2.2.2.2 Hierarchical cluster analysis

The Hierarchical Cluster Analyses was undertaken using PRIMERv7 comparing the floristics of each floristic quadrat from the current survey (test sites) with the 50 site Perseverance Greenstone Belt regional dataset.

4.2.2.2.2.1 Survey quadrats (test sites)

An analysis was initially run on the 92 test quadrats from the current survey (Graph 2) to determine existing groupings based on floristic similarities between sites. Physiographic unit (landform) was added as a factor to investigate the influence of landscape position on floristic composition. The outcomes of this analysis assisted in the vegetation unit mapping for the survey area. Graph 2 shows the 92 quadrat sites forming 20 statistically significant clusters. These groups of sites were well correlated landform.

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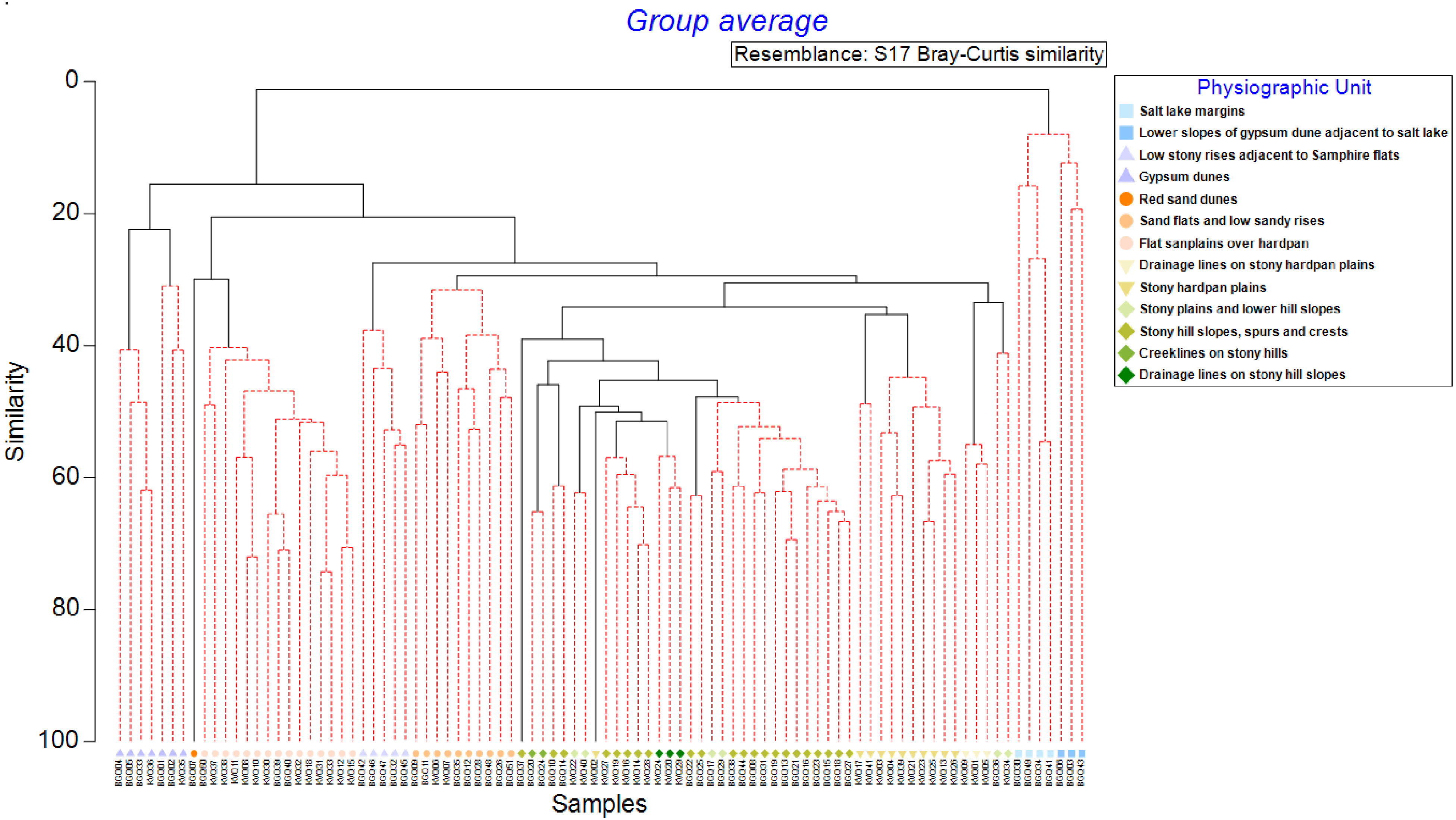
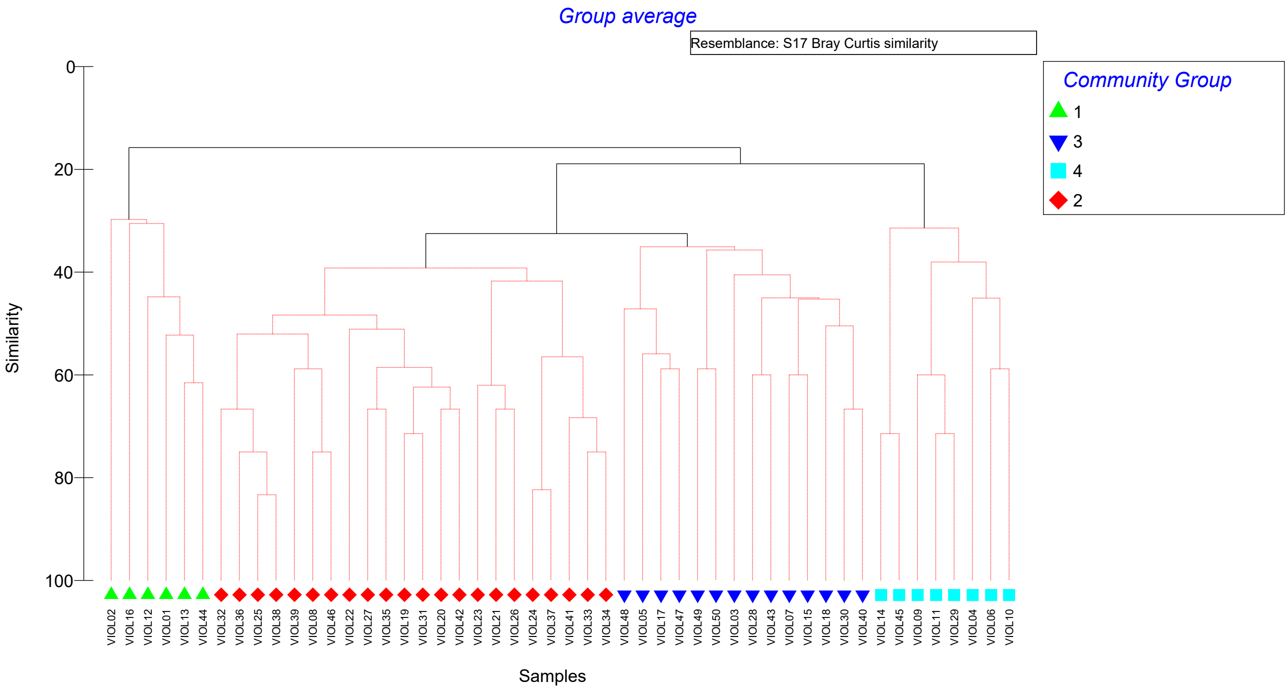


Graph 2: Classification dendrogram showing grouping of the 92 survey quadrats according to floristics and in relation to physiographic unit

4.2.2.2.2.2 Perseverance Greenstone Belt regional dataset (Meissner and Wright 2010)

A Hierarchical Cluster Analysis was run on the Perseverance Greenstone Belt regional dataset to see if the output showed similar groupings to those of the original study.

The similarity profile (SIMPROF) analysis shows identical clustering of the sites to that of the original Meissner and Wright (2010) study, with the SIMPROF analysis identifying four significant plant community groups ($p<0.05$; Clarke and Gorley 2015) as it had in the original study (Graph 3).



Graph 3 Classification dendrogram showing grouping of Perseverance Greenstone Belt regional survey quadrats (excluding annuals and singletons) identical to the original analysis, forming four statistically significant clusters which form the basis for their four community types

4.2.2.2.2.3 Combined Bellevue and Perseverance Greenstone Belt regional dataset

The Perseverance Greenstone Belt regional (50 quadrat) dataset was combined with the 37 test sites that occurred on the stony hills within the survey area (sand plain, hardpan flat, and gypsum sites were excluded) and a Hierarchical Cluster Analysis performed. The output from the analysis shows all 37 of the test sites falling within the regional sites but forming a separate cluster within the dendrogram indicating that the test group is most similar floristically to Community Group 4 than it is to the other three Community Groups (Graph 4).

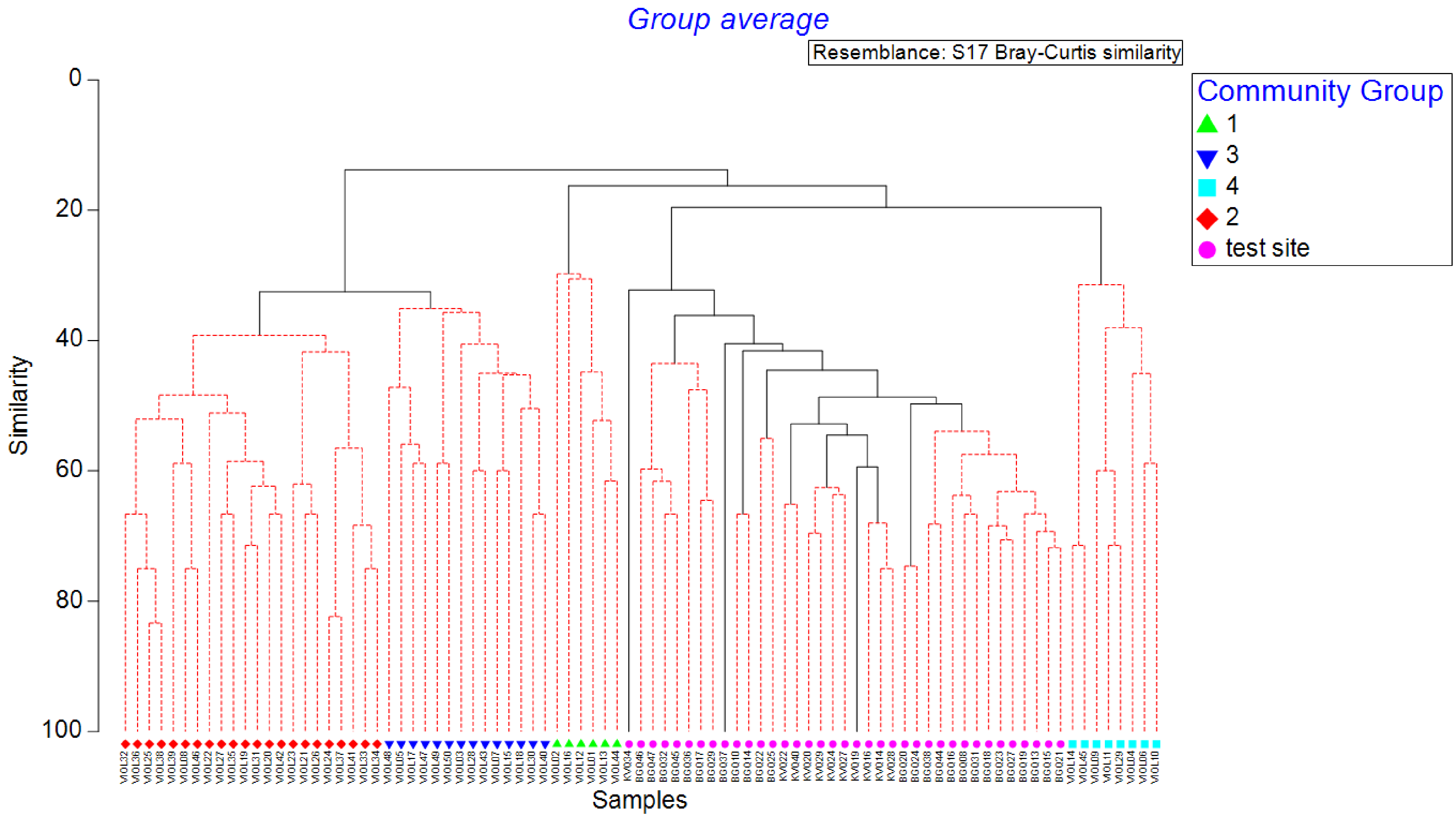
In an effort to reduce any disruption that may be caused by adding a large number of test sites to a regional dataset, two representative stony hill test sites (KVQ19 and KVQ28) were added to the regional dataset separately and similarly analysed. The resulting dendrogram shows both test sites had the greatest affinity floristically to Perseverance Greenstone Belt Community Group 1 (Graph 5) but formed a significantly distinct group.

Community Groups 1 and 4 are both associated with metabasalt and mafic substrates (which occur extensively within the survey area), whereas Community Groups 2 and 3 are associated with ironstone lithologies (Meissner and Wright 2010).

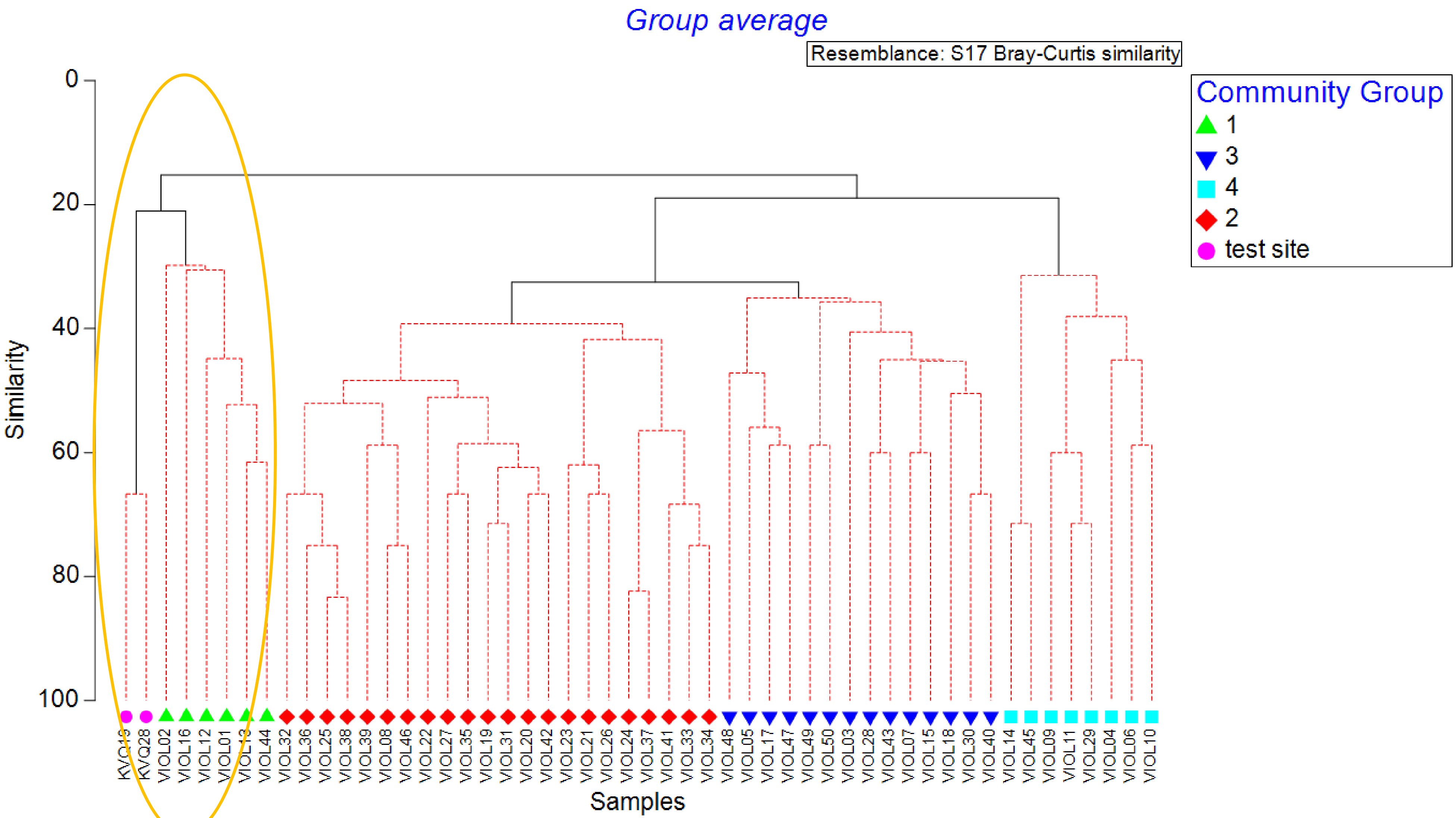
Community Group 1 is associated with the slopes and crests of metabasalt derived hills. The vegetation is described by Meissner and Wright (2010) as *Acacia* cf. *resinimarginea* and *A. grasbyi* (equivalent to *A. doreta* (long phyllode form) in our survey area) Tall Sparse Shrubland over *Senna. artemisioides* subsp. *helmsii* and *Senna* sp. Meekatharra (E. Bailey 1–26) Sparse Shrubland. Key indicator species for this community type are *A.* cf. *resinimarginea*, *S. artemisioides* subsp. *helmsii* and *Acacia aneura* var. *fuliginea* (now *Acacia fuscaneura*).

Community Group 4 is associated with lower slopes and colluvium derived from metabasalt rocks. The vegetation of this community is described by Meissner and Wright (2010) as Mulga Tall Sparse Shrublands (with other *Acacia* spp.) over *Sida ectogama*, *Senna*. sp. Meekatharra (E. Bailey 1–26) and *Eremophila pantonii* Open to Sparse Shrublands over *Maireana georgei* and *M. triptera* Sparse Chenopod Shrublands. Key indicator species are *Eremophila oldfieldii, M. triptera, E. pantonii, Acacia oswaldii, Hakea preissii* and *A. tetragonophylla*.

Indicator and characteristic species of both these Perseverance Greenstone Belt metabasalt derived communities (Community Groups 1 and 4) were common and widespread throughout the stony hill vegetation recorded within the survey area. However, despite these clear floristic similarities, the fact that the test sites formed groups significantly distinct from the four regional survey community groups defined by Meissner and Wright (2010) suggests that the vegetation of the basalt stony hills within the survey area likely represents one or more (as yet undescribed) community groups within the Perseverance Greenstone Belt, similar to, but distinct from the four defined community types.



Graph 4 Classification dendrogram showing grouping of Perseverance Greenstone Belt regional survey quadrats combined with the 37 stony hill test sites (excluding annuals and singletons)



Graph 5 **Classification dendrogram showing grouping of Perseverance Greenstone Belt regional survey quadrats combined with the two representative stony hill test sites (KVQ19 and KVQ28)**

4.2.2.3 Vegetation condition

Vegetation condition within the survey area ranged from Very Good throughout much of the intact vegetation (on the stony hills, sandy rises and undulating plains and hardpan flats, drainage lines and on the gypsum dunes and samphire flats adjacent to Lake Miranda), to Completely Degraded on areas of the stony hills and plains subject to historical mining activities including the old tailings storage facility, open pits, waste rock dumps, access roads and exploration camp. Much of the survey area has been subjected to some level of clearing or disturbance at some stage in its mining history, and extant vegetation comprises a range of revegetation ages. There is not much of the survey area which has not been impacted by mining-related activities or modified to some degree over the past century. Even areas recorded for the current assessment as Very Good in condition showed signs of human impact. Very Good is defined in EPA (2016) as *some relatively slight signs of damage caused by human activities since European settlement.* It is likely that much of the hill crest and slope vegetation has undergone selective felling and clearing of tree species including mulga and eucalypts as a source of timber for construction of buildings and other structures associated with prospecting and mining.

A total of nine weed species were recorded for the survey area (Table 14). These weed species were recorded at low densities throughout most of the more disturbed portions of the survey area, however buffel grass (*Cenchrus ciliaris*) was significantly denser along the verges adjacent to roads and tracks, particularly within the Mulga sand plain vegetation represented by vegetation units S02 and S03. Ruby dock was present in greater densities on the banks of the waste rock dumps and around the open pits in the areas mapped as C/M (Cleared/Modified). The area (ha) of each condition grade is presented in Table 16.

The vegetation condition mapping is presented in Figures J-1 to I-5.

Table 16: Vegetation condition within the survey area

Vegetation condition		Hectares (ha)	Percentage (%)
P	Pristine	0	0
E	Excellent	0	0
VG	Very Good	1416.45	62.81
G-VG	Good to Very Good	414.81	18.39
G	Good	127.59	5.66
P	Poor	117.69	5.22
D	Degraded	16.83	0.75
CD	Completely Degraded	161.70	7.17

5 DISCUSSION

5.1 Floristic diversity and representation

In assessing the conservation significance of flora within the survey area, consideration is given to rarity, biodiversity, endemism and representativeness of the flora in the area.

5.1.1 Rarity and endemism

The rarity of the flora was assessed via the various categories of TF (protected under the BC Act and under the EPBC Act) and PF (listed by DBCA).

No TF or putative new taxa were recorded within the survey area for the current survey.

Three PF species listed by the DBCA were recorded within the survey area:

1. *Grevillea inconspicua* (Priority 4). Five populations of *G. inconspicua* were recorded on the metabasalt derived stony hills within the survey area with between 50 and several hundred individuals recorded for each population. A total of 751 individuals were recorded within the survey area. This is considered a fairly comprehensive census of this species within the survey area. The DBCA Threatened and Priority Flora database records a total number of 8,263 plants known regionally. The count of 751 individuals within the survey area therefore represents 9% of the total regional population.
2. *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (Priority 3). One record of *H.* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) was recorded at one floristic site (KVQ05) located in a drainage line on a stony hardpan plain at Kathleen Valley.
3. *Goodenia lyrata* (Priority 3). One record of *G. lyrata* was recorded within the survey area BGQ15 located on the slopes of a low stony hill.

One taxon of ‘other’ conservation significance, *Eriachne aristidea*, recorded at one location within the survey area. It is considered to be conservation significant because this record represents a range extension to the south of its known range.

Rarity of the flora within the survey area was assessed as moderate.

5.2 Biodiversity

A total of 345 vascular flora taxa (species, subspecies, varieties and forms) were recorded from 92 quadrats and 20 relevés of which 336 were native taxa. A total of 2,059 native vascular flora taxa are known for the East Murchison IBRA sub region (WAH 2020b), so the number of native taxa recorded for the survey area represents 16% of the total known for the region.

Floral biodiversity within the 2,255.06 ha survey area is assessed as high.

5.3 Vegetation conservation significance

5.3.1 Bioregional representation

On a regional scale, the survey area is mapped as Vegetation Associations 39; 125; and 676. All three of these vegetation associations have greater than 90% of their pre-European extent remaining within the state and the MUR01 subregion, and between 3.5% and 7.2% of their present extents are protected within the conservation estate.

5.3.2 Commonwealth-listed threatened ecological communities

No known records of any Commonwealth-listed TECs occur within the survey area, nor is any of the vegetation described and mapped for the survey area likely to represent a Commonwealth-listed TEC.

5.3.3 State-listed threatened and priority ecological communities

No known records of any state-listed TECs occur within the survey area, nor is any of the vegetation described and mapped for the survey area likely to represent a State-listed TEC.

One State-listed PEC occurs within the survey area - Violet Range (Perseverance Greenstone) BIF Priority 1 PEC. Part of the 2,000 m buffer for a record of the Lake Miranda East Calcrete PEC, intersects a south-eastern portion of the survey area (Figure G), however the community itself does not occur within the survey area. The nearest record of this community lies approximately 1,000 m to the east of, and outside, the M36/25 tenement boundary.

5.3.3.1 Violet Range (Perseverance Greenstone) BIF PEC (Priority 1)

The Violet Range (Perseverance Greenstone) BIF Priority 1 PEC occupies a total of 19,256.21 ha across its mapped extent including its 500 m buffer. The survey area occupies 1,443.69 ha (7.5%) of the PEC's total extent. A significant portion of the PEC within the survey area is arguably in the worst condition of any area of the PEC due to historical impacts caused by past mining activities at the Bellevue site. In an assessment of the Mount Keith Satellite project located immediately to the north of the survey area, Western Botanical (2017) suggested that the PEC likely extends both north and south of the current mapped extent for a length of approximately 82 km. Their study concluded that the PEC occupies a much larger area than is currently acknowledged and documented and that the extent and boundaries were in need of further investigation.

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FIGURES

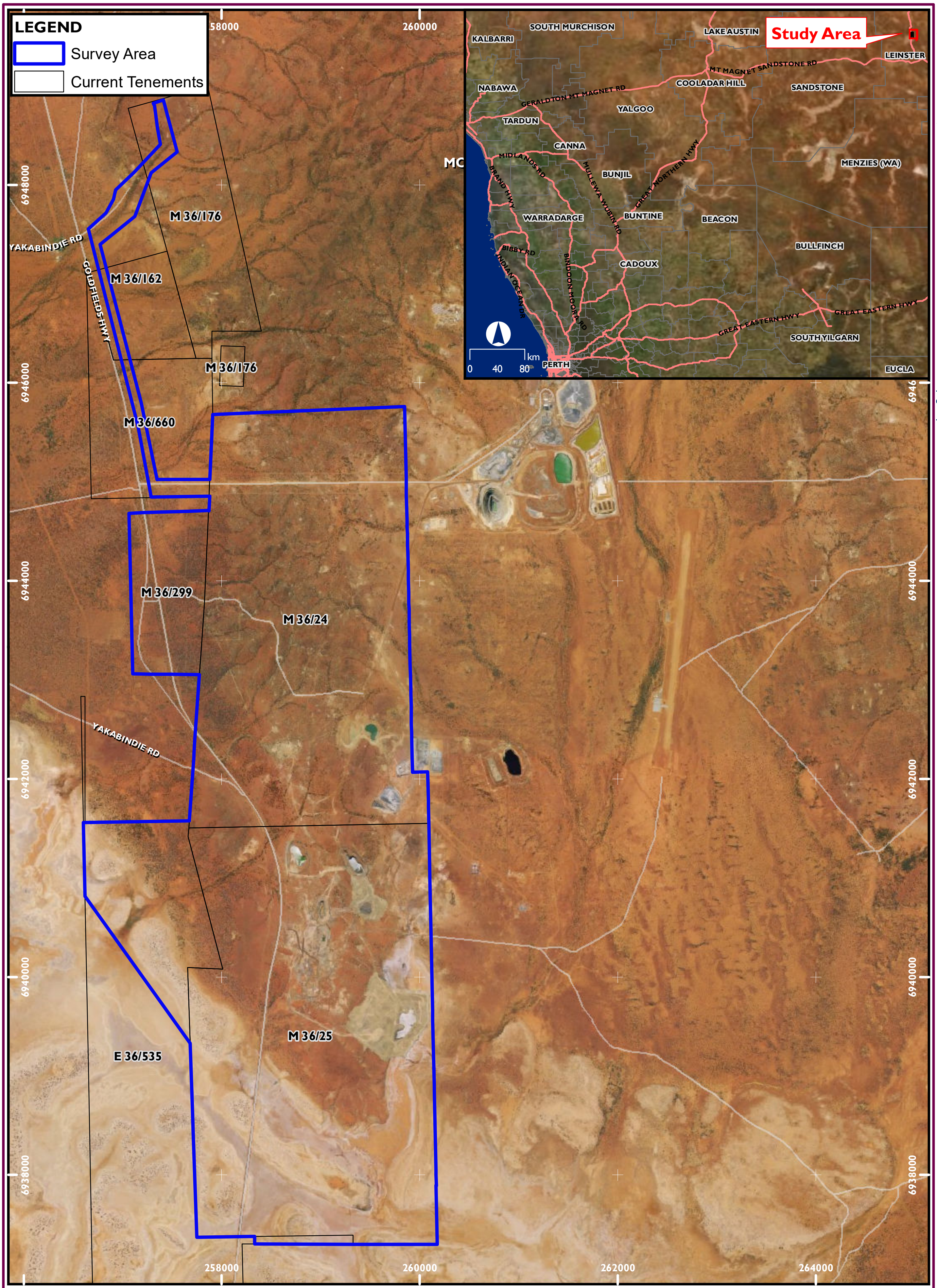

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Figure A

Regional location

GDA 1994 MGA Zone 51

0 500 1,000 m

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Doc Number: A
Date: 19.02.20
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Created by: MA
Source: Imagery - Landgate

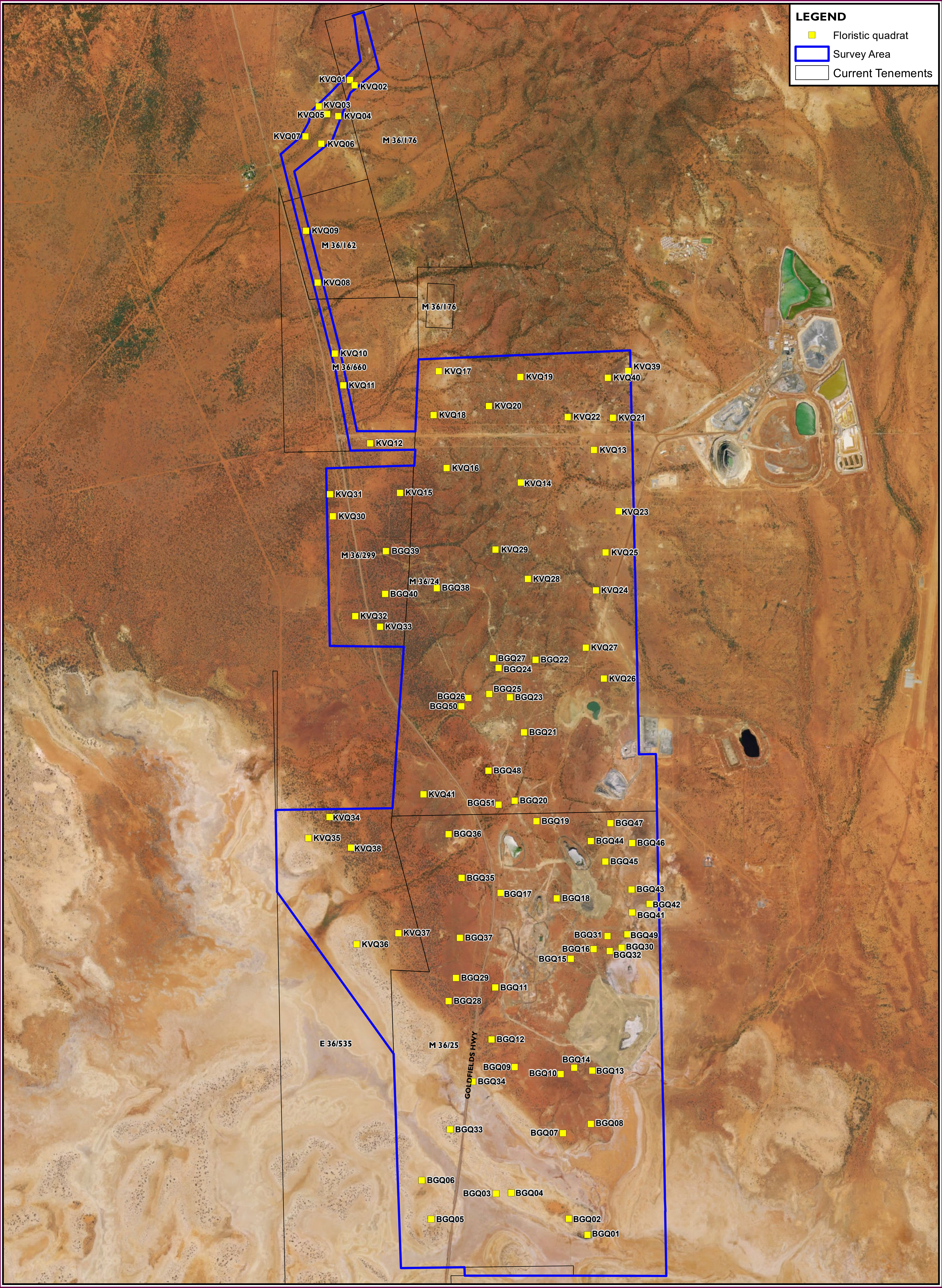

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Figure B

Floristic quadrat locations

GDA 1994 MGA Zone 51

0 0.25 0.5 1 km

Job Number: N18041-004
Doc Number: B
Date: 05.02.20
Scale: 1:30,500 @ A3
Created by: MA
Source: Cadastre - 2020 Orthophoto - Landgate

rps

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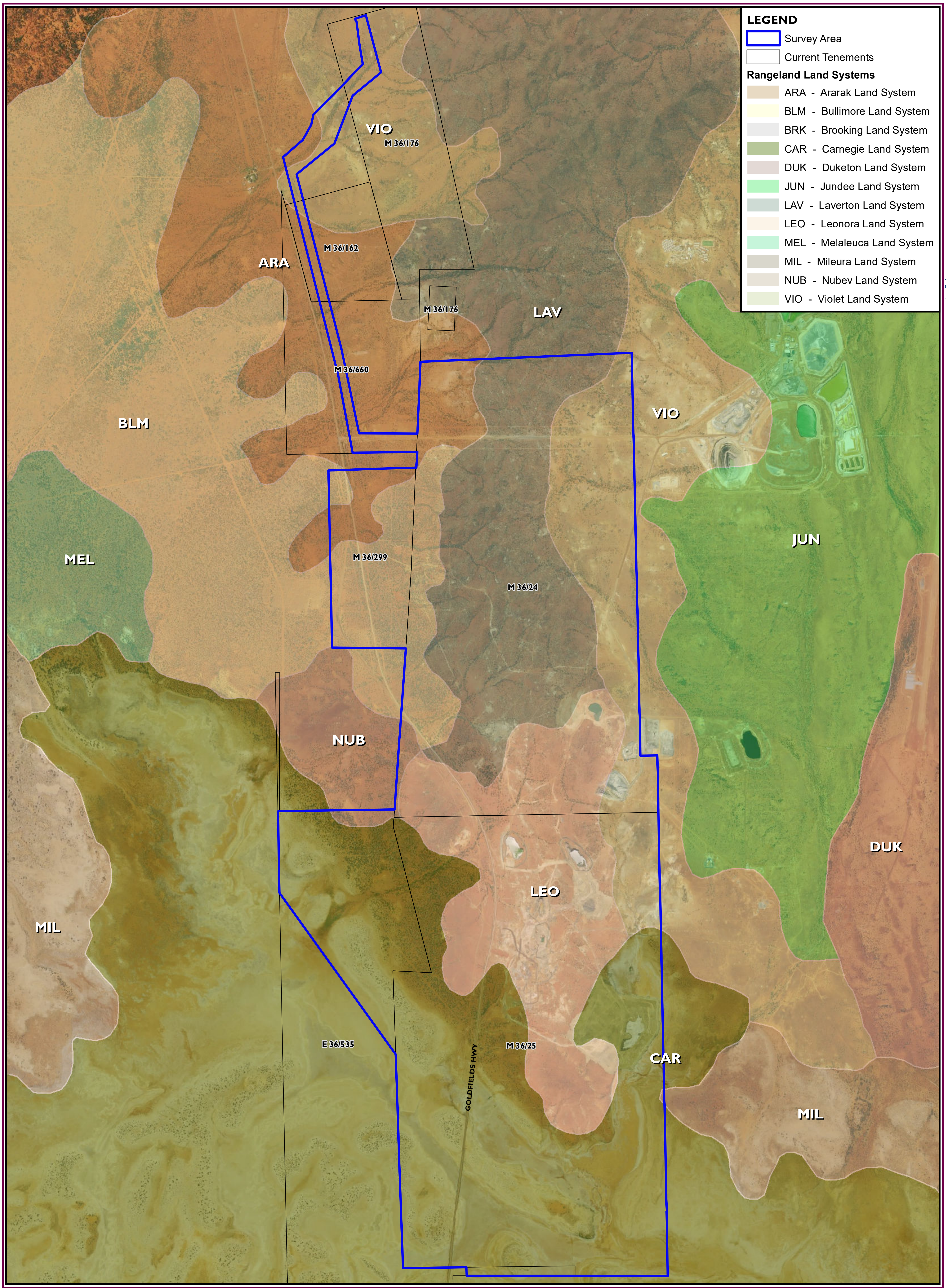

Figure C

Land system mapping

GDA 1994 MGA Zone 51

0 0.25 0.5 1 km

Job Number: N18041-004
Doc Number: C
Date: 19.02.20
Scale: 1:30,500 @ A3
Created by: MA
Source: Orthophoto - Landgate

rps

Document Path: G:\Jobs\N Jobs\N18041 - Bellevue Gold\Figures N18041-004\N18041-004_G_FigC Land System Mapping_200219.mxd

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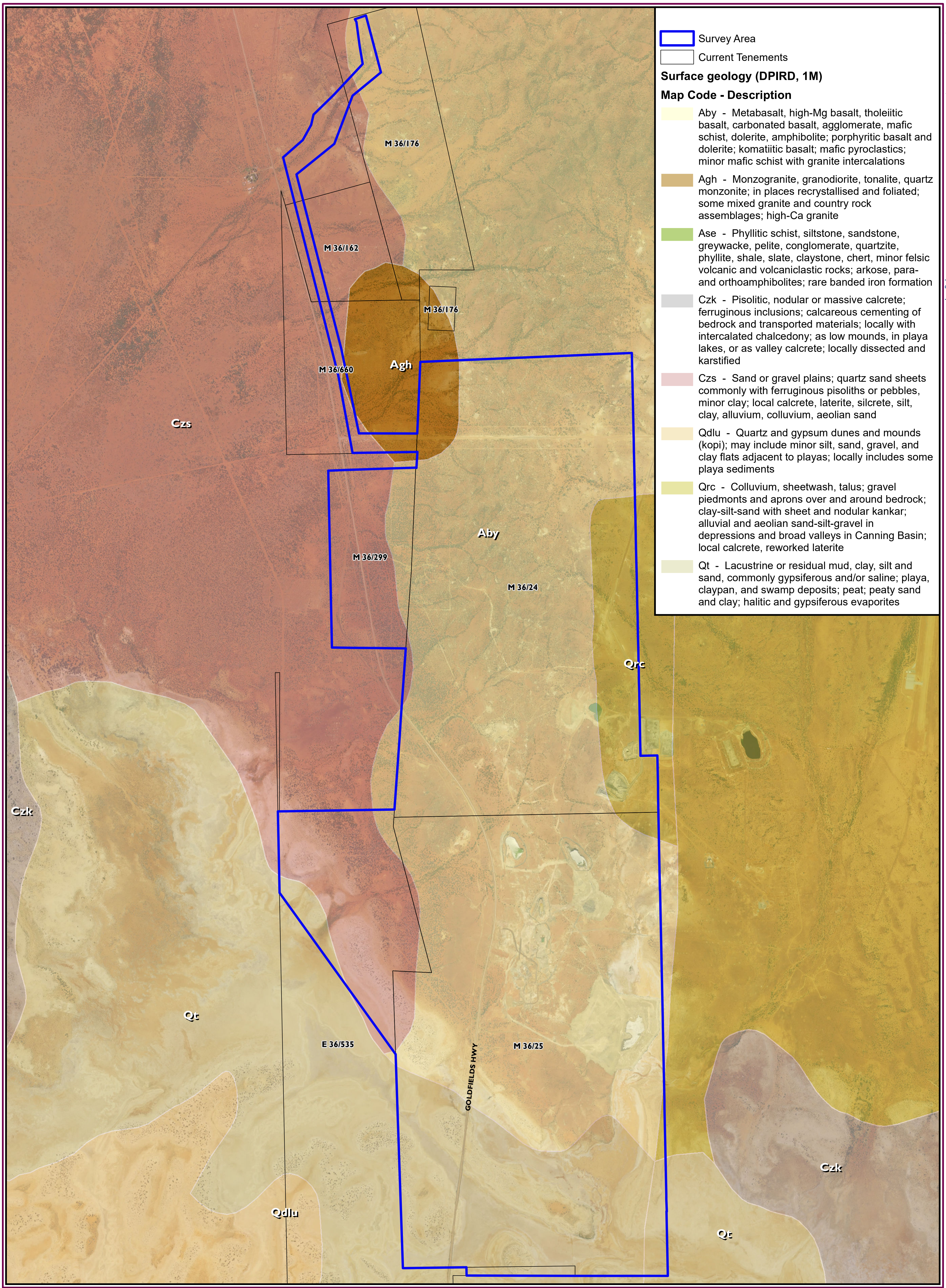

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Figure D

Surface geology mapping

GDA 1994 MGA Zone 51

0 0.25 0.5 1 km

Job Number: N18041-004
Doc Number: D
Date: 19.02.20
Scale: 1:30,500 @ A3
Created by: MA
Source: Orthophoto - Landgate

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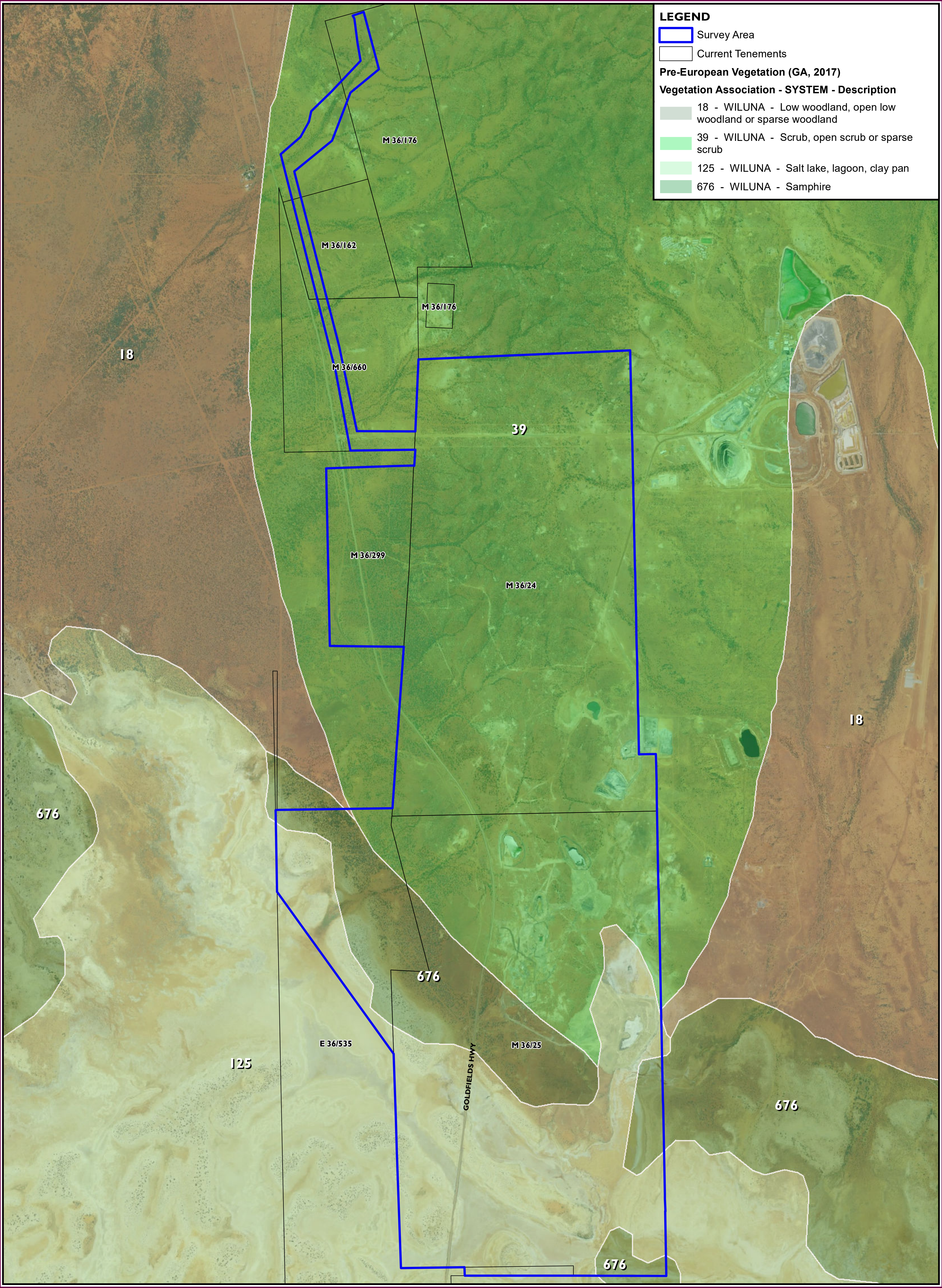

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Figure E

Regional vegetation mapping

GDA 1994 MGA Zone 51

0 0.25 0.5 1 km

Job Number: N18041-004
Doc Number: E
Date: 19.02.20
Scale: 1:30,500 @ A3
Created by: MA
Source: Orthophoto - Landgate

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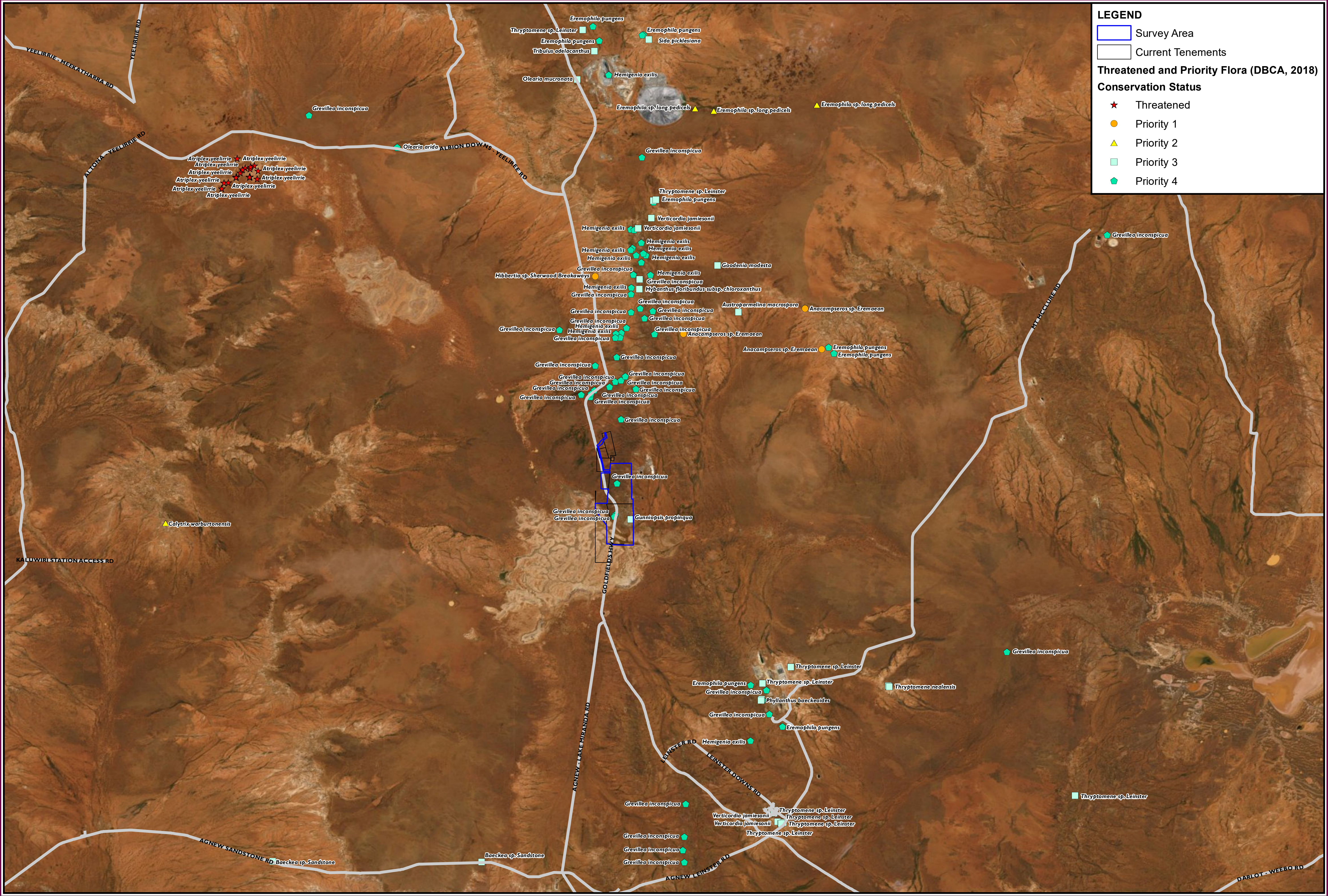

Figure F

Conservation significant flora (DBCA)

Job Number: N18041-004
Doc Number: F
Date: 19.02.20
Scale: 1:350,000 @ A3
Created by: MA
Source: Orthophoto - Esri World Imagery

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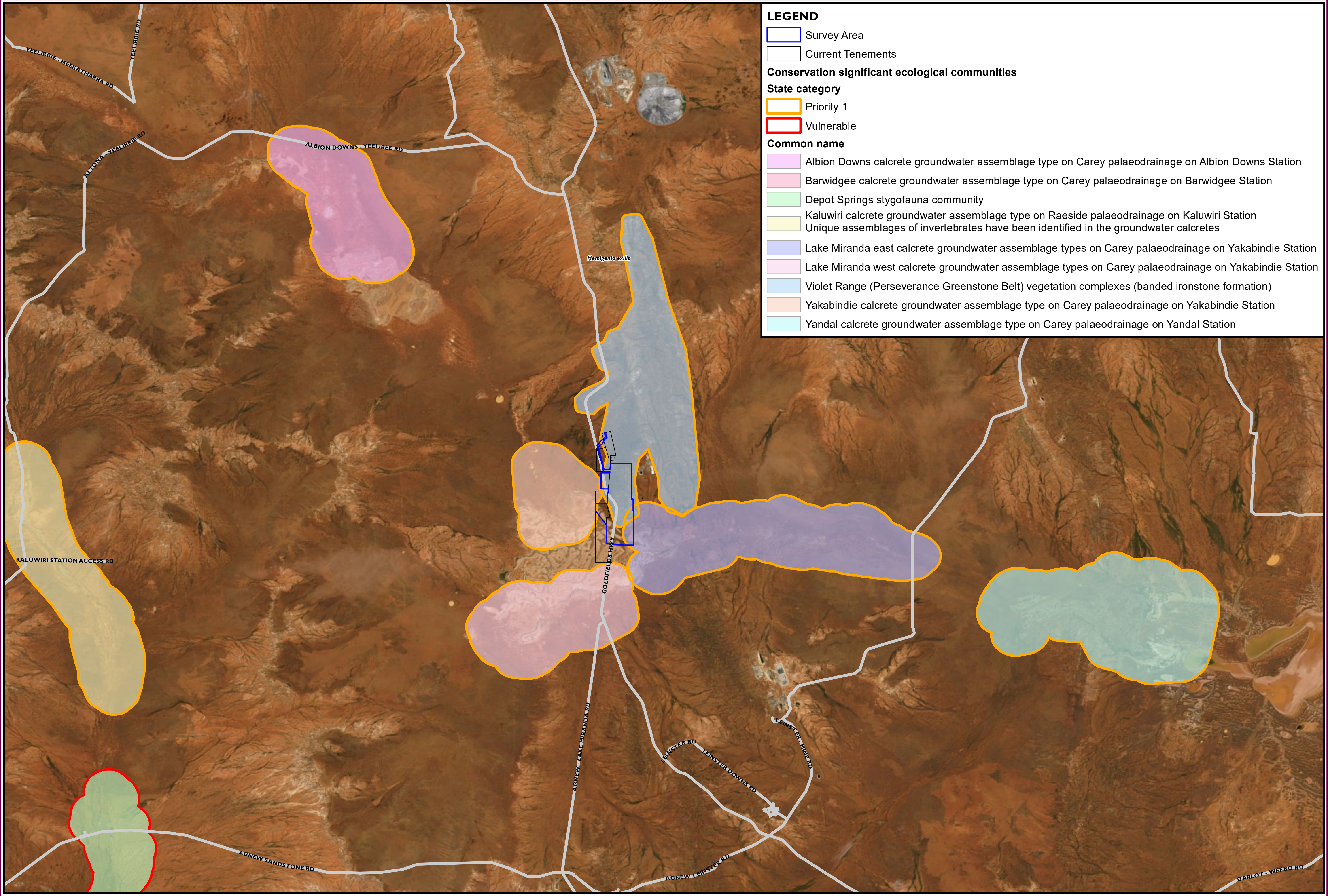

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Figure G

Conservation significant ecological communities (DBCA)

GCS GDA 1994

0 2.5 5 10 km

Job Number: N18041-004
Doc Number: G
Date: 19.02.20
Scale: 1:350,000 @ A3
Created by: MA
Source: Orthophoto - Esri World Imagery

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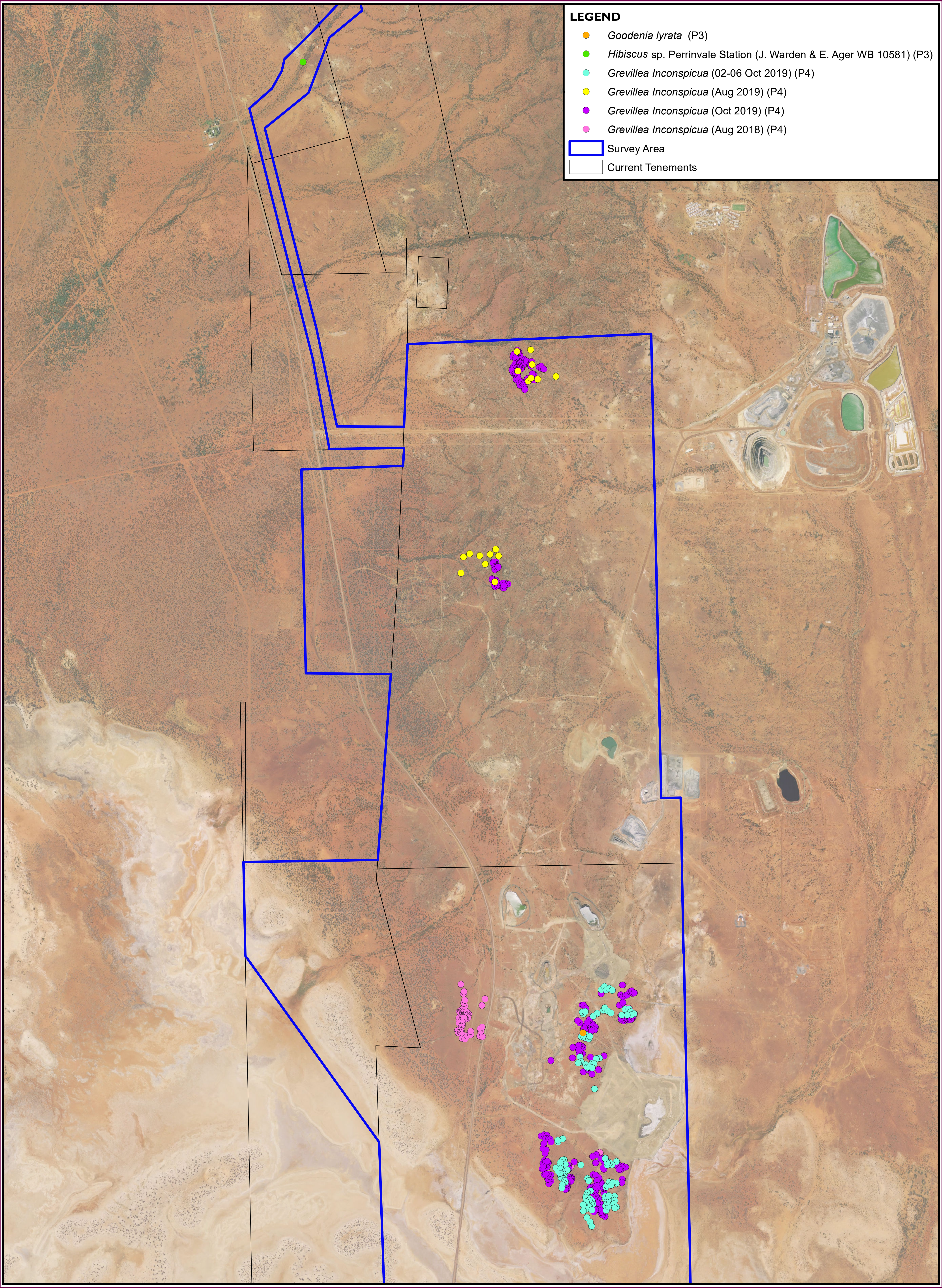

Figure H

Conservation significant flora (RPS)

GDA 1994 MGA Zone 51

0 0.25 0.5 1 km

Job Number: N18041-004
Doc Number: H
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Created by: MA
Source: Cadastre - 2020 Orthophoto - Landgate

Document Path: G:\Jobs\N Jobs\N18041 - Bellevue Gold\Figures N18041-004\N18041-004_G_FigH RPS Conservation significant flora_200225.mxd

VEGETATION UNIT LEGEND	
Veg Unit	**Description**
Salt lake margins	
L01	*Tecticornia* spp. Open to Closed Low Samphire Shrubland on salt lake margins
L02	*Tecticornia* spp. Open to Sparse Low Samphire Shrubland over *Eragrostis falcata, E. pergracilis* Sparse Tussock Grassland on lower slopes of gypsum dunes adjacent to salt lake
Gypsum dunes	
G01	*Cratystylis subspinescens* Mid Sparse Shrubland over *Maireana pyramidata* and *Tecticornia* sp. Low Sparse Chenopod Shrubland over mixed Sparse Tussock Grassland / Forbland on low stony rises adjacent to Samphire shrublands
G02	*Eucalyptus striaticalyx* and/or *Casuarina pauper* Isolated Clumps of Trees over *Grevillea sarissa* subsp. *bicolor* Tall Sparse Shrubland over *Scaevola spinescens, Lycium australe* and *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and/or *Eragrostis falcata* Sparse Tussock Grassland and *Frankenia* sp. Forbland on gypsum (kopi) dunes adjacent to salt lake
Stony plains and lower hill slopes	
H01	Mulga spp. Isolated Trees to Low Open Woodland over *Acacia tetragonophylla, Eremophila galeata* and *Hakea preissii* Tall Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopod Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland on stony plains and lower hill slopes
H02	Mulga spp. and *Acacia doreta* (long phyllode form) Low Open Woodland to Low Isolated Trees over *Senna* sp. Meekatharra Mid Sparse to Open Shrubland on stony plains and lower hill slopes
Stony hill slopes, spurs and crests	
H03	*Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens, Enneapogon polyphyllus* and *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
H04	*Eremophila galeata, E. forrestii* subsp. *forrestii, E. exilifolia* and *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Aristida contorta* Open Tussock Grassland on stony hill slopes, spurs and crests
H05	*Acacia fuscaneura* Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Eremophila exilifolia* and *E. forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
H06	Mulga spp.and *Acacia doreta* (long phyllode form) Low Open Woodland with Isolated *Eremophila oldfieldii* subsp. *angustifolia* over *A. xanthocarpa* Tall Isolated Shrubs over *Eremophila exilifolia, E. forrestii* subsp. *forrestii* and *Senna artemesioides* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and *Maireana* spp. Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hill slopes, spurs and crests
H07	*Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse to Open Shrubland over *Senna* sp. Meekatharra and *S. artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Shrubland on stony hillslopes, spurs and crests
Drainage lines on stony hills	
H08	Mulga spp. Low Open Woodland over *Senna* spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Enneapogon caerulescens* and *Cymbopogon ambiguus* Sparse Tussock Grassland in drainage lines on stony hill slopes
H09	Mulga spp. Low Open to Closed Forest over *Acacia xanthocarpa* Tall Sparse to Open Shrubland over *Eremophila exilifolia* and *Senna* spp. Mid to Low Open Shrubland over *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hill slopes
Drainage lines on stony hardpan plains	
P01	Mulga spp. Low Woodland to Low Open Forest over *Eremophila galeata, E. serrulata* and *Senna* spp. Mid Sparse to open Shrubland over *Cymbopogon obtectus* and *Aristida contorta* Sparse to Open Tussock Grassland in drainage lines on stony hardpan plains
Stony hardpan plains	
P02	Mulga spp. Low Open Woodland to Isolated Trees over *Eremophila pantonii* and *E. galeata* Tall Open to Sparse Shrubland over *Senna* sp. Meekatharra Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopods Low Open to Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hardpan plains
P03	*Eremophila* spp. Tall Open Shrubland over Senna spp. Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland over *Aristida contorta* Sparse Tussock Grassland on stony hardpan plains
Red sand dunes	
S01	Mixed Isolated Trees and Shrubs including *Santalum lanceolatum, Rhagodia drummondii, Scaevola spinescens* and *Alyogyne pinonia* over *Aristida holathera* var. *holathera* Open Tussock Grassland on red sand dune crests and slopes
Sand flats and low sandy rises	
S02	Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over a mixed Open Tussock Grassland on sand plains and low undulating sand hills and sandy rises
Flat sandplains over hardpan	
S03	Mulga spp. Low Open Woodland to Low Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda, Monachather paradoxus* and *Eriachne helmsii* Tussock Grassland on sand over hardpan plains
Cleared / highly modified	
C/M	Highly modified and cleared areas devoid of native vegetation - includes, roads, tracks, buildings, mining infrastructure, historical pits, processing areas and camps

Figure I-1

Vegetation units legend

Job Number: N18041-004
Doc Number: I-1
Date: 27.02.2020
Scale: Map NTS @ A4
Created by: TO
Source: Imagery - Landgate

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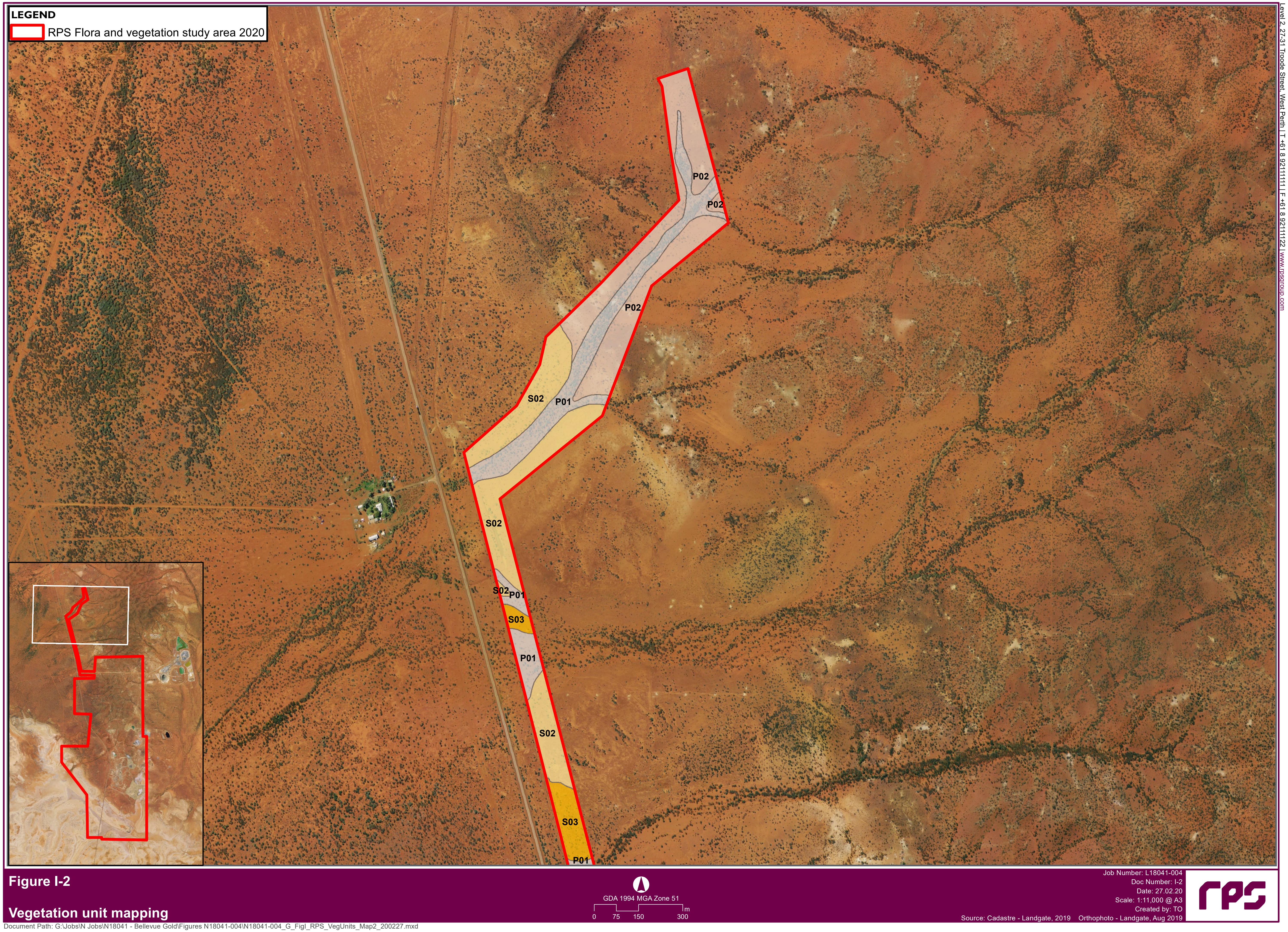

Figure I-2

Vegetation unit mapping

Job Number: L18041-004
Doc Number: I-2
Date: 27.02.20
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Created by: TO
Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

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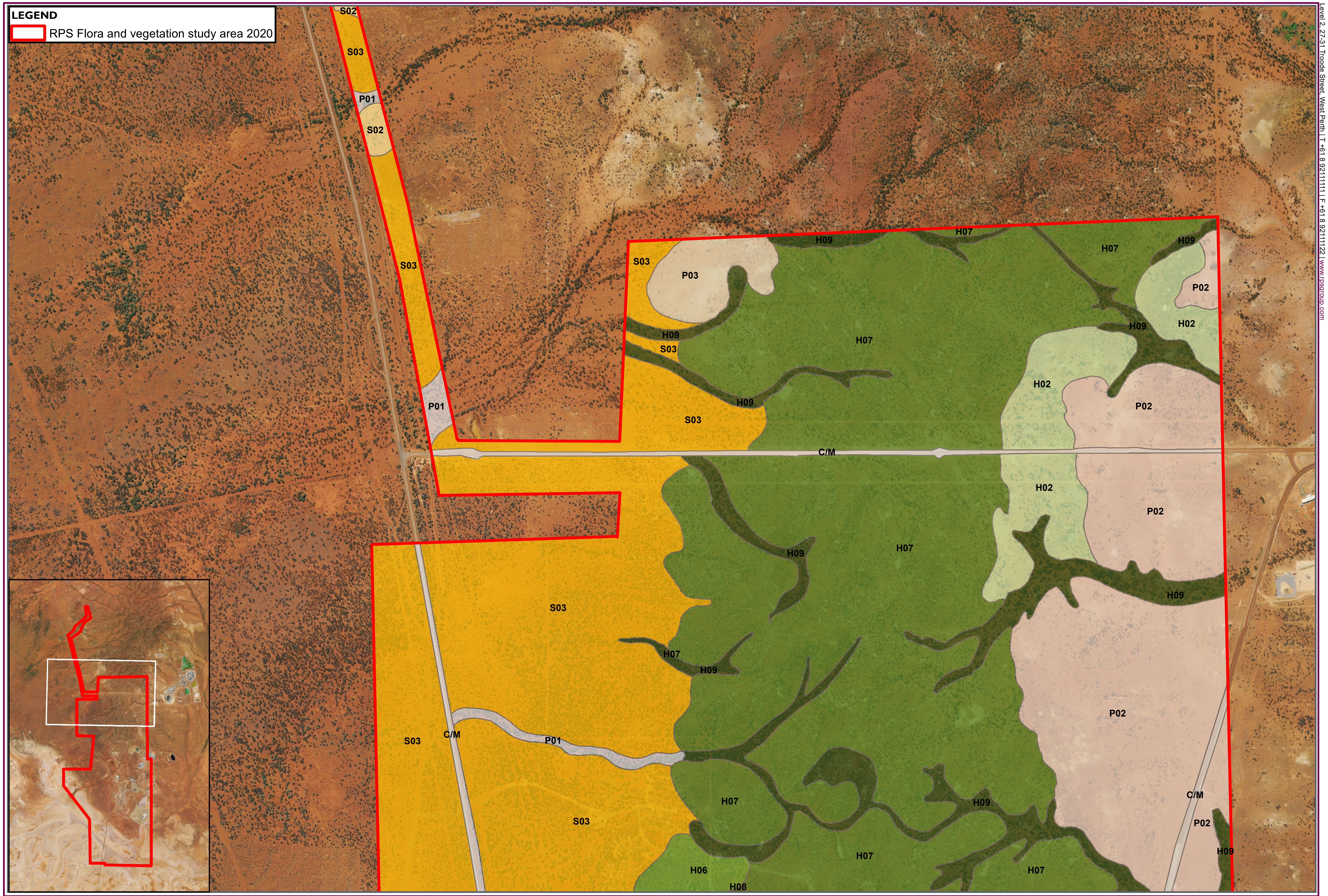

Figure I-3

Vegetation unit mapping

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Doc Number: I-3
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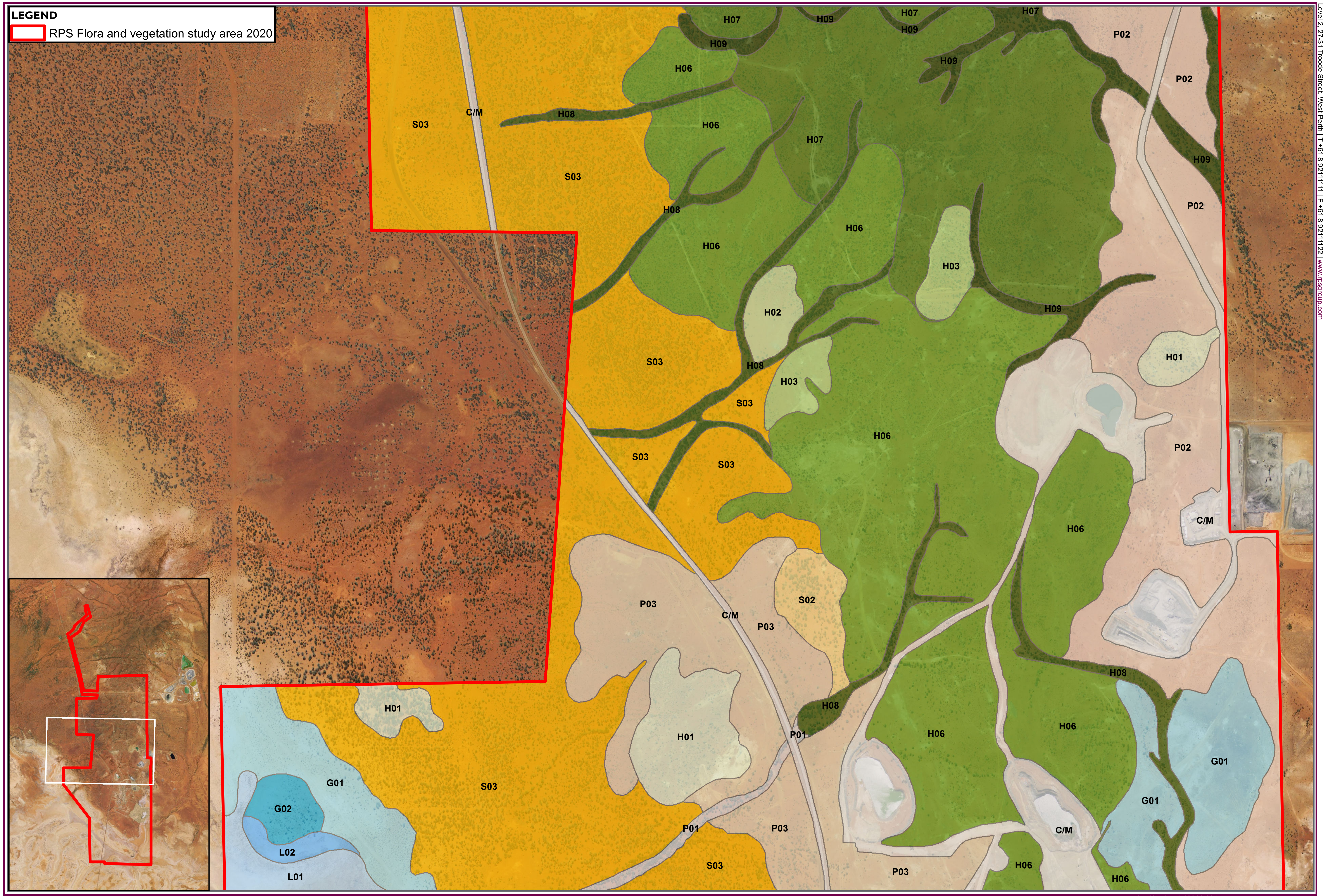

Figure I-4

Vegetation unit mapping

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Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

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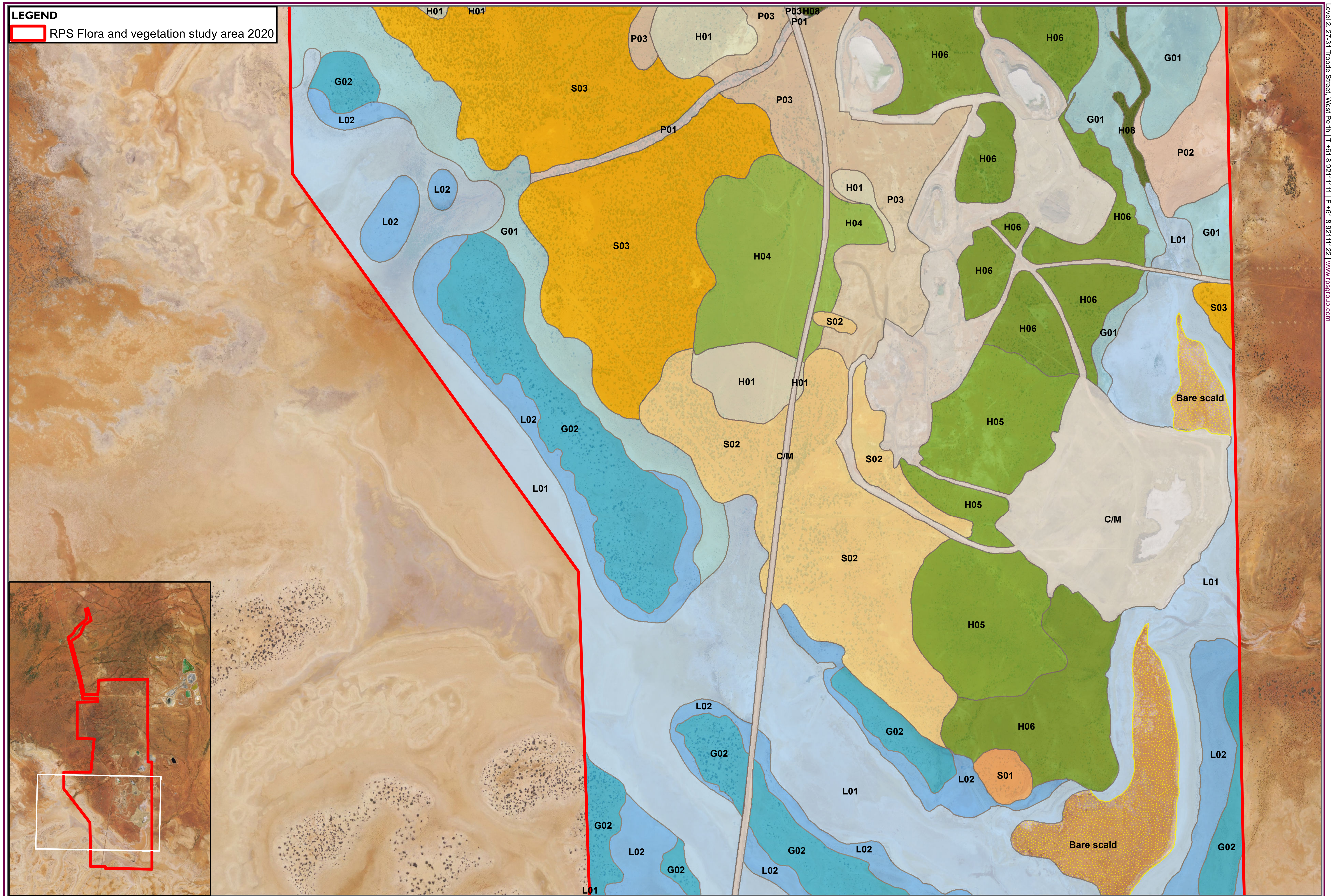

Figure I-5

Vegetation unit mapping

GDA 1994 MGA Zone 51

0 75 150 300 m

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Doc Number: I-5
Date: 27.02.20
Scale: 1:12,510 @ A3
Created by: TO

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

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Document Path: G:\Jobs\N Jobs\N18041 - Bellevue Gold\Figures N18041-004\N18041-004_G_FigI_RPS_VegUnits_Map5_200227.mxd

Figure I-6

Vegetation unit mapping

GDA 1994 MGA Zone 51

0 75 150 300 m

Job Number: L18041-004
Doc Number: I-6
Date: 27.02.20
Scale: 1:12,510 @ A3
Created by: TO

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

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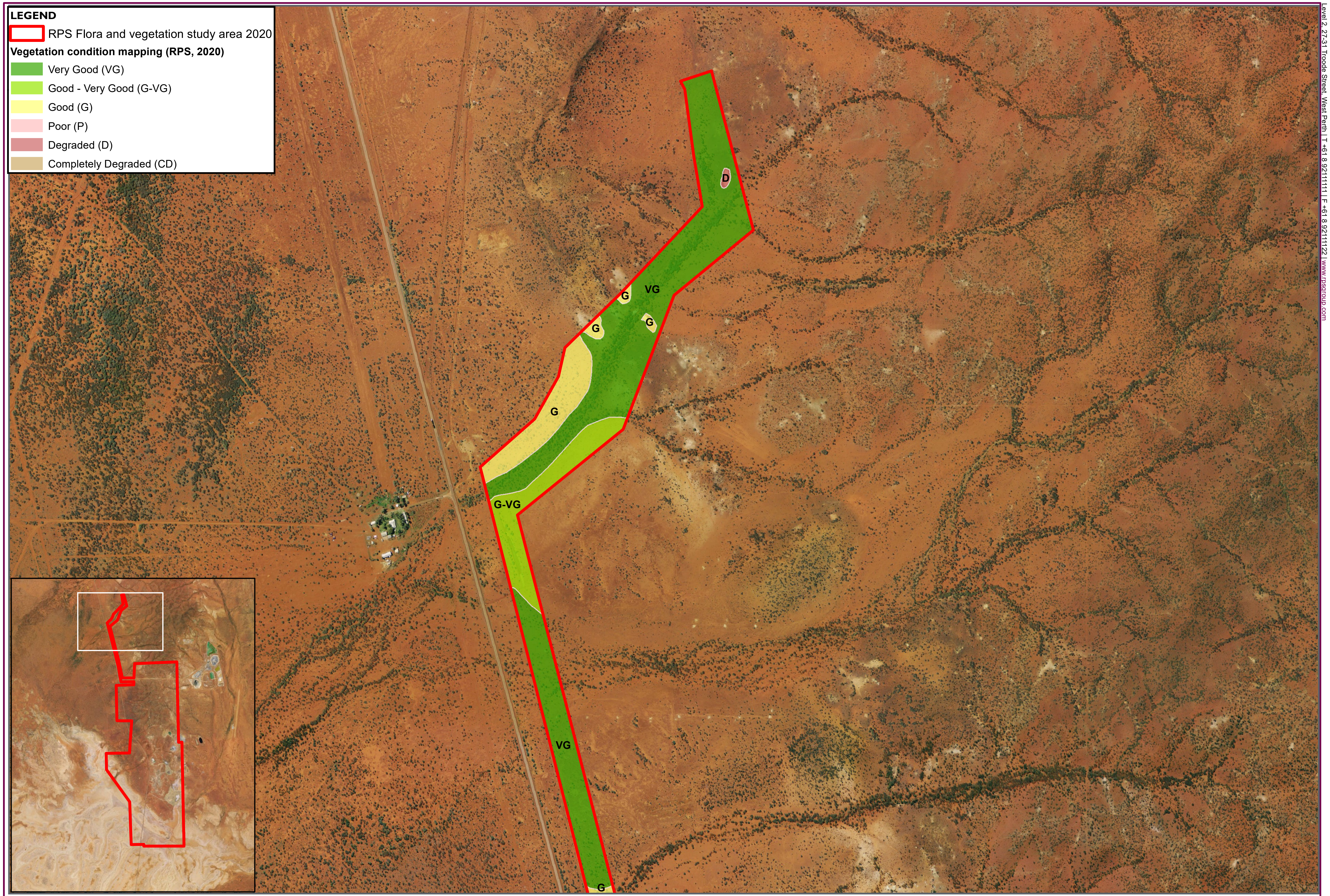

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Figure J-1

Vegetation condition mapping

GDA 1994 MGA Zone 51

0 100 200 400 m

Job Number: L18041-004
Doc Number: J-1
Date27.02.2020
Scale: 1:11,000 @ A3
Created by: TO
Source: Cadastre - Landgate, 2019   Orthophoto - Landgate, Aug 2019

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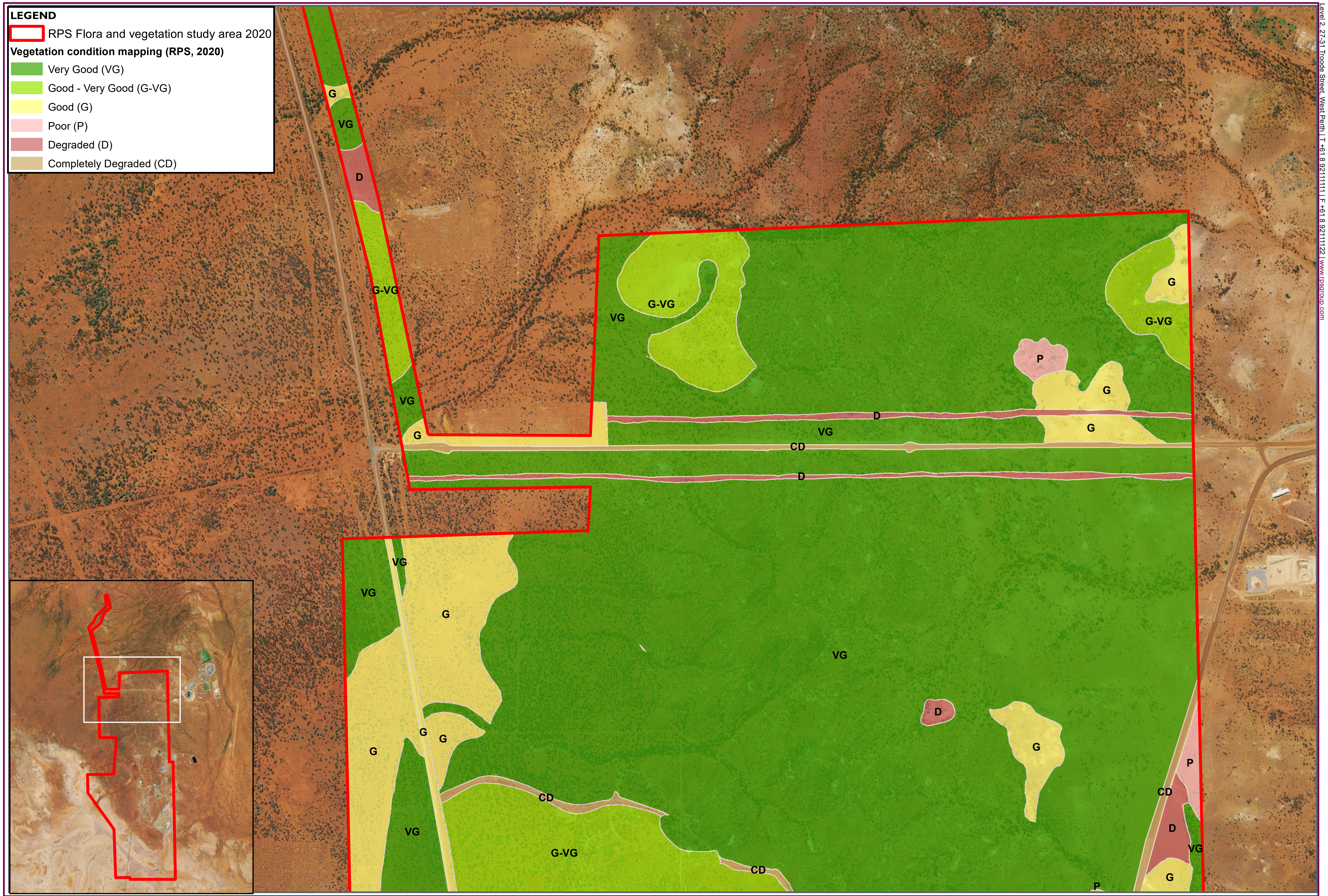

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Figure J-2

Vegetation condition mapping

GDA 1994 MGA Zone 51

0 100 200 400 m

Job Number: L18041-004
Doc Number: J-2
Date27.02.2020
Scale: 1:11,000 @ A3
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Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

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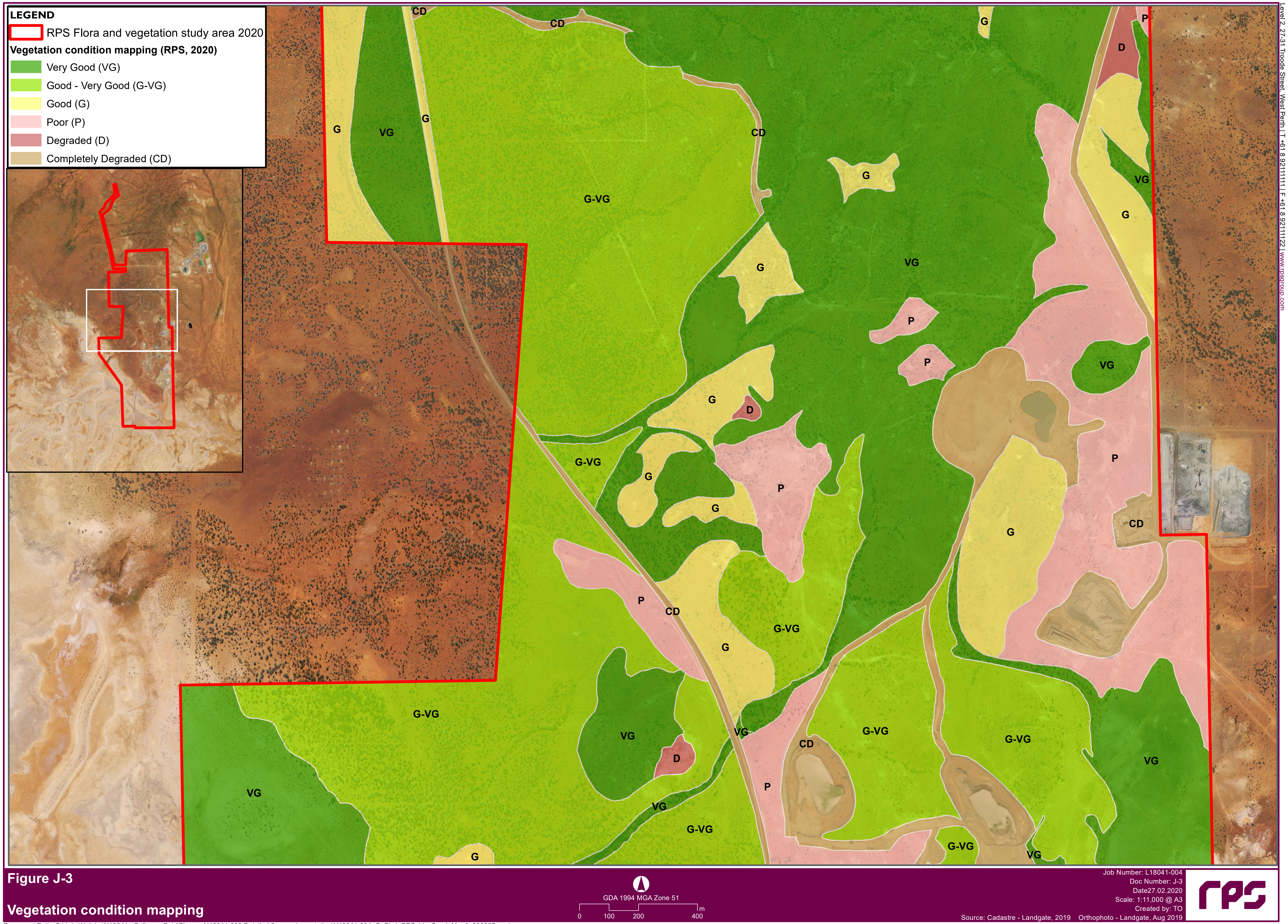

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Figure J-3

Vegetation condition mapping

Job Number: L18041-004
Doc Number: J-3
Date27.02.2020
Scale: 1:11,000 @ A3
Created by: TO
Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

Document Path: G:\Jobs\N Jobs\N18041 - Bellevue Gold\Figures N18041-003 Detailed flora and vegetation\N18041-004_G_FigJ_RPS_VegCond_Map3_200227.mxd

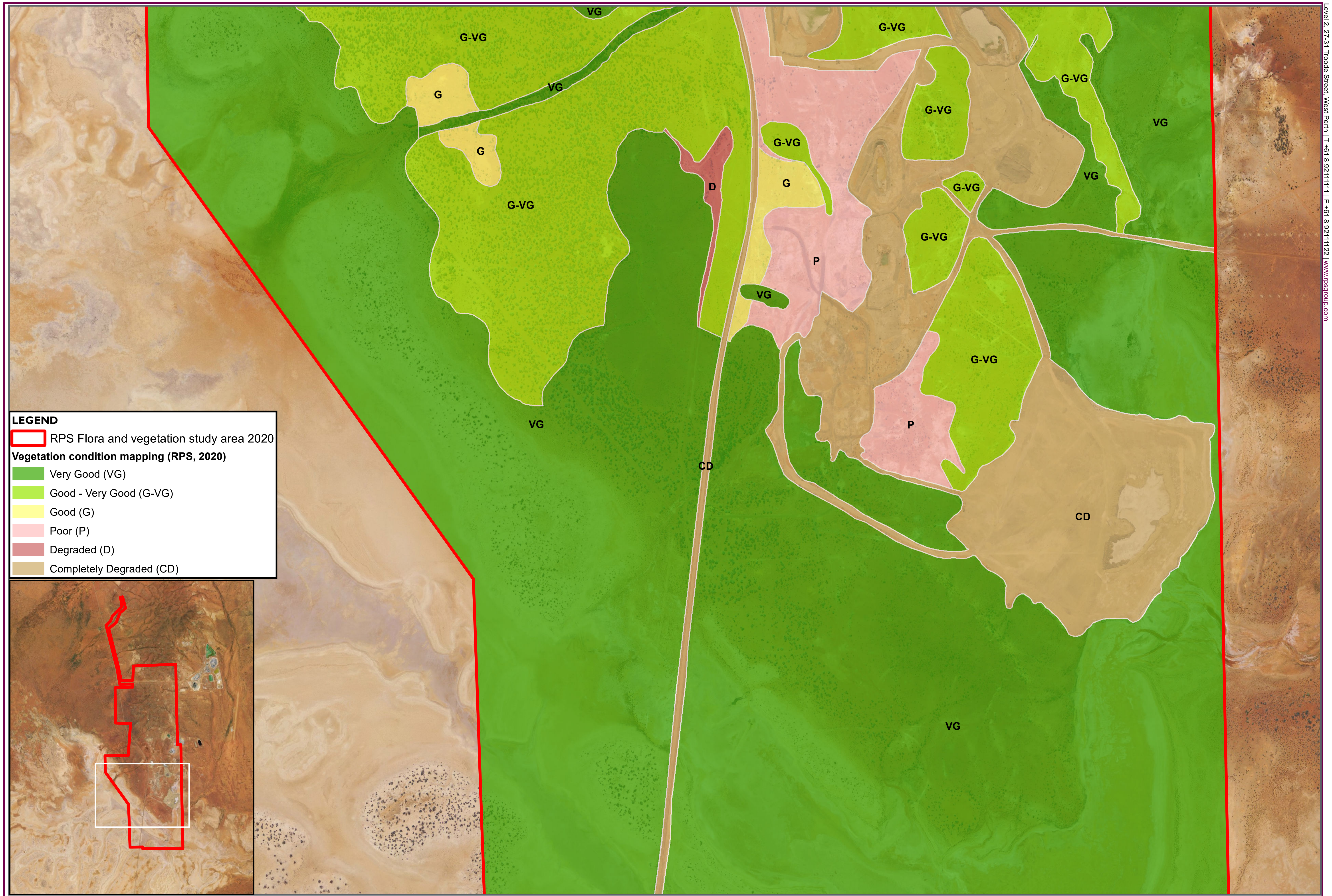

Figure J-4

Vegetation condition mapping

Job Number: L18041-004
Doc Number: J-4
Date27.02.2020
Scale: 1:11,000 @ A3
Created by: TO

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

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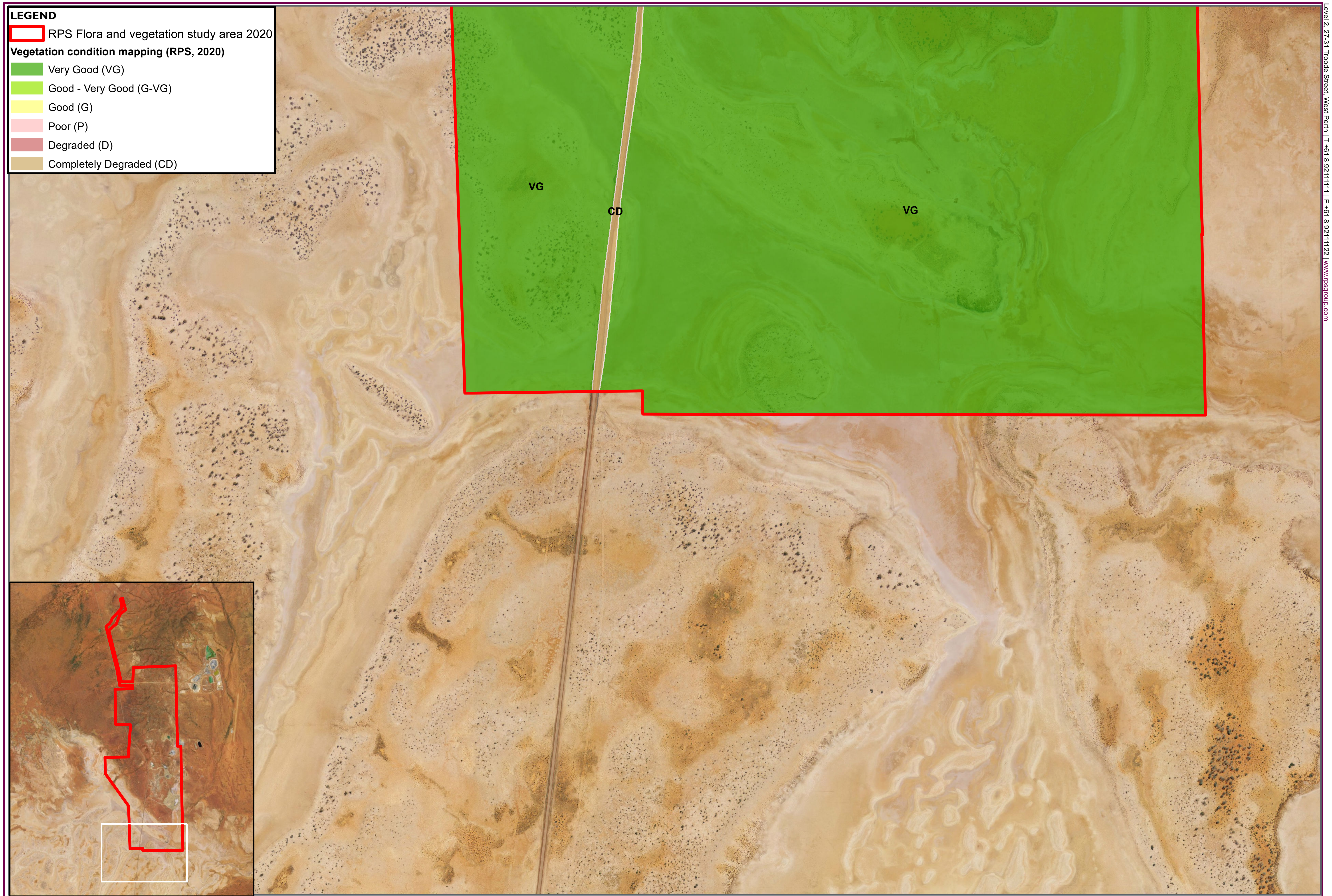

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Figure J-5

Vegetation condition mapping

GDA 1994 MGA Zone 51

0 100 200 400 m

Job Number: L18041-004
Doc Number: J-5
Date27.02.2020
Scale: 1:11,000 @ A3
Created by: TO

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2019

Document Path: G:\Jobs\N Jobs\N18041 - Bellevue Gold\Figures N18041-003 Detailed flora and vegetation\N18041-004_G_FigJ_RPS_VegCond_Map5_200227.mxd

Appendix A

Definitions

APPENDIX A: DEFINITIONS

Table A-1: Conservation codes for Western Australian flora and fauna

Category	Definition
Threatened species	
T	**Threatened species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). **Threatened fauna** is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. **Threatened flora** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	**Critically endangered species** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered species** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	**Vulnerable species** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct species	
EX	**Extinct species** Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	**Extinct in the wild species** Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species	
	Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

Category	Definition
M (IA)	**Migratory species** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes 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 fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	**Species of special conservation interest (conservation dependent fauna)** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Priority species	
P	Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
P1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey
P4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy

(Source: DBCA 2019)

Table A-2: EPBC Act conservation codes

Category	Definition
EX	**Extinct** A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EW	**Extinct in the Wild** A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CR	**Critically Endangered** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
EN	**Endangered** A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VU	**Vulnerable** A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NT	**Near Threatened** A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LC	**Least Concern** A taxon is Least Concern when it has been evaluated against the criteria and it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DD	**Data Deficient** A taxon is Data Deficient when 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 taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period has elapsed since the last record of the taxon, threatened status may well be justified.
NE	**Not Evaluated** A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

(Source: IUCN 2019)

Table A-3: Threatened ecological communities category of threat

Category	Definition
Presumed Totally Destroyed (PD)	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 or likely habitats or. All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	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. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria: The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply: Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately five years). Modification throughout its range is continuing such that in the immediate future (within approximately five years) the community is unlikely to be capable of being substantially rehabilitated. Current distribution is limited, and one or more of the following apply (i, ii or iii): Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes, which are likely to result in total destruction throughout its range in the immediate future (within approximately five years). There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. There may be many occurrences, but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately five years).
Endangered (EN)	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. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (i or ii) Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years). Modification throughout its range is continuing such that in the short-term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated. Current distribution is limited, and one or more of the following apply (i, ii or iii): Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short-term future (within approximately 10 years). There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. There may be many occurrences, but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. The ecological community exists only as highly modified occurrences, which may be capable of being rehabilitated if such work begins in the short-term future (within approximately 10 years).
Vulnerable (VU)	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): The ecological community exists largely as modified occurrences, which are likely to be capable of being substantially restored or rehabilitated. The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.

Category	Definition
Data Deficient (DD)	An ecological community, which has not been adequately evaluated with respect to status or where there is currently insufficient information to assign it to a particular category. (An ecological community with poorly known distribution or biology that is suspected to belong to any of the above categories. These ecological communities have a high priority for survey and/or research).
Lower Risk (LR)	An ecological community that has been adequately surveyed and does not qualify for any of the above categories of threat and appears unlikely to be under threat of significant modification or destruction in the short to medium term future.

(Source: English and Blyth 1997)

Table A-4: Priority ecological communities category of threat

Category	Definition
P1	Priority One: 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. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two: 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, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: 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 by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	Priority Four: 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. Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: 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.

(Source: DEC 2013)

Table A-5: EPBC Act listed threatened ecological communities category of threat

Category	Definition
CR	**Critically Endangered** If an ecological community is facing an extremely high risk of extinction in the wild in the immediate future.
EN	**Endangered** If an ecological community is not Critically Endangered but is facing a very high risk of extinction in the wild in the immediate future.
VU	**Vulnerable** If an ecological community is not Critically Endangered or Endangered but is facing a very high risk of extinction in the wild in the medium-term future.

Table A-6: NVIS vegetation structure classes

Stratum	Growth form	Height	Structural formation classes (% cover)					
			70-100	30-70	10-30	< 10	0-5	~0
U	Tree, palm	Tall; Mid; Low	Closed forest	Open forest	Woodland	Open woodland	Isolated trees	Isolated clumps of trees
	Tree mallee	Tall; Mid; Low	Closed mallee forest	Open mallee forest	Mallee woodland	Open mallee woodland	Isolated mallee trees	Isolated clumps of mallee trees
M	Shrub, cycad, grass-tree, tree-fern	Tall; Mid; Low	Closed shrubland	Shrubland	Open shrubland	Sparse shrubland	Isolated shrubs	Isolated clumps of shrubs
	Mallee shrub	Tall; Mid; Low	Closed mallee shrubland	Mallee shrubland	Open mallee shrubland	Sparse mallee shrubland	Isolated mallee shrubs	Isolated clumps of mallee shrubs
	Heath shrub	Tall; Mid; Low	Closed heathland	Heathland	Open heathland	Sparse heathland	Isolated heath shrubs	Isolated clumps of heath shrubs
	Chenopod shrub	Tall; Mid; Low	Closed chenopod shrubland	Chenopod shrubland	Open chenopod shrubland	Sparse chenopod shrubland	Isolated chenopod shrubs	Isolated clumps of chenopod shrubs
	Samphire shrub	Mid; Low	Closed samphire shrubland	Samphire shrubland	Open samphire shrubland	Sparse samphire shrubland	Isolated samphire shrubs	Isolated clumps of samphire shrubs
G	Hummock grass	Mid; Low	Closed hummock grassland	Hummock grassland	Open hummock grassland	Sparse hummock grassland	Isolated hummock grasses	Isolated clumps of hummock grasses
	Tussock grass	Mid; Low	Closed tussock grassland	Tussock grassland	Open tussock grassland	Sparse tussock grassland	Isolated tussock grasses	Isolated clumps of tussock grasses
	Other grass	Mid; Low	Closed grassland	Grassland	Open grassland	Sparse grassland	Isolated grasses	Isolated clumps of grasses
	Sedge	Mid; Low	Closed sedgeland	Sedgeland	Open sedgeland	Sparse sedgeland	Isolated sedges	Isolated clumps of sedges
	Rush	Mid; Low	Closed rushland	Rushland	Open rushland	Sparse rushland	Isolated rushes	Isolated clumps of rushes
	Forb (Herb)	Mid; Low	Closed forbland	Forbland	Open forbland	Sparse forbland	Isolated forbs	Isolated clumps of forbs

(Source: ESCAVI 2003)

Table A-7: NVIS vegetation height classes

Height		Growth form			
Height class	Height range (m)	Tree, vine (m and u), palm (single-stemmed)	Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)	Tree mallee, mallee shrub	Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (g)
8	>30	Tall			
7	10-30	Mid		Tall	
6	<10	Low		Mid	
5				Low	
4	>2		Tall		Tall
3	1-2		Mid		Tall
2	0.5-1		Low		Mid
1	<0.5		Low		Low

(Source: ESCAVI 2003)

Table A-8: Vegetation condition scale for the Eremaen and Northern Botanical provinces

Condition		Definition
E	Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
VG	Very Good	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.
G	Good	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.
P	Poor	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.
D	Degraded	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.
CD	Completely Degraded	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.

(Source: EPA 2016)

Appendix B

Flora likelihood of occurrence

APPENDIX B: FLORA LIKELIHOOD OF OCCURRENCE

Table B-1 Flora likelihood of occurrence ranks and definitions

Likelihood of occurrence	Score	Definition
Known	5	Species is known to occur within the survey area
High (Likely)	4	Not known to occur within the survey area but there are records within 5 km of the survey area and suitable habitat for the species is known to be, or likely to be, present within the survey area
Moderate (Possible)	3 or 2 (if suitable habitat is known to be, or likely to be, present) or 4 (if suitable habitat may be present within the survey area)	Not known to occur within the survey area but there are records within 20 km of the survey area and suitable habitat for the species is known to be, or likely to be, present within the survey area OR Not known to occur within the survey area but there are records within the Local Government Area and suitable habitat for the species is known to be, or likely to be, present within the survey area OR Not known to occur within the survey area but there are records within 20 km of the survey area and the Local Government Area and suitable habitat for the species is known to be, or likely to be, present within the survey area
Low (Unlikely)	3 or 2 (if suitable habitat may be present)	Not known to occur within the survey area but there are records within 20 km of the survey area and suitable habitat for the species may be present within the survey area
Negligible (suitable habitat not present	1 or 2 or 3 (if suitable habitat is absent) OR 4 or 3 or 2 (if species not recorded during the field survey)	Despite records being present within 10 km of the survey area no suitable habitat is present within the survey area therefore the likelihood of the species occurring there is negligible OR There are records within 10 km of the survey area and suitable habitat for the species is present within the survey area however after an extensive search for the species within the survey area it was not found

Table B-2 Risk matrix for analysis of the likelihood that each species of conservation significance would occur within the survey area based on the desktop study (database search) results

Taxon	Habitat	WA conservation code	Commonwealth (EPBC Act listing) conservation code	Known records within the survey area or 500 m buffer (context area)	Known records within a 5 km radius of the survey area	Known records within a 20 km radius of the survey area	Known occurrence within the local government area	Potential presence of suitable habitat within the survey area	Total score
Grevillea inconspicua	Loam, gravel. Along drainage lines on rocky outcrops,	4	-	1	1	1	1	1	**5**
Eremophila pungens	Sandy loam, clayey sand over laterite. Plains, ridges, breakaways.	4	-	0	0	1	1	1	**3**
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	Stony Ironstone Mulga Shrubland	3	-	0	0	1	1	1	**3**
Hemigenia exilis	Laterite. Breakaways slopes.	4	-	0	0	1	1	1	**3**
Hybanthus floribundus subsp. *chloroxanthus*	Dark red-brown soil, never sandy, rich in iron oxide, laterite. Rocky areas, creek banks, along drainage lines.	3	-	0	0	1	1	1	**3**
Gunniopsis propinqua	Plain. Alluvial loam. Ironstone and quartz pebbles.	3	-	1	0	0	1	0	**2**
Baeckea sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	Orange sand. Flats.	3	-	0	0	0	1	1	**2**
Eremophila congesta	Lateritic outcrops in greenstone hills, stony quartzite slopes.	1	-	0	0	0	1	1	**2**
Eremophila sp. long pedicels (G. Cockerton 1975) PN	Dark red hardpans over paleochanel Mulga woodland	2	-	0	0	0	1	1	**2**
Goodenia modesta	Red loam, sand.	3	-	0	0	0	1	1	**2**
Micromyrtus chrysodema	Red sands. Sandplains.	1	-	0	0	0	1	1	**2**
Olearia arida	Red or yellow sand. Undulating low rises.	4	-	0	0	0	1	1	**2**
Sida picklesiana	Red-brown sandy clay loam. Ironstone, quartz and basalt.	3	-	0	0	0	1	0	**1**
Tribulus adelacanthus	Stony Ironstone Mulga Shrubland	3	-	0	0	0	1	0	**1**
Verticordia jamiesonii	Sandy clay soils. Lateritic breakaways	3	-	0	0	0	1	0	**1**
Atriplex yeelirrie	Smectite clay with calcrete soil	T	EN	0	0	0	1	0	**1**

(Source: DBCA NatureMap and FloraBase, and Main Roads supplied database searches from DBCA's Species & Communities Branch (Threatened and Priority Fl1ora)

Table B-3 Likelihood of occurrence of conservation significant flora within the survey area based on the desktop results (initial risk) and field survey results (residual risk)

Taxon	WA conservation code	Commonwealth (EPBC Act listing) conservation code	Likelihood of occurrence Initial risk (pre-field survey)	Residual risk (post-field survey)
Grevillea inconspicua	4	-	Known	Known
Eremophila pungens	4	-	Possible	Negligible
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	3	-	Possible	Negligible
Hemigenia exilis	4	-	Possible	Negligible
Hybanthus floribundus subsp. *chloroxanthus*	3	-	Possible	Negligible
Gunniopsis propinqua	3	-	Negligible	Negligible
Baeckea sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	3	-	Possible	Negligible
Eremophila congesta	1	-	Possible	Negligible
Eremophila sp. long pedicels (G. Cockerton 1975) PN	2	-	Unlikely	Negligible
Goodenia modesta	3	-	Possible	Negligible
Micromyrtus chrysodema	1	-	Possible	Negligible
Olearia arida	4	-	Unlikely	Negligible
Sida picklesiana	3	-	Negligible	Negligible
Tribulus adelacanthus	3	-	Negligible	Negligible
Verticordia jamiesonii	4	-	Negligible	Negligible
Atriplex yeelirrie	T	EN	Negligible	Negligible

Appendix C

Flora inventory

APPENDIX C: FLORA INVENTORY

Family	Weed	Name
Aizoaceae		*Disphyma crassifolium* subsp. *clavellatum*
Amaranthaceae		*Ptilotus aervoides*
Amaranthaceae		*Ptilotus chamaecladus*
Amaranthaceae		*Ptilotus exaltatus*
Amaranthaceae		*Ptilotus gaudichaudii*
Amaranthaceae		*Ptilotus helichrysoides*
Amaranthaceae		*Ptilotus helipteroides*
Amaranthaceae		*Ptilotus macrocephalus*
Amaranthaceae		*Ptilotus obovatus* var. *obovatus*
Amaranthaceae		*Ptilotus polystachyus*
Amaranthaceae		*Ptilotus roei*
Amaranthaceae		*Ptilotus schwartzii* var. *schwartzii*
Amaranthaceae		*Surreya diandra*
Apiaceae		*Daucus glochidiatus*
Apocynaceae		*Marsdenia australis*
Apocynaceae		*Vincetoxicum lineare*
Asphodelaceae	*	*Asphodelus fistulosus*
Asteraceae		*Angianthus cyathifer*
Asteraceae		*Asteridea chaetopoda*
Asteraceae		*Brachyscome ciliaris*
Asteraceae		*Calotis hispidula*
Asteraceae		*Calotis multicaulis*
Asteraceae		*Centipeda thespidioides*
Asteraceae		*Cephalipterum drummondii*
Asteraceae		*Cratystylis subspinescens*
Asteraceae		*Gnephosis arachnoidea*
Asteraceae		*Helipterum craspedioides*
Asteraceae		*Hyalosperma* sp.
Asteraceae		*Millotia incurva*
Asteraceae		*Minuria cunninghamii*
Asteraceae		*Minuria gardneri*
Asteraceae		*Myriocephalus rudallii*
Asteraceae		*Olearia humilis*
Asteraceae		*Podolepis capillaris*
Asteraceae		*Pterocaulon sphacelatum*
Asteraceae		*Rhodanthe battii*
Asteraceae		*Rhodanthe charsleyae*
Asteraceae		*Rhodanthe maryonii*
Asteraceae		*Rhodanthe sterilescens*
Asteraceae		*Schoenia ayersii*
Asteraceae		*Senecio glossanthus*
Asteraceae		*Senecio lacustrinus*
Asteraceae	*	*Sonchus oleraceus*
Asteraceae		*Streptoglossa liatroides*
Asteraceae		*Taraxacum khatoonae*
Asteraceae		*Vittadinia eremaea*
Boraginaceae		*Heliotropium curassavicum*
Boraginaceae		*Heliotropium inexplicitum*
Boraginaceae		*Trichodesma zeylanicum*
Brassicaceae		*Lepidium muelleri-ferdinandii*
Brassicaceae		*Lepidium rotundum*
Brassicaceae		*Menkea australis*
Brassicaceae		*Menkea sphaerocarpa*
Campanulaceae		*Wahlenbergia tumidifructa*

Family	Weed	Name
Casuarinaceae		*Casuarina pauper*
Celastraceae		*Stackhousia muricata*
Chenopodiaceae		*Atriplex codonocarpa*
Chenopodiaceae		*Atriplex holocarpa*
Chenopodiaceae		*Atriplex nana*
Chenopodiaceae		*Atriplex semilunaris*
Chenopodiaceae		*Atriplex spongiosa*
Chenopodiaceae		*Atriplex vesicaria*
Chenopodiaceae		*Dissocarpus paradoxus*
Chenopodiaceae		*Dysphania glomulifera* subsp. *eremaea*
Chenopodiaceae		*Dysphania melanocarpa*
Chenopodiaceae		*Dysphania plantaginella*
Chenopodiaceae		*Dysphania rhadinostachya* subsp. *rhadinostachya*
Chenopodiaceae		*Dysphania simulans*
Chenopodiaceae		*Enchylaena tomentosa* var. *tomentosa*
Chenopodiaceae		*Enchylaena tomentosa* x *Maireana georgei*
Chenopodiaceae		*Eremophea spinosa*
Chenopodiaceae		*Eriochiton sclerolaenoides*
Chenopodiaceae		*Maireana amoena*
Chenopodiaceae		*Maireana appressa*
Chenopodiaceae		*Maireana carnosa*
Chenopodiaceae		*Maireana convexa*
Chenopodiaceae		*Maireana erioclada*
Chenopodiaceae		*Maireana georgei*
Chenopodiaceae		*Maireana glomerifolia*
Chenopodiaceae		*Maireana integra*
Chenopodiaceae		*Maireana lobiflora*
Chenopodiaceae		*Maireana melanocoma*
Chenopodiaceae		*Maireana pentatropis*
Chenopodiaceae		*Maireana planifolia*
Chenopodiaceae		*Maireana planifolia* (hairy variant)
Chenopodiaceae		*Maireana pyramidata*
Chenopodiaceae		*Maireana suaedifolia*
Chenopodiaceae		*Maireana thesioides*
Chenopodiaceae		*Maireana tomentosa*
Chenopodiaceae		*Maireana tomentosa* subsp. *tomentosa*
Chenopodiaceae		*Maireana tomentosa x*
Chenopodiaceae		*Maireana triptera*
Chenopodiaceae		*Maireana villosa*
Chenopodiaceae		*Rhagodia drummondii*
Chenopodiaceae		*Rhagodia eremaea*
Chenopodiaceae		*Rhagodia spinescens*
Chenopodiaceae		*Roycea divaricata*
Chenopodiaceae		*Salsola australis*
Chenopodiaceae		*Sclerolaena articulata*
Chenopodiaceae		*Sclerolaena convexula*
Chenopodiaceae		*Sclerolaena cornishiana*
Chenopodiaceae		*Sclerolaena costata*
Chenopodiaceae		*Sclerolaena cuneata*
Chenopodiaceae		*Sclerolaena densiflora*
Chenopodiaceae		*Sclerolaena deserticola*
Chenopodiaceae		*Sclerolaena diacantha*
Chenopodiaceae		*Sclerolaena eriacantha*
Chenopodiaceae		*Sclerolaena fimbriolata*
Chenopodiaceae		*Sclerolaena fusiformis*
Chenopodiaceae		*Sclerolaena gardneri*
Chenopodiaceae		*Sclerolaena lanicuspis*

Family	Weed	Name
Chenopodiaceae		*Sclerolaena obliquicuspis*
Chenopodiaceae		*Sclerolaena patenticuspis*
Chenopodiaceae		*Tecticornia aff. undulata*
Chenopodiaceae		*Tecticornia disarticulata*
Chenopodiaceae		*Tecticornia doliiformis*
Chenopodiaceae		*Tecticornia halocnemoides* subsp. *catenulata*
Chenopodiaceae		*Tecticornia indica* subsp. *bidens*
Chenopodiaceae		*Tecticornia peltata*
Chenopodiaceae		*Tecticornia pergranulata* subsp. *pergranulata*
Chenopodiaceae		*Tecticornia pruinosa*
Chenopodiaceae		*Tecticornia* sp. *Burnerbinmah* (D. Edinger et al. 101)
Chenopodiaceae		*Tecticornia* sp. *Dennys Crossing* (K.A. Shepherd & J. English KS 552)
Chenopodiaceae		*Tecticornia* sp. flowers 1
Chenopodiaceae		*Tecticornia* sp. flowers 2
Chenopodiaceae		*Tecticornia* sp. sterile 1
Chenopodiaceae		*Tecticornia undulata*
Cleomaceae		*Cleome viscosa*
Colchicaceae		*Wurmbea deserticola*
Convolvulaceae		*Convolvulus remotus*
Convolvulaceae	*	*Cuscuta planiflora*
Convolvulaceae		*Duperreya commixta*
Cucurbitaceae		*Citrullus amarus*
Cucurbitaceae	*	*Cucumis myriocarpus*
Cyperaceae		*Bulbostylis barbata*
Cyperaceae		*Fimbristylis* sp.
Euphorbiaceae		*Euphorbia australis*
Euphorbiaceae		*Euphorbia australis* var. *subtomentosa*
Euphorbiaceae		*Euphorbia boophthona*
Euphorbiaceae		*Euphorbia drummondii*
Euphorbiaceae		*Euphorbia tannensis* subsp. *eremophila*
Fabaceae		*Acacia minyura* (hybrid)
Fabaceae		*Acacia aneura*
Fabaceae		*Acacia aptaneura*
Fabaceae		*Acacia ayersiana*
Fabaceae		*Acacia burkittii*
Fabaceae		*Acacia caesaneura*
Fabaceae		*Acacia caesaneura* (narrow phyllode variant)
Fabaceae		*Acacia craspedocarpa*
Fabaceae		*Acacia craspedocarpa* hybrid
Fabaceae		*Acacia doreta* (long phyllode form)
Fabaceae		*Acacia fuscaneura*
Fabaceae		*Acacia macraneura*
Fabaceae		*Acacia minyura*
Fabaceae		*Acacia mulganeura*
Fabaceae		*Acacia murrayana*
Fabaceae		*Acacia oswaldii*
Fabaceae		*Acacia pteraneura*
Fabaceae		*Acacia quadrimarginea*
Fabaceae		*Acacia ramulosa* var. *linophylla*
Fabaceae		*Acacia tetragonophylla*
Fabaceae		*Acacia victoriae* subsp. *victoriae*
Fabaceae		*Acacia xanthocarpa*
Fabaceae		*Glycine canescens*
Fabaceae		*Indigofera georgei*
Fabaceae		*Senna artemisiodes* subsp. *x sturtii* hybrid
Fabaceae		*Senna artemisioides* subsp. *filifolia*
Fabaceae		*Senna artemisioides* subsp. *helmsii*

Family	Weed	Name
Fabaceae		*Senna artemisioides* subsp. *oligophylla* x *helmsii*
Fabaceae		*Senna artemisioides* subsp. *petiolaris*
Fabaceae		*Senna artemisioides* subsp. *x artemisioides*
Fabaceae		*Senna artemisioides* subsp. *x sturtii*
Fabaceae		*Senna charlesiana*
Fabaceae		*Senna glaucifolia*
Fabaceae		*Senna glutinosa* subsp. *chatelainiana*
Fabaceae		*Senna glutinosa* subsp. *glutinosa*
Fabaceae		*Senna glutinosa* subsp. *luerssenii*
Fabaceae		*Senna pleurocarpa* var. *angustifolia*
Fabaceae		*Senna* sp. *Meekatharra* (E. Bailey 1-26)
Fabaceae		*Swainsona elegantoides*
Fabaceae		*Swainsona incei*
Fabaceae		*Swainsona kingii*
Fabaceae		*Swainsona microphylla*
Fabaceae		*Swainsona paradoxa*
Frankeniaceae		*Frankenia cinerea*
Frankeniaceae		*Frankenia irregularis*
Frankeniaceae		*Frankenia setosa*
Gentianaceae		*Schenkia clementii*
Geraniaceae		*Erodium crinitum*
Geraniaceae		*Erodium cygnorum*
Goodeniaceae		*Goodenia lyrata (P3)*
Goodeniaceae		*Goodenia maideniana*
Goodeniaceae		*Goodenia mimuloides*
Goodeniaceae		*Goodenia prostrata*
Goodeniaceae		*Goodenia* sp.
Goodeniaceae		*Scaevola spinescens*
Goodeniaceae		*Velleia rosea*
Haloragaceae		*Haloragis odontocarpa*
Haloragaceae		*Haloragis trigonocarpa*
Juncaginaceae		*Triglochin hexagona*
Juncaginaceae		*Triglochin nana*
Lamiaceae	*	*Salvia verbenaca*
Loranthaceae		*Amyema fitzgeraldii*
Loranthaceae		*Lysiana murrayi*
Malvaceae		*Abutilon ?cryptopetalum*
Malvaceae		*Abutilon ?otocarpum*
Malvaceae		*Abutilon cryptopetalum*
Malvaceae		*Abutilon fraseri*
Malvaceae		*Abutilon leucopetalum*
Malvaceae		*Abutilon otocarpum*
Malvaceae		*Abutilon oxycarpum*
Malvaceae		*Abutilon oxycarpum* subsp. *Prostrate*
Malvaceae		*Alyogyne pinoniana*
Malvaceae		*Brachychiton gregorii*
Malvaceae		*Hibiscus burtonii*
Malvaceae		*Hibiscus* sp. *Gardneri*
Malvaceae		*Hibiscus* sp. *Perrinvale Station* (J. Warden & E. Ager WB 10581) (P3)
Malvaceae		*Lawrencia densiflora*
Malvaceae		*Lawrencia glomerata*
Malvaceae		*Lawrencia helmsii*
Malvaceae		*Sida ?ammophila*
Malvaceae		*Sida calyxhymenia*
Malvaceae		*Sida ectogama*
Malvaceae		*Sida fibulifera*
Malvaceae		*Sida* sp. *dark green fruit (S. van Leeuwen 2260)*
Malvaceae		*Sida* sp. *Exidentifolia* (J.L. Egan 1925)

Family	Weed	Name
Malvaceae		*Sida* sp. *spiciform panicles* (E. Leyland s.n. 14/8/1990)
Myrtaceae		*Eucalyptus comitae-vallis*
Myrtaceae		*Eucalyptus kingsmillii* subsp. *kingsmillii*
Myrtaceae		*Eucalyptus striaticalyx*
Myrtaceae		*Melaleuca interioris*
Myrtaceae		*Melaleuca leiocarpa*
Myrtaceae		*Melaleuca xerophila*
Nyctaginaceae		*Boerhavia coccinea*
Phrymaceae		*Mimulus gracilis*
Phrymaceae		*Peplidium* sp. *C Evol*. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)
Phyllanthaceae		*Phyllanthus erwinii*
Pittosporaceae		*Pittosporum angustifolium*
Plantaginaceae		*Stemodia florulenta*
Poaceae		*Aristida contorta*
Poaceae		*Aristida holathera* var. *holathera*
Poaceae		*Austrostipa nitida*
Poaceae		*Austrostipa scabra*
Poaceae		*Austrostipa trichophylla*
Poaceae	*	*Cenchrus ciliaris*
Poaceae	*	*Cenchrus setiger*
Poaceae		*Cymbopogon ambiguus*
Poaceae		*Cymbopogon obtectus*
Poaceae		*Dactyloctenium radulans*
Poaceae		*Digitaria brownii*
Poaceae		*Enneapogon caerulescens*
Poaceae		*Enneapogon cylindricus*
Poaceae		*Enneapogon polyphyllus*
Poaceae		*Enteropogon ramosus*
Poaceae		*Eragrostis dielsii*
Poaceae		*Eragrostis eriopoda*
Poaceae		*Eragrostis falcata*
Poaceae		*Eragrostis lanipes*
Poaceae		*Eragrostis leptocarpa*
Poaceae	*	*Eragrostis minor*
Poaceae		*Eragrostis pergracilis*
Poaceae		*Eragrostis setifolia*
Poaceae		*Eragrostis xerophila*
Poaceae		*Eriachne aristidea*
Poaceae		*Eriachne benthamii*
Poaceae		*Eriachne helmsii*
Poaceae		*Eriachne mucronata*
Poaceae		*Eriachne pulchella*
Poaceae		*Eriachne pulchella* subsp. *dominii*
Poaceae		*Eriachne pulchella* subsp. *pulchella*
Poaceae		*Iseilema eremaeum*
Poaceae		*Monachather paradoxus*
Poaceae		*Themeda triandra*
Poaceae		*Thyridolepis mitchelliana*
Poaceae		*Tragus australianus*
Poaceae		*Triodia basedowii*
Poaceae		*Triraphis mollis*
Poaceae		*Tripogonella loliiformis*
Polygalaceae		*Polygala glaucifolia*
Polygonaceae	*	*Rumex vesicarius*
Montiaceae		*Calandrinia eremaea*
Montiaceae		*Calandrinia polyandra*
Montiaceae		*Calandrinia ptychosperma*
Montiaceae		*Calandrinia* sp.
Portulacaceae		*Portulaca oleracea*
Primulaceae		*Lysimachia arvensis*

Family	Weed	Name
Proteaceae		*Grevillea inconspicua* (P4)
Proteaceae		*Grevillea nematophylla* subsp. *supraplana*
Proteaceae		*Grevillea sarissa* subsp. *bicolor*
Proteaceae		*Hakea lorea* subsp. *lorea*
Proteaceae		*Hakea preissii*
Pteridaceae		*Cheilanthes brownii*
Pteridaceae		*Cheilanthes lasiophylla*
Rubiaceae		*Psydrax latifolia*
Rubiaceae		*Psydrax rigidula*
Rubiaceae		*Psydrax suaveolens*
Rubiaceae		*Synaptantha tillaeacea* var. *tillaeacea*
Santalaceae		*Exocarpos aphyllus*
Santalaceae		*Santalum acuminatum*
Santalaceae		*Santalum lanceolatum*
Santalaceae		*Santalum spicatum*
Sapindaceae		*Dodonaea petiolaris*
Sapindaceae		*Dodonaea rigida*
Sapindaceae		*Dodonaea viscosa* subsp. *angustissima*
Scrophulariaceae		*Eremophila alternifolia*
Scrophulariaceae		*Eremophila decipiens* subsp. *decipiens*
Scrophulariaceae		*Eremophila exilifolia*
Scrophulariaceae		*Eremophila foliosissima*
Scrophulariaceae		*Eremophila forrestii* subsp. *forrestii*
Scrophulariaceae		*Eremophila galeata*
Scrophulariaceae		*Eremophila glabra* subsp. *glabra*
Scrophulariaceae		*Eremophila glabra* subsp. *tomentosa*
Scrophulariaceae		*Eremophila granitica*
Scrophulariaceae		*Eremophila latrobei* subsp. *latrobei*
Scrophulariaceae		*Eremophila longifolia*
Scrophulariaceae		*Eremophila malacoides*
Scrophulariaceae		*Eremophila metallicorum*
Scrophulariaceae		*Eremophila oldfieldii*
Scrophulariaceae		*Eremophila oldfieldii* subsp. *angustifolia*
Scrophulariaceae		*Eremophila pantonii*
Scrophulariaceae		*Eremophila platycalyx* ?subsp. Leonora (J. Morrisey 252)
Scrophulariaceae		*Eremophila ramiflora*
Scrophulariaceae		*Eremophila serrulata*
Solanaceae		*Lycium australe*
Solanaceae		*Nicotiana occidentalis* subsp. *occidentalis*
Solanaceae		*Nicotiana rosulata*
Solanaceae		*Nicotiana rotundifolia*
Solanaceae		*Solanum lasiophyllum*
Solanaceae		*Solanum nummularium*
Thymelaeaceae		*Pimelea forrestiana*
Thymelaeaceae		*Pimelea microcephala* subsp. *microcephala*
Thymelaeaceae		*Pimelea trichostachya*
Zygophyllaceae		*Tribulus astrocarpus*
Zygophyllaceae		*Tribulus forrestii*
Zygophyllaceae		*Tribulus terrestris*
Zygophyllaceae		*Roepera aurantiaca* subsp. *aurantiaca*
Zygophyllaceae		*Roepera compressa*
Zygophyllaceae		*Roepera eremaea*
Zygophyllaceae		*Roepera glauca*
Zygophyllaceae		*Roepera iodocarpa*
Zygophyllaceae		*Roepera kochii*
Zygophyllaceae		*Roepera lobulata*
Zygophyllaceae		*Roepera reticulata*
Zygophyllaceae		*Roepera similis*
Zygophyllaceae		*Roepera tetraptera*

* - Weed

Appendix D

Species by quadrat

APPENDIX D: SPECIES BY SITE

BG quadrats

Name	BGQ01	BGQ02	BGQ03	BGQ04	BGQ05	BGQ06	BGQ07	BGQ08	BGQ09	BGQ10	BGQ11	BGQ12	BGQ13	BGQ14	BGQ15	BGQ16	BGQ17	BGQ18	BGQ19	BGQ20	BGQ21	BGQ22	BGQ23	BGQ24	BGQ25	BGQ26	BGQ27	BGQ28	BGQ29	BGQ30	BGQ31	BGQ32	BGQ33	BGQ34	BGQ35	BGQ36	BGQ37	BGQ38	BGQ39	BGQ40	BGQ41	BGQ42	BGQ43	BGQ44	BGQ45	BGQ46	BGQ47	BGQ48	BGQ49	BGQ50	BGQ51
Abutilon ?cryptopetalum																x							x				x										x	x													
Abutilon ?otocarpum																																					x														
Abutilon cryptopetalum		x						x				x							x	x		x		x																											
Abutilon fraseri																	x																																		
Abutilon leucopetalum																																																			
Abutilon otocarpum							x																	x	x			x																				x		x	x
Abutilon oxycarpum	x													x				x					x																												
Abutilon oxycarpum subsp. Prostrate																x						x			x													x						x							
Abutilon sp.																																																			
Acacia ? minyura (hybrid)									x			x																							x																
Acacia aneura							x		x		x																																								
Acacia aptaneura	x																					x				x		x							x		x		x					x							x
Acacia ayersiana																																							x	x										x	
Acacia burkittii																																																			
Acacia caesaneura																												x												x										x	
Acacia caesaneura (narrow phyllode variant)																																																			
Acacia craspedocarpa																																																			
Acacia craspedocarpa hybrid																																																			
Acacia doreta (long phyllode form)															x	x		x	x	x	x	x	x	x			x											x										x			
Acacia fuscaneura								x	x	x				x	x			x		x				x								x																			
Acacia macraneura																x	x														x																				
Acacia minyura									x			x												x											x												x				
Acacia mulganeura																																																		x	
Acacia murrayana																																																			
Acacia oswaldii																																																			
Acacia pteraneura																			x	x	x		x				x																				x	x		x	x
Acacia quadrimarginea																																																			
Acacia ramulosa var. linophylla							x				x															x													x	x										x	
Acacia tetragonophylla	x							x	x		x		x	x	x	x	x	x	x	x	x		x	x			x		x		x	x			x	x									x		x				x
Acacia victoriae subsp. victoriae																																																			
Acacia xanthocarpa										x			x	x	x	x		x	x	x	x	x	x	x			x				x							x						x						x	
Alyogyne pinoniana							x																																												
Amyema fitzgeraldii																																																			
Angianthus cyathifer			x																																																
Aristida contorta	x	x		x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x	x	x				x		x	x	x	x			x	x
Aristida holathera var. holathera							x					x																x											x	x											
Asphodelus fistulosus																																																			
Asteridea chaetopoda					x																												x																		
Atriplex codonocarpa																																x													x	x	x				
Atriplex holocarpa																																																			
Atriplex nana						x																																													
Atriplex semilunaris																																																			
Atriplex sp.							x																																												
Atriplex spongiosa						x																																													
Atriplex vesicaria	x	x																																																	
Austrostipa nitida																																																			
Austrostipa scabra																							x																				x								
Austrostipa trichophylla																																																			
Boerhavia coccinea	x													x		x		x		x				x								x				x		x						x							
Brachychiton gregorii																																																			
Brachyscome ciliaris	x																																									x									
Bulbine sp.																																																			
Bulbostylis barbata																																																			
Calandrinia eremaea																																																			

Name	BGQ01	BGQ02	BGQ03	BGQ04	BGQ05	BGQ06	BGQ07	BGQ08	BGQ09	BGQ10	BGQ11	BGQ12	BGQ13	BGQ14	BGQ15	BGQ16	BGQ17	BGQ18	BGQ19	BGQ20	BGQ21	BGQ22	BGQ23	BGQ24	BGQ25	BGQ26	BGQ27	BGQ28	BGQ29	BGQ30	BGQ31	BGQ32	BGQ33	BGQ34	BGQ35	BGQ36	BGQ37	BGQ38	BGQ39	BGQ40	BGQ41	BGQ42	BGQ43	BGQ44	BGQ45	BGQ46	BGQ47	BGQ48	BGQ49	BGQ50	BGQ51
Calandrinia polyandra																																																x			
Calandrinia ptychosperma												x																																							
Calandrinia sp.																																																x			
Calotis hispidula																																																			
Calotis multicaulis																																x																			
Casuarina pauper					x																												x																		
Cenchrus ciliaris											x	x																x																				x			
Cenchrus setiger																												x																							
Centipeda thespidioides																																																			
Cephalipterum drummondii																																																			
Cheilanthes brownii																																																			
Cheilanthes lasiophylla										x				x		x																																			
Citrullus amarus																										x																									
Cleome viscosa																																																		x	
Convolvulus remotus		x																																																	
Cratystylis subspinescens																																x										x	x			x	x				
Cucumis myriocarpus																																																			
Cuscuta planiflora		x																																																	
Cymbopogon ambiguus									x					x			x	x	x	x	x			x							x					x															
Cymbopogon obtectus																		x																										x							
Dactyloctenium radulans		x																		x						x		x				x			x																
Daucus glochidiatus	x																																																		
Digitaria brownii								x						x		x				x				x							x																				
Disphyma crassifolium subsp. clavellatum		x																																																
Dissocarpus paradoxus		x																														x				x									x	x				x	
Dodonaea petiolaris																																																			
Dodonaea rigida													x																																						
Dodonaea viscosa subsp. angustissima																																																			
Duperreya commixta																		x		x				x			x									x		x						x			x			x	
Dysphania glomulifera subsp. eremaea	x			x																													x																		
Dysphania melanocarpa																																																			
Dysphania plantaginella				x																																															
Dysphania rhadinostachya subsp. rhadinostachya																																																			
Dysphania simulans						x																																												
Enchylaena tomentosa var. tomentosa	x				x		x		x		x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x					x		x	x		x									x	x		x	x
Enchylaena tomentosa x Maireana georgei																																									x										x
Enneapogon caerulescens	x	x		x				x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x		x				x		x	x	x	x	x			x
Enneapogon cylindricus																																																			
Enneapogon polyphyllus	x	x						x	x			x				x	x	x	x			x		x	x	x		x	x		x	x			x	x	x	x							x			x		x	x
Enneapogon sp.																				x			x																											
Enteropogon ramosus																	x																			x						x				x	x				
Eragrostis ?falcata																																										x									
Eragrostis dielsii			x																													x											x								
Eragrostis eriopoda							x		x		x	x														x									x				x	x								x		x	x
Eragrostis falcata	x			x		x																																				x				x				
Eragrostis lanipes												x														x		x																						
Eragrostis leptocarpa																																																			
Eragrostis minor																																																			
Eragrostis pergracilis	x	x	x																																							x	x								
Eragrostis setifolia																																																			
Eragrostis sp.			x																																																
Eragrostis xerophila												x																					x																		
Eremophea spinosa																																																			
Eremophila alternifolia																															x																				
Eremophila decipiens subsp. decipiens																																																			
Eremophila exilifolia								x		x	x		x	x	x	x		x	x	x	x		x	x			x				x	x					x	x						x							
Eremophila foliosissima																																																			
Eremophila forrestii subsp. forrestii								x	x	x	x			x	x	x		x	x	x			x	x		x		x	x		x	x			x		x	x	x	x				x			x	x		x	x
Eremophila galeata								x			x		x				x						x						x			x				x	x					x					x				x
Eremophila glabra subsp. glabra												x								x				x																											

Name	BGQ01	BGQ02	BGQ03	BGQ04	BGQ05	BGQ06	BGQ07	BGQ08	BGQ09	BGQ10	BGQ11	BGQ12	BGQ13	BGQ14	BGQ15	BGQ16	BGQ17	BGQ18	BGQ19	BGQ20	BGQ21	BGQ22	BGQ23	BGQ24	BGQ25	BGQ26	BGQ27	BGQ28	BGQ29	BGQ30	BGQ31	BGQ32	BGQ33	BGQ34	BGQ35	BGQ36	BGQ37	BGQ38	BGQ39	BGQ40	BGQ41	BGQ42	BGQ43	BGQ44	BGQ45	BGQ46	BGQ47	BGQ48	BGQ49	BGQ50	BGQ51
Eremophila glabra subsp. tomentosa	x																																																			
Eremophila granitica																																																				
Eremophila latrobei subsp. latrobei																																																				
Eremophila longifolia		x										x								x						x													x													x	
Eremophila malacoides																																																				
Eremophila metallicorum																															x							x														
Eremophila oldfieldii																																																				
Eremophila oldfieldii subsp. angustifolia	x														x	x		x	x		x	x	x		x	x	x						x											x							
Eremophila pantonii																																											x										
Eremophila platycalyx ?subsp. Leonora (J. Morrisey 252)																																																				
Eremophila ramiflora																															x																						
Eremophila serrulata														x																																						x
Eremophila sp.																				x																																
Eriachne aristidea																																																				
Eriachne benthamii											x	x								x								x							x																	
Eriachne helmsii									x																														x							x				
Eriachne mucronata										x				x																																				
Eriachne pulchella																																						x														
Eriachne pulchella subsp. dominii																				x																		x															
Eriachne pulchella subsp. pulchella														x				x																																		
Eriachne sp.																																																				
Eriochiton sclerolaenoides																											x																				x			
Erodium crinitum																																																				
Erodium cygnorum	x																								x																										
Erodium sp.																																																				
Eucalyptus comitae-vallis																																																				
Eucalyptus kingsmillii																																																				
Eucalyptus kingsmillii subsp. kingsmillii																																																				
Eucalyptus striaticalyx						x																																													
Euphorbia australis																																																				
Euphorbia australis var. subtomentosa	x																								x																										
Euphorbia boophthona									x							x								x																										
Euphorbia drummondii		x																								x						x												x			x			
Euphorbia sp.																																x										x					x					
Euphorbia tannensis subsp. eremophila	x																															x																				
Exocarpos aphyllus								x																									x																			
Fimbristylis sp.																																											x										
Frankenia cinerea	x			x	x			x																												x																			
Frankenia irregularis																																												x									
Frankenia setosa																																																				
Frankenia sp.																																																x			
Glycine canescens																x				x				x			x																									
Gnephosis arachnoidea	x																															x																				
Goodenia lyrata				x																																															
Goodenia maideniana					x																																														
Goodenia mimuloides																																x																				
Goodenia prostrata																																																				
Goodenia sp.															x				x																																	
Grevillea inconspicua										x			x		x																x																						
Grevillea nematophylla subsp. supraplana																																																				
Grevillea sarissa subsp. bicolor	x				x	x																												x																			
Hakea lorea ssp. lorea																																																				
Hakea lorea subsp. lorea											x													x												x	x			x											x	
Hakea preissii												x															x							x								x			x					
Haloragis odontocarpa																																																				x
Haloragis trigonocarpa	x																	x						x		x										x		x														
Heliotropium curassavicum				x																																															
Heliotropium inexplicitum										x						x				x				x														x															
Heliotropium sp.																x																																				

Name	BGQ01	BGQ02	BGQ03	BGQ04	BGQ05	BGQ06	BGQ07	BGQ08	BGQ09	BGQ10	BGQ11	BGQ12	BGQ13	BGQ14	BGQ15	BGQ16	BGQ17	BGQ18	BGQ19	BGQ20	BGQ21	BGQ22	BGQ23	BGQ24	BGQ25	BGQ26	BGQ27	BGQ28	BGQ29	BGQ30	BGQ31	BGQ32	BGQ33	BGQ34	BGQ35	BGQ36	BGQ37	BGQ38	BGQ39	BGQ40	BGQ41	BGQ42	BGQ43	BGQ44	BGQ45	BGQ46	BGQ47	BGQ48	BGQ49	BGQ50	BGQ51
Helipterum craspedioides																								x		x																									
Hibiscus burtonii										x																																									
Hibiscus sp. Gardneri								x					x					x		x			x	x		x	x										x											x			
Hibiscus sp. Perrinvale Station (P3)																																																			
Hyalosperma sp.																																																			
Indigofera georgei																																																			
Indigofera sp.																																																			
Iseilema eremaeum																				x						x																									
Lawrencia densiflora																																x										x	x								
Lawrencia glomerata																																										x				x	x				
Lawrencia helmsii	x			x	x	x																											x																		
Lepidium muelleri-ferdinandii																																																			
Lepidium rotundum																										x																									
Lycium australe	x	x		x	x																											x	x									x	x								
Lysiana murrayi							x																			x							x																	x	
Lysimachia arvensis																																																			
Maireana amoena		x				x																																													
Maireana appressa																																										x									
Maireana carnosa																																													x	x	x				
Maireana convexa																																																			
Maireana erioclada	x			x																													x																		
Maireana georgei	x				x			x	x		x		x		x	x	x	x	x		x		x		x	x			x		x													x							
Maireana glomerifolia																																										x									
Maireana integra																			x																									x							
Maireana lobiflora																																											x								
Maireana melanocoma																																																			
Maireana pentatropis				x	x																																														
Maireana planifolia								x		x				x		x															x																				
Maireana planifolia (hairy variant)																																																			
Maireana pyramidata	x	x						x	x		x	x						x	x								x	x				x				x						x			x	x	x				x
Maireana sp.										x			x						x					x									x			x										x					
Maireana suaedifolia																																																			
Maireana thesioides																																																x		x	
Maireana tomentosa																																														x					
Maireana tomentosa subsp. tomentosa		x															x																																		
Maireana tomentosa x																							x												x																
Maireana triptera											x		x		x	x	x	x	x		x	x	x	x		x	x		x		x	x				x				x		x		x	x	x	x				
Maireana villosa					x											x				x		x				x		x			x																				
Marsdenia australis										x	x	x		x				x	x	x		x		x		x	x				x					x	x	x	x	x				x							
Melaleuca interioris																																																			
Melaleuca leiocarpa																																																			
Melaleuca xerophila																																																			
Menkea australis																																																			
Menkea sphaerocarpa																																																			
Millotia incurva																																																			
Mimulus gracilis			x																																																
Minuria cunninghamii									x																																										
Minuria gardneri	x			x																																															
Monachather paradoxus									x		x	x														x		x							x				x	x								x		x	
Myriocephalus rudallii																																																			
Nicotiana occidentalis subsp. occidentalis		x																																																	
Nicotiana rosulata		x																																																	
Nicotiana rotundifolia																																x																			
Olearia humilis												x																																							
Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)			x																																																
Phyllanthus erwinii																								x																											
Pimelea forrestiana									x																																										
Pimelea microcephala subsp. microcephala	x	x						x				x																																	x						
Pimelea trichostachya	x																																																		

Name	BGQ01	BGQ02	BGQ03	BGQ04	BGQ05	BGQ06	BGQ07	BGQ08	BGQ09	BGQ10	BGQ11	BGQ12	BGQ13	BGQ14	BGQ15	BGQ16	BGQ17	BGQ18	BGQ19	BGQ20	BGQ21	BGQ22	BGQ23	BGQ24	BGQ25	BGQ26	BGQ27	BGQ28	BGQ29	BGQ30	BGQ31	BGQ32	BGQ33	BGQ34	BGQ35	BGQ36	BGQ37	BGQ38	BGQ39	BGQ40	BGQ41	BGQ42	BGQ43	BGQ44	BGQ45	BGQ46	BGQ47	BGQ48	BGQ49	BGQ50	BGQ51
Pittosporum angustifolium	x																														x																				
Poaceae sp.		x	x				x																					x										x		x											x
Podolepis capillaris																																										x									
Polygala glaucifolia																																x																			
Portulaca oleracea														x	x	x		x	x	x		x		x			x		x			x			x		x	x													
Psydrax latifolia																																																			
Psydrax rigidula																																																			
Psydrax suaveolens																																																			
Pterocaulon sphacelatum									x																																										
Ptilotus aervoides	x							x						x	x	x	x	x	x		x	x		x	x	x	x		x							x	x														x
Ptilotus chamaecladus									x																	x		x																							
Ptilotus exaltatus												x			x	x	x										x					x						x							x		x				
Ptilotus gaudichaudii																										x																									
Ptilotus helichrysoides																																										x									
Ptilotus helipteroides										x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x					x	x						x	x			x			x
Ptilotus macrocephalus									x																	x		x																							
Ptilotus obovatus var. obovatus	x						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x			x		x	x	x	x		x		x	x		x	x		x	x
Ptilotus polystachyus																																																			
Ptilotus roei																															x							x						x				x			
Ptilotus schwartzii var. schwartzii											x																																								
Ptilotus sp.																																x				x									x						
Rhagodia drummondii		x					x											x				x			x		x		x						x	x															
Rhagodia eremaea																				x				x		x												x	x	x				x				x			x
Rhagodia sp.																			x																					x		x									
Rhagodia spinescens												x																																							
Rhodanthe battii																																																			
Rhodanthe charsleyae																																																			
Rhodanthe maryonii																																																			
Rhodanthe sterilescens	x	x																																																	
Roepera aurantiaca subsp. aurantiaca																																																			
Roepera compressa					x	x											x	x			x												x																		
Roepera eremaea				x																																												x			
Roepera glauca															x																																				
Roepera iodocarpa																																																			
Roepera kochii																																																			
Roepera lobulata																						x	x		x		x																								
Roepera reticulata	x			x																													x																		
Roepera similis																																x																			
Roepera sp.		x																																				x													
Roepera tetraptera																																																			
Roycea divaricata																																																			
Rumex vesicarius	x																																												x						
Salsola australis		x				x	x	x							x	x		x			x	x	x		x	x	x											x						x				x			x
Salvia verbenaca																				x																															
Santalum acuminatum																x																																			
Santalum lanceolatum							x										x																						x												
Santalum spicatum														x								x	x				x					x						x													
Scaevola spinescens	x	x				x	x	x				x	x		x	x	x	x	x	x	x		x					x			x	x						x				x		x	x		x			x	
Schenkia clementii																																											x								
Schoenia ayersii	x																																																		
Sclerolaena articulata		x																																																	
Sclerolaena convexula																																																x		x	x
Sclerolaena cornishiana																																										x		x							
Sclerolaena costata																																																			
Sclerolaena cuneata																	x															x					x					x	x		x	x	x				
Sclerolaena densiflora								x					x			x	x	x	x		x	x	x		x		x				x	x				x	x							x	x						
Sclerolaena deserticola												x		x										x		x									x																
Sclerolaena diacantha	x											x			x	x				x				x		x	x																		x		x				x
Sclerolaena eriacantha	x			x				x								x															x	x														x					
Sclerolaena fimbriolata						x																											x			x															

Name	BGQ01	BGQ02	BGQ03	BGQ04	BGQ05	BGQ06	BGQ07	BGQ08	BGQ09	BGQ10	BGQ11	BGQ12	BGQ13	BGQ14	BGQ15	BGQ16	BGQ17	BGQ18	BGQ19	BGQ20	BGQ21	BGQ22	BGQ23	BGQ24	BGQ25	BGQ26	BGQ27	BGQ28	BGQ29	BGQ30	BGQ31	BGQ32	BGQ33	BGQ34	BGQ35	BGQ36	BGQ37	BGQ38	BGQ39	BGQ40	BGQ41	BGQ42	BGQ43	BGQ44	BGQ45	BGQ46	BGQ47	BGQ48	BGQ49	BGQ50	BGQ51
Sclerolaena fusiformis																																																			
Sclerolaena gardneri																																																			
Sclerolaena lanicuspis																																																			
Sclerolaena obliquicuspis	x	x					x	x	x		x							x							x																										
Sclerolaena patenticuspis																																																			
Sclerolaena sp.						x																																								x					
Senecio glossanthus	x																																																		
Senecio lacustrinus						x	x																																												
Senna artemisioides subsp. X sturtii hybrid																																																			x
Senna artemisioides subsp. filifolia		x																		x		x													x												x				
Senna artemisioides subsp. helmsii								x		x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x					x	x	x						x			x			x	x
Senna artemisioides subsp. oligophylla x helmsii																																																			
Senna artemisioides subsp. petiolaris																																			x																
Senna artemisioides subsp. x artemisioides								x							x	x		x	x	x			x				x				x							x						x			x				x
Senna artemisioides subsp. x sturtii									x		x							x			x	x			x							x				x										x	x	x		x	
Senna charlesiana											x	x				x				x	x			x	x			x					x															x			
Senna glaucifolia								x		x	x		x	x	x	x	x		x		x						x		x		x													x							
Senna glutinosa subsp. chatelainiana	x	x						x											x												x																				
Senna glutinosa subsp. glutinosa																																																			
Senna glutinosa subsp. luerssenii																																																			
Senna pleurocarpa var. angustifolia							x																																												
Senna sp. Meekatharra (E. Bailey 1-26)	x							x					x			x			x	x		x	x													x		x				x			x					x	x
Sida ?ammophila		x																																																	
Sida ?calyxhymenia																			x																																
Sida ?ectogama																																																			
Sida ?fibulifera																	x																														x				
Sida ?sp. dark green fruits (S. van Leeuwen 2260)																																																			
Sida calyxhymenia	x							x		x		x		x		x	x	x		x			x	x	x	x	x	x	x		x	x			x									x	x		x	x			x
Sida ectogama																																												x							
Sida fibulifera																																																x			
Sida sp.													x								x																										x				
Sida sp. dark green fruits (S. van Leeuwen 2260)										x									x				x		x												x	x						x							
Sida sp. Exidentifolia (J.L. Egan 1925)																x				x		x		x	x	x	x	x				x													x	x	x				x
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)													x						x		x	x		x		x											x														
Solanum lasiophyllum	x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x	x	x	x	x		x		x	x	x	x	x		x	x
Solanum nummularium																																																			
Sonchus oleraceus		x																																																	
Stackhousia muricata																	x																																		
Stemodia florulenta																																																			
Streptoglossa liatroides																																x															x				
Surreya diandra						x																																													
Swainsona elegantoides	x															x				x																															
Swainsona incei																																																			
Swainsona kingii	x																															x																			
Swainsona microphylla																																																			
Swainsona paradoxa		x	x			x																																													
Swainsona sp.		x																																																	
Synaptantha tillaeacea var. tillaeacea																																																			
Taraxacum khatoonae	x	x																																																	
Tecticornia aff. undulata																																		x																	
Tecticornia disarticulata																																x											x		x		x				
Tecticornia doliiformis																																									x										
Tecticornia halocnemoides subsp. catenulata																																		x							x								x		
Tecticornia indica subsp. bidens			x																																						x		x								
Tecticornia peltata			x																											x				x							x										
Tecticornia pergranulata subsp. pergranulata			x																																																
Tecticornia pruinosa						x																				x				x																					
Tecticornia sp.																																										x				x					
Tecticornia sp. Burnerbinmah (D. Edinger et al. 101)																														x																					

Name	BGQ01	BGQ02	BGQ03	BGQ04	BGQ05	BGQ06	BGQ07	BGQ08	BGQ09	BGQ10	BGQ11	BGQ12	BGQ13	BGQ14	BGQ15	BGQ16	BGQ17	BGQ18	BGQ19	BGQ20	BGQ21	BGQ22	BGQ23	BGQ24	BGQ25	BGQ26	BGQ27	BGQ28	BGQ29	BGQ30	BGQ31	BGQ32	BGQ33	BGQ34	BGQ35	BGQ36	BGQ37	BGQ38	BGQ39	BGQ40	BGQ41	BGQ42	BGQ43	BGQ44	BGQ45	BGQ46	BGQ47	BGQ48	BGQ49	BGQ50	BGQ51
Tecticornia sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)						x																												x							x		x								
Tecticornia sp. flowers 1																																																	x		
Tecticornia sp. flowers 2																																		x																	
Tecticornia sp. sterile 1			x																																																
Tecticornia undulata																																		x																	
Themeda triandra																																																			
Thyridolepis mitchelliana																																																			
Tragus australianus																																																			
Tribulus astrocarpus														x										x																											
Tribulus forrestii																																																			
Tribulus sp.											x																																								
Tribulus terrestris																																																			x
Trichodesma zeylanicum																																																			
Triglochin hexagona			x																																																
Triglochin nana																																																			
Triodia basedowii																																							x	x											
Tripogonella loliiformis																																																			
Triraphis mollis																																																			
Velleia rosea																																																			
Vincetoxicum lineare																																				x															
Vittadinia eremaea	x																																																		
Wahlenbergia tumidifructa																																																			
Wurmbea deserticola																																																			

KV quadrats

Name	KVQ01	KVQ02	KVQ03	KVQ04	KVQ05	KVQ06	KVQ07	KVQ08	KVQ09	KVQ10	KVQ11	KVQ12	KVQ13	KVQ14	KVQ15	KVQ16	KVQ17	KVQ18	KVQ19	KVQ20	KVQ21	KVQ22	KVQ23	KVQ24	KVQ25	KVQ26	KVQ27	KVQ28	KVQ29	KVQ30	KVQ31	KVQ32	KVQ33	KVQ34	KVQ35	KVQ36	KVQ37	KVQ38	KVQ39	KVQ40	KVQ41
Abutilon ?cryptopetalum																																									
Abutilon ?otocarpum																																									
Abutilon cryptopetalum									x							x			x	x	x	x		x			x							x							
Abutilon fraseri																x				x		x							x					x						x	
Abutilon leucopetalum																																									x
Abutilon otocarpum				x												x				x	x	x																			
Abutilon oxycarpum																																									
Abutilon oxycarpum subsp. Prostrate																																									
Abutilon sp.	x																							x										x							
Acacia ? minyura (hybrid)																																									
Acacia aneura						x							x				x				x			x							x		x								
Acacia aptaneura	x		x	x	x		x	x	x	x		x		x	x	x		x		x		x				x				x		x		x							
Acacia ayersiana											x	x			x			x								x				x	x	x	x					x			
Acacia burkittii	x																																								
Acacia caesaneura									x	x	x	x			x			x												x	x	x	x				x				
Acacia caesaneura (narrow phyllode variant)												x									x				x						x	x						x			
Acacia craspedocarpa					x		x		x															x										x							
Acacia craspedocarpa hybrid	x				x		x		x															x		x											x				
Acacia doreta (long phyllode form)														x		x			x			x		x			x	x												x	
Acacia fuscaneura									x															x																	
Acacia macraneura																																									
Acacia minyura																																									
Acacia mulganeura								x					x																	x											
Acacia murrayana																																									
Acacia oswaldii			x																				x		x															x	
Acacia pteraneura		x																				x	x	x	x		x													x	
Acacia quadrimarginea																																									
Acacia ramulosa var. linophylla												x	x		x			x				x								x	x	x	x					x			
Acacia tetragonophylla	x	x		x	x	x							x	x		x	x			x	x	x	x	x	x	x	x	x	x					x					x	x	x
Acacia victoriae subsp. victoriae																																		x							

Name	KVQ01	KVQ02	KVQ03	KVQ04	KVQ05	KVQ06	KVQ07	KVQ08	KVQ09	KVQ10	KVQ11	KVQ12	KVQ13	KVQ14	KVQ15	KVQ16	KVQ17	KVQ18	KVQ19	KVQ20	KVQ21	KVQ22	KVQ23	KVQ24	KVQ25	KVQ26	KVQ27	KVQ28	KVQ29	KVQ30	KVQ31	KVQ32	KVQ33	KVQ34	KVQ35	KVQ36	KVQ37	KVQ38	KVQ39	KVQ40	KVQ41
Acacia xanthocarpa	x	x			x									x		x			x	x	x			x			x	x	x												
Alyogyne pinoniana																																									
Amyema fitzgeraldii																																									
Angianthus cyathifer																																									
Aristida contorta	x	x	x	x	x	x	x		x				x	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x		x		x	x	x	x	x	x		x
Aristida holathera var. holathera																																									
Asphodelus fistulosus																																									
Asteridea chaetopoda																																				x					
Atriplex codonocarpa																																									
Atriplex holocarpa																																									
Atriplex nana																																									
Atriplex semilunaris																																									
Atriplex sp.																																									
Atriplex spongiosa																																									
Atriplex vesicaria																																									
Austrostipa nitida																																									
Austrostipa scabra																																									
Austrostipa trichophylla																					x	x																			
Boerhavia coccinea																																									x
Brachychiton gregorii																																x									
Brachyscome ciliaris																																									
Bulbine sp.																																									
Bulbostylis barbata																																									
Calandrinia eremaea																x																									
Calandrinia polyandra																																									
Calandrinia ptychosperma					x																																				
Calandrinia sp.																																									
Calotis hispidula					x				x																							x									
Calotis multicaulis																																									
Casuarina pauper																																				x					
Cenchrus ciliaris																																									
Cenchrus setiger																																									
Centipeda thespidioides																																		x							
Cephalipterum drummondii																								x															x		
Cheilanthes brownii																													x												
Cheilanthes lasiophylla																																									
Citrullus amarus																																									
Cleome viscosa																																									
Convolvulus remotus																																									
Cratystylis subspinescens																																			x						
Cucumis myriocarpus																																									
Cuscuta planiflora																																									
Cymbopogon ambiguus							x													x				x			x		x												
Cymbopogon obtectus	x	x		x	x				x																																
Dactyloctenium radulans																																									
Daucus glochidiatus																																									
Digitaria brownii	x				x		x		x											x				x										x			x			x	
Disphyma crassifolium subsp. clavellatum																																									
Dissocarpus paradoxus																																		x	x						
Dodonaea petiolaris	x				x																																				
Dodonaea rigida																																									
Dodonaea viscosa subsp. angustissima																																									
Duperreya commixta	x	x			x		x		x					x						x				x			x	x	x												
Dysphania glomulifera subsp. eremaea																																									
Dysphania melanocarpa									x																																
Dysphania plantaginella																																									
Dysphania rhadinostachya subsp. rhadinostachya					x																																				
Dysphania simulans																																									
Enchylaena tomentosa var. tomentosa	x		x	x			x		x			x		x			x	x		x	x	x		x			x		x		x	x	x	x			x	x		x	x
Enchylaena tomentosa x Maireana georgei			x	x									x					x			x		x		x		x														

Name	KVQ01	KVQ02	KVQ03	KVQ04	KVQ05	KVQ06	KVQ07	KVQ08	KVQ09	KVQ10	KVQ11	KVQ12	KVQ13	KVQ14	KVQ15	KVQ16	KVQ17	KVQ18	KVQ19	KVQ20	KVQ21	KVQ22	KVQ23	KVQ24	KVQ25	KVQ26	KVQ27	KVQ28	KVQ29	KVQ30	KVQ31	KVQ32	KVQ33	KVQ34	KVQ35	KVQ36	KVQ37	KVQ38	KVQ39	KVQ40	KVQ41
Enneapogon caerulescens	x	x	x	x	x									x		x			x	x		x		x			x	x	x					x	x	x			x	x	
Enneapogon cylindricus			x																									x							x						
Enneapogon polyphyllus				x																x		x		x										x			x		x	x	x
Enneapogon sp.																																									
Enteropogon ramosus																	x																								x
Eragrostis ?falcata																																									
Eragrostis dielsii																																			x						
Eragrostis eriopoda					x		x	x	x	x	x	x			x			x												x	x	x	x				x	x			
Eragrostis falcata																																									
Eragrostis lanipes																																									
Eragrostis leptocarpa																																									
Eragrostis minor																																									
Eragrostis pergracilis	x																																		x						
Eragrostis setifolia		x				x	x																																		
Eragrostis sp.													x												x							x						x			
Eragrostis xerophila																																									
Eremophea spinosa																																			x						
Eremophila alternifolia																																									
Eremophila decipiens subsp. decipiens																																		x							
Eremophila exilifolia									x										x	x				x				x	x												
Eremophila foliosissima								x		x	x																														
Eremophila forrestii subsp. forrestii	x				x	x	x	x	x	x	x	x			x	x		x	x											x	x	x	x	x			x				
Eremophila galeata	x	x	x	x	x	x	x		x												x	x	x		x	x								x							x
Eremophila glabra subsp. glabra																																									
Eremophila glabra subsp. tomentosa																																									
Eremophila granitica	x				x									x								x					x	x													
Eremophila latrobei subsp. latrobei						x	x		x		x										x					x								x							
Eremophila longifolia	x																																	x							
Eremophila malacoides																																									
Eremophila metallicorum																				x																					
Eremophila oldfieldii																											x	x													
Eremophila oldfieldii subsp. angustifolia														x							x			x					x												
Eremophila pantonii			x	x									x										x			x													x		
Eremophila platycalyx ?subsp. Leonora (J. Morrisey 252)							x																											x				x			
Eremophila ramiflora																	x																								
Eremophila serrulata	x				x																			x										x							
Eremophila sp.																																									
Eriachne aristidea																																									
Eriachne benthamii																																									
Eriachne helmsii	x							x	x	x	x				x			x						x							x		x				x	x			x
Eriachne mucronata																																									
Eriachne pulchella																																									
Eriachne pulchella subsp. dominii																																									
Eriachne pulchella subsp. pulchella																																									
Eriachne sp.																																						x			
Eriochiton sclerolaenoides							x																																		
Erodium crinitum					x																																				
Erodium cygnorum									x							x																									x
Erodium sp.					x																																				
Eucalyptus comitae-vallis																																	x								
Eucalyptus kingsmillii																																x	x								
Eucalyptus kingsmillii subsp. kingsmillii												x																													
Eucalyptus striaticalyx																																									
Euphorbia australis																x																									x
Euphorbia australis var. subtomentosa																																									
Euphorbia boophthona																																									
Euphorbia drummondii					x																														x						
Euphorbia sp.																																									
Euphorbia tannensis subsp. eremophila	x				x				x																																
Exocarpos aphyllus												x			x				x															x		x					

Name	KVQ01	KVQ02	KVQ03	KVQ04	KVQ05	KVQ06	KVQ07	KVQ08	KVQ09	KVQ10	KVQ11	KVQ12	KVQ13	KVQ14	KVQ15	KVQ16	KVQ17	KVQ18	KVQ19	KVQ20	KVQ21	KVQ22	KVQ23	KVQ24	KVQ25	KVQ26	KVQ27	KVQ28	KVQ29	KVQ30	KVQ31	KVQ32	KVQ33	KVQ34	KVQ35	KVQ36	KVQ37	KVQ38	KVQ39	KVQ40	KVQ41
Fimbristylis sp.																																									
Frankenia cinerea																																									
Frankenia irregularis																																									
Frankenia setosa																																									
Frankenia sp.																																									
Glycine canescens					x				x											x				x					x												
Gnephosis arachnoidea																																									
Goodenia lyrata																																									
Goodenia maideniana																																									
Goodenia mimuloides					x				x							x			x	x							x	x	x												
Goodenia prostrata					x				x																																
Goodenia sp.																															x					x					
Grevillea inconspicua (P4)																			x																						
Grevillea nematophylla subsp. supraplana																																									
Grevillea sarissa subsp. bicolor																																				x					
Hakea lorea ssp. lorea																		x																							
Hakea lorea subsp. lorea									x																							x		x							x
Hakea preissii																								x																x	
Haloragis odontocarpa																																									
Haloragis trigonocarpa	x	x		x	x				x							x		x	x	x		x		x			x	x	x					x			x		x		
Heliotropium curassavicum																																									
Heliotropium inexplicitum	x																																								
Heliotropium sp.																																									
Helipterum craspedioides	x				x				x											x							x							x							
Hibiscus burtonii	x				x		x		x	x										x					x													x			
Hibiscus sp. Gardneri	x													x																											x
Hibiscus sp. Perrinvale Station (P3)					x																																				
Hyalosperma sp.																													x												
Indigofera georgei	x	x			x				x																				x												
Indigofera sp.					x																																				
Iseilema eremaeum																																									
Lawrencia densiflora																																									
Lawrencia glomerata																																									
Lawrencia helmsii																																				x					
Lepidium muelleri-ferdinandii																																									
Lepidium rotundum																x																									
Lycium australe																																			x	x					
Lysiana murrayi																																									
Lysimachia arvensis					x																																				
Maireana amoena																																									
Maireana appressa																																									
Maireana carnosa																																									
Maireana convexa																																x									
Maireana erioclada																																									
Maireana georgei		x	x	x		x	x					x	x	x				x			x	x	x	x		x	x								x	x			x	x	
Maireana glomerifolia																																									
Maireana integra																																									
Maireana lobiflora																																									
Maireana melanocoma																						x																			
Maireana pentatropis																																				x					
Maireana planifolia							x		x		x						x										x														x
Maireana planifolia (hairy variant)						x		x		x		x																													
Maireana pyramidata							x							x															x					x	x	x	x				
Maireana sp.		x																										x	x		x					x					
Maireana suaedifolia																		x																							
Maireana thesioides																																									
Maireana tomentosa			x	x										x		x						x												x			x				x
Maireana tomentosa subsp. tomentosa																																									
Maireana tomentosa x																																									
Maireana triptera			x	x									x	x		x						x	x		x	x	x												x	x	

Name	KVQ01	KVQ02	KVQ03	KVQ04	KVQ05	KVQ06	KVQ07	KVQ08	KVQ09	KVQ10	KVQ11	KVQ12	KVQ13	KVQ14	KVQ15	KVQ16	KVQ17	KVQ18	KVQ19	KVQ20	KVQ21	KVQ22	KVQ23	KVQ24	KVQ25	KVQ26	KVQ27	KVQ28	KVQ29	KVQ30	KVQ31	KVQ32	KVQ33	KVQ34	KVQ35	KVQ36	KVQ37	KVQ38	KVQ39	KVQ40	KVQ41
Maireana villosa						x																																			
Marsdenia australis	x		x		x		x							x		x			x	x	x	x		x			x	x	x	x				x				x		x	
Melaleuca interioris																																									
Melaleuca leiocarpa																																									
Melaleuca xerophila																																									
Menkea australis																																									
Menkea sphaerocarpa																																									
Millotia incurva																																									
Mimulus gracilis																																									
Minuria cunninghamii																																									
Minuria gardneri																																									
Monachather paradoxus	x					x	x	x	x	x	x	x			x			x			x									x	x	x	x				x	x			
Myriocephalus rudallii																																									
Nicotiana occidentalis subsp. occidentalis																																									
Nicotiana rosulata																																									
Nicotiana rotundifolia					x																																				
Olearia humilis																																									
Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)																																		x							
Phyllanthus erwinii					x																																				
Pimelea forrestiana																																									
Pimelea microcephala subsp. microcephala																												x						x			x				
Pimelea trichostachya																																									
Pittosporum angustifolium																																				x					
Poaceae sp.																																			x		x				
Podolepis capillaris																			x																						
Polygala glaucifolia																																									
Portulaca oleracea																																									
Psydrax latifolia					x						x																														
Psydrax rigidula	x																			x				x			x				x										
Psydrax suaveolens	x									x												x		x							x			x							
Pterocaulon sphacelatum																																									
Ptilotus aervoides						x			x											x														x							
Ptilotus chamaecladus					x																																				
Ptilotus exaltatus																						x																	x	x	
Ptilotus gaudichaudii							x		x																		x														
Ptilotus helichrysoides																																									
Ptilotus helipteroides	x	x		x	x				x					x		x		x	x			x					x	x	x										x	x	
Ptilotus macrocephalus																																									
Ptilotus obovatus var. obovatus	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x			x	x	x	x	x
Ptilotus polystachyus									x									x														x							x	x	
Ptilotus roei		x		x	x	x										x													x												x
Ptilotus schwartzii var. schwartzii						x		x		x																															
Ptilotus sp.																																									
Rhagodia drummondii												x			x									x	x										x	x	x	x		x	x
Rhagodia eremaea																																	x								
Rhagodia sp.																																x									
Rhagodia spinescens																																									
Rhodanthe battii					x				x									x																x							
Rhodanthe charsleyae																																		x							
Rhodanthe maryonii																						x					x														
Rhodanthe sterilescens																																									
Roepera aurantiaca subsp. aurantiaca				x																																					
Roepera compressa																																									
Roepera eremaea																																									
Roepera glauca																																									
Roepera iodocarpa														x		x			x	x		x		x			x	x	x										x		
Roepera kochii			x																																						
Roepera lobulata																																									
Roepera reticulata																																				x					

Name	KVQ01	KVQ02	KVQ03	KVQ04	KVQ05	KVQ06	KVQ07	KVQ08	KVQ09	KVQ10	KVQ11	KVQ12	KVQ13	KVQ14	KVQ15	KVQ16	KVQ17	KVQ18	KVQ19	KVQ20	KVQ21	KVQ22	KVQ23	KVQ24	KVQ25	KVQ26	KVQ27	KVQ28	KVQ29	KVQ30	KVQ31	KVQ32	KVQ33	KVQ34	KVQ35	KVQ36	KVQ37	KVQ38	KVQ39	KVQ40	KVQ41
Roepera similis																																									
Roepera sp.																																								x	
Roepera tetraptera																																									
Roycea divaricata																																									
Rumex vesicarius					x																																				
Salsola australis			x	x								x		x		x	x									x	x	x											x		x
Salvia verbenaca																																									
Santalum acuminatum																																									
Santalum lanceolatum	x				x				x			x					x	x						x	x																
Santalum spicatum							x							x		x			x									x	x												
Scaevola spinescens		x											x	x		x		x			x	x	x	x	x	x		x	x		x		x	x		x	x	x		x	
Schenkia clementii																																									
Schoenia ayersii																																									
Sclerolaena articulata																																									
Sclerolaena convexula							x									x																					x				
Sclerolaena cornishiana																																			x						
Sclerolaena costata																																		x							
Sclerolaena cuneata																																							x		
Sclerolaena densiflora			x											x		x												x												x	x
Sclerolaena deserticola									x																							x						x			
Sclerolaena diacantha		x				x	x						x						x		x			x		x	x	x	x						x				x		
Sclerolaena eriacantha				x									x	x							x	x	x		x	x	x												x	x	
Sclerolaena fimbriolata																																				x					
Sclerolaena fusiformis		x		x																															x				x		
Sclerolaena gardneri																																			x						
Sclerolaena lanicuspis			x	x																			x																x		
Sclerolaena obliquicuspis																																			x						
Sclerolaena patenticuspis			x																																						
Sclerolaena sp.																																									
Senecio glossanthus																																									
Senecio lacustrinus																																									
Senna artemisioides subsp. X sturtii hybrid																																									
Senna artemisioides subsp. filifolia			x	x	x	x	x		x											x		x		x					x						x						
Senna artemisioides subsp. helmsii		x	x		x				x				x	x	x	x	x		x	x		x		x	x		x	x	x											x	x
Senna artemisioides subsp. oligophylla x helmsii	x																																								
Senna artemisioides subsp. petiolaris																																									
Senna artemisioides subsp. x artemisioides	x	x	x		x				x				x				x			x		x		x			x		x												
Senna artemisioides subsp. x sturtii	x	x			x				x															x								x					x				
Senna charlesiana																																				x					
Senna glaucifolia	x	x			x	x	x							x										x				x													
Senna glutinosa subsp. chatelainiana																																									
Senna glutinosa subsp. glutinosa																																									
Senna glutinosa subsp. luerssenii															x																										
Senna pleurocarpa var. angustifolia																																									
Senna sp. Meekatharra (E. Bailey 1-26)		x	x	x	x	x							x	x		x	x		x		x	x	x	x	x	x	x	x	x						x				x	x	x
Sida ?ammophila																																									
Sida ?calyxhymenia																													x												
Sida ?ectogama				x													x				x																				
Sida ?fibulifera																																									
Sida ?sp. dark green fruits (S. van Leeuwen 2260)																																									
Sida calyxhymenia			x																	x							x											x	x		
Sida ectogama	x				x																x																				
Sida fibulifera	x						x		x				x											x			x							x					x		x
Sida sp.																										x															
Sida sp. dark green fruits (S. van Leeuwen 2260)	x	x				x			x					x		x			x	x	x	x		x	x		x	x	x		x									x	
Sida sp. Exidentifolia (J.L. Egan 1925)					x																						x														
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	x																																								
Solanum lasiophyllum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Solanum nummularium																																						x			
Sonchus oleraceus																																									

Name	KVQ01	KVQ02	KVQ03	KVQ04	KVQ05	KVQ06	KVQ07	KVQ08	KVQ09	KVQ10	KVQ11	KVQ12	KVQ13	KVQ14	KVQ15	KVQ16	KVQ17	KVQ18	KVQ19	KVQ20	KVQ21	KVQ22	KVQ23	KVQ24	KVQ25	KVQ26	KVQ27	KVQ28	KVQ29	KVQ30	KVQ31	KVQ32	KVQ33	KVQ34	KVQ35	KVQ36	KVQ37	KVQ38	KVQ39	KVQ40	KVQ41
Stackhousia muricata	x				x															x																					
Stemodia florulenta																																									
Streptoglossa liatroides																																									
Surreya diandra																																									
Swainsona elegantoides																																									
Swainsona incei					x														x																						x
Swainsona kingii	x				x				x																										x						
Swainsona microphylla																																									
Swainsona paradoxa																																									
Swainsona sp.																																									
Synaptantha tillaeacea var. tillaeacea																																									
Taraxacum khatoonae																																									
Tecticornia aff. undulata																																									
Tecticornia disarticulata																																									
Tecticornia doliiformis																																									
Tecticornia halocnemoides subsp. catenulata																																									
Tecticornia indica subsp. bidens																																									
Tecticornia peltata																																									
Tecticornia pergranulata subsp. pergranulata																																									
Tecticornia pruinosa																																									
Tecticornia sp.																																									
Tecticornia sp. Burnerbinmah (D. Edinger et al. 101)																																									
Tecticornia sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)																																									
Tecticornia sp. flowers 1																																									
Tecticornia sp. flowers 2																																									
Tecticornia sp. sterile 1																																									
Tecticornia undulata																																									
Themeda triandra					x				x																																
Thyridolepis mitchelliana	x									x		x			x																x		x								
Tragus australianus																																									
Tribulus astrocarpus																																									
Tribulus forrestii																																									
Tribulus sp.																																									
Tribulus terrestris																																									
Trichodesma zeylanicum					x																																				
Triglochin hexagona																																									
Triglochin nana																																									
Triodia basedowii										x																				x											
Tripogonella loliiformis																																									x
Triraphis mollis																																									
Velleia rosea									x																																
Vincetoxicum lineare	x				x				x															x										x			x	x			
Vittadinia eremaea																																									
Wahlenbergia tumidifructa					x																																				
Wurmbea deserticola																																									

Appendix E

Detailed floristic site data

APPENDIX E: DETAILED SITE DATA

Site BGQ01

Described by	CG	**Date**	25/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259453 mE	6937675 mN			
Habitat	Stony rise on gypsum dune (island) in Lake Miranda					
Soil	Red-brown sandy clay and patches of powdery white gypsum					
Rock Type	Basalt - numerous large rocks					

Vegetation Acacia aptaneura, Pittosporum phylliraeoides, A. tetragonophylla and Eremophila oldfieldii Tall Sparse Shrubland over Senna artemisioides subsp. x sturtii Mid Sparse Shrubland over Ptilotus obovatus Low Sparse Shrubland over Aristida contorta Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	>10 years		
Species List	Name	Cover	Height
	Abutilon oxycarpum	+	20
	Acacia aptaneura	+	500
	Acacia tetragonophylla	+	200
	Aristida contorta	30	30
	Atriplex vesicaria	ADJ	
	Boerhavia coccinea	ADJ	
	Brachyscome ciliaris	ADJ	
	Daucus glochidiatus	ADJ	
	Dysphania glomulifera subsp. eremaea	+	5
	Enchylaena tomentosa var. tomentosa	+	70
	Enneapogon caerulescens	3.5	30
	Enneapogon polyphyllus	+	30
	Eragrostis falcata	1.5	35
	Eragrostis pergracilis	+	7
	Eremophila glabra subsp. tomentosa	ADJ	
	Eremophila oldfieldii subsp. angustifolia	1	300
	Erodium cygnorum	+	3
	Euphorbia australis var. subtomentosa	+	20
	Euphorbia tannensis subsp. eremophila	+	5
	Frankenia cinerea	ADJ	
	Gnephosis arachnoidea	ADJ	
	Grevillea sarissa subsp. bicolor	ADJ	
	Haloragis trigonocarpa	+	7
	Lawrencia helmsii	+	80

Lycium australe	1	100
Maireana erioclada	+	25
Maireana georgei	+	50
Maireana pyramidata	+	100
Minuria gardneri	+	2
Pimelea microcephala subsp. microcephala	+	120
Pimelea trichostachya	+	25
Pittosporum angustifolium	+	250
Ptilotus aervoides	+	1
Ptilotus obovatus var. obovatus	6	60
Rhodanthe sterilescens	ADJ	
Roepera reticulata	+	100
Rumex vesicarius	+	10
Scaevola spinescens	+	80
Schoenia ayersii	+	7
Sclerolaena diacantha	+	25
Sclerolaena eriacantha	2	25
Sclerolaena obliquicuspis	+	30
Senecio glossanthus	ADJ	
Senna glutinosa subsp. chatelainiana	+	3
Senna sp. Meekatharra (E. Bailey 1-26)	1.5	120
Sida calyxhymenia	+	100
Solanum lasiophyllum	+	60
Swainsona elegantoides	+	5
Swainsona kingii	ADJ	
Taraxacum khatoonae	ADJ	
Vittadinia eremaea	ADJ	

Site BGQ02

Described by	CG	**Date**	25/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259283 mE	6937822 mN			
Habitat	Clay flat - depression on gypsum dune					
Soil	Brown clay					
Rock Type						
Vegetation	Mixed Chenopod Low Shrubland over *Swainsona paradoxa* Sparse Forbland					
Veg Condition	Excellent					
Fire Age	>10 years					

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	40
	Aristida contorta	+	35
	Atriplex vesicaria	25	60
	Convolvulus remotus	+	cr
	Cuscuta planiflora	ADJ	
	Dactyloctenium radulans	+	5
	Disphyma crassifolium subsp. clavellatum	+	10
	Dissocarpus paradoxus	+	40
	Enneapogon caerulescens	+	25
	Enneapogon polyphyllus	+	40
	Eragrostis pergracilis	+	30
	Eremophila longifolia	+	30
	Euphorbia drummondii	+	2
	Lycium australe	+	150
	Maireana amoena	+	30
	Maireana pyramidata	3	100
	Maireana tomentosa subsp. tomentosa	25	70
	Nicotiana occidentalis subsp. occidentalis	+	80
	Nicotiana rosulata	+	70
	Pimelea microcephala subsp. microcephala	+	120
	Poaceae sp.	+	30
	Rhagodia drummondii	+	20
	Rhodanthe sterilescens	+	25
	Roepera sp.	+	5
	Salsola australis	+	50
	Scaevola spinescens	+	100
	Sclerolaena articulata	+	50
	Sclerolaena obliquicuspis	1	50
	Senna artemisioides subsp. filifolia	+	40
	Senna glutinosa subsp. chatelainiana	ADJ	
	Sida ?ammophila	1	60
	Solanum lasiophyllum	+	50
	Sonchus oleraceus	+	40
	Swainsona paradoxa	10	cr
	Swainsona sp.	+	15
	Taraxacum khatoonae	+	20

Site BGQ03

Described by KMc **Date** 25/08/2018 **Type** Quadrat 20 x 20

Location Bellevue Gold Project

MGA Zone 51 258619 mE 6938052 mN

Habitat Edge of salt lake

Soil Gypsum

Rock Type Basalt and gypsum

Vegetation *Tecticornia indica* subsp. *bidens* and *T. pergranulata* subsp. *pergranulata* Open Samphire Shrubland over *Goodenia lyrata* and *eplidium* sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & *A.* Kanis 8) Sparse Forbland and *Eragrostis pergracilis* Sparse Grassland

Veg Condition Excellent

Fire Age >10 years

Species List	Name	Cover	Height
	?*Mimulus* sp.	+	1
	Angianthus cyathifer	+	7
	Eragrostis dielsii	+	8
	Eragrostis pergracilis	+	15
	Eragrostis sp.	+	20
	Frankenia cinerea	+	10
	Goodenia lyrata	4	2
	Heliotropium curassavicum	+	2
	Mimulus gracilis	+	3
Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & *A.* Kanis 8)	1	2	
	Poaceae sp.	+	2
	Swainsona paradoxa	+	20
	Tecticornia indica subsp. bidens	10	20
	Tecticornia peltata	3	15
	Tecticornia pergranulata subsp. pergranulata	+	10
	Tecticornia sp. sterile 1	+	10
	Triglochin hexagona	+	1

Site BGQ04

Described by	CG	**Date**	25/08/2018	**Type**	Quadrat	10 x 40
Location	Bellevue Gold Project					
MGA Zone	51	258758 mE	6938056 mN			
Habitat	Crest of gypsum dune					
Soil	Brown-white powdery loam, gypsum					
Rock Type						

Vegetation *Grevillea sarissa* subsp. *bicolor* Tall Sparse Shrubland over *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	>10 years		
Species List	Name	Cover	Height
	Aristida contorta	1.5	25
	Dysphania glomulifera subsp. eremaea	+	20
	Dysphania plantaginella	+	20
	Enneapogon caerulescens	+	30
	Eragrostis falcata	+	35
	Frankenia cinerea	+	25
	Goodenia maideniana	+	3
	Grevillea sarissa subsp. bicolor	4	200
	Lawrencia helmsii	5	100
	Lycium australe	ADJ	-28
	Maireana erioclada	ADJ	-28
	Maireana pentatropis	+	70
	Minuria gardneri	+	1
	Roepera eremaea	ADJ	
	Roepera reticulata	ADJ	
	Sclerolaena eriacantha	+	25

Site BGQ05

Described by	CG	**Date**	26/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258023 mE	6937816 mN			
Habitat	Crest of gypsum dune					
Soil	Brown-white powdery loam, gypsum					
Rock Type						

Vegetation *Eucalyptus striaticalyx* and *Casuarina pauper* Low Open Woodland over *Lawrencia helmsii* Sparse Shrubland over Isolated Clumps of Chenopods

Veg Condition	Excellent		
Fire Age	>10 years		
Species List	Name	Cover	Height
	Aristida contorta	ADJ	
	Asteridea chaetopoda	ADJ	
	Casuarina pauper	4	350
	Enchylaena tomentosa var. tomentosa	+	45
	Eucalyptus striaticalyx	15	1000
	Grevillea sarissa subsp. bicolor	ADJ	
	Lawrencia helmsii	+	100
	Lycium australe	+	80
	Maireana georgei	+	35
	Maireana pentatropis	+	50
	Maireana villosa	ADJ	
	Roepera compressa	+	10

Site BGQ06

Described by	KMc	**Date**	26/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	257938 **mE**	6938174 **mN**			
Habitat	Slope of gypsum dune					
Soil	Orange powdery clayey loam, gypsum					
Rock Type						

Vegetation *Tecticornia halocnemoides* and *T. pruinosa* Sparse Chenopod Shrubland over *Eragrostis falcata* Tussock Grassland

Veg Condition	Excellent		
Fire Age	>10 years		
Species List	Name	Cover	Height
	Atriplex nana	+	30
	Atriplex spongiosa	+	15
	Dysphania simulans	+	5
	Eragrostis falcata	50	20
	Frankenia cinerea	+	15
	Lawrencia helmsii	ADJ	
	Maireana amoena	+	15
	Roepera compressa	+	10
	Salsola australis	+	40
	Scaevola spinescens	ADJ	
	Sclerolaena fimbriolata	+	25
	Sclerolaena sp.	+	2
	Senecio lacustrinus	+	10
	Surreya diandra	+	20
	Swainsona paradoxa	+	10
	Tecticornia pruinosa	2	60

Tecticornia sp. Dennys Crossing (K.*A.* Shepherd & J. English KS 552)	12	70

Site BGQ07

Described by	CG	**Date**	26/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259229 **mE**	6938604 **mN**			
Habitat	Crest of red sand dune					
Soil	Red sand					
Rock Type						

Vegetation Santalum lanceolatum Isolated Trees over Rhagodia drummondii, Scaevola spinescens, Alyogyne pinoniana and Ptilotus obovatus Sparse Shrubland over Aristida holathera var. holathera Open Tussock Grassland

Veg Condition	Excellent		
Fire Age	>10 years		
Species List	Name	Cover	Height
	Abutilon otocarpum	+	60
	Acacia aneura	ADJ	
	Acacia ramulosa var. linophylla	1	200
	Alyogyne pinoniana	+	100
	Aristida holathera var. holathera	20	60
	Atriplex sp.	+	120
	Enchylaena tomentosa var. tomentosa	+	40
	Eragrostis eriopoda	+	70
	Exocarpos aphyllus	ADJ	
	Lysiana murrayi	+	cr
	Poaceae sp.	+	20
	Ptilotus obovatus var. obovatus	+	100
	Rhagodia drummondii	+	100
	Salsola australis	+	8
	Santalum lanceolatum	1	400
	Scaevola spinescens	+	200
	Sclerolaena obliquicuspis	+	40
	Senecio lacustrinus	+	25
	Senna pleurocarpa var. angustifolia	+	40
	Solanum lasiophyllum	+	70

Site BGQ08

Described by	KMc	**Date**	26/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259486 **mE**	6938689 **mN**			
Habitat	Lower stony slope					
Soil	Red clayey sand					
Rock Type	Basalt and quartz					

Vegetation *Acacia fuscaneura* Isolated Trees over *Eremophila exilifolia* and *E. forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Ptilotus obovatus* and *Solanum lasiophyllum* Low Sparse Shrubland over *Aristida contorta* open Tussock Grassland

Veg Condition	Excellent		
Fire Age	>10 years		
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	40
	Acacia fuscaneura	+	400
	Acacia tetragonophylla	+	100
	Aristida contorta	30	30
	Digitaria brownii	+	25
	Enneapogon caerulescens	+	20
	Enneapogon polyphyllus	+	30
	Eremophila exilifolia	0.5	170
	Eremophila forrestii subsp. forrestii	+	120
	Eremophila galeata	2	160
	Hibiscus sp. Gardneri	+	15
	Maireana georgei	+	25
	Maireana planifolia	+	60
	Maireana pyramidata	+	40
	Pimelea microcephala subsp. microcephala	ADJ	
	Ptilotus aervoides	+	1
	Ptilotus obovatus var. obovatus	1	50
	Salsola australis	+	20
	Scaevola spinescens	+	30
	Sclerolaena densiflora	+	2
	Sclerolaena eriacantha	+	15
	Sclerolaena obliquicuspis	+	15
	Senna artemisioides subsp. helmsii	+	60
	Senna artemisioides subsp. x artemisioides	ADJ	
	Senna glaucifolia	+	70
	Senna glutinosa subsp. chatelainiana	ADJ	
	Senna sp. Meekatharra (E. Bailey 1-26)	+	30
	Sida calyxhymenia	+	60
	Solanum lasiophyllum	1	60

Site BGQ09

Described by	CG	**Date**	26/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258788 **mE**	6939209 **mN**			
Habitat	Sand flat					
Soil	Red sand					
Rock Type						

Vegetation *Acacia aneura* Low Open Woodland over *A. ? minyura* (hybrid) Tall Isolated Shrubs to Tall Sparse Shrubland over *Maireana pyramidata* Low Sparse Shrubland over mixed Open Tussock Grassland

Veg Condition Excellent to Very Good

Fire Age >10 years

Species List	Name	Cover	Height
	Acacia ? *minyura* (hybrid)	7	400
	Acacia aneura	10	1000
	Acacia fuscaneura	ADJ	
	Acacia minyura	1.5	120
	Acacia tetragonophylla	+	150
	Aristida contorta	12	35
	Cymbopogon ambiguus	+	70
	Enchylaena tomentosa var. tomentosa	+	80
	Enneapogon polyphyllus	+	30
	Eragrostis eriopoda	15	50
	Eremophila forrestii subsp. forrestii	+	100
	Eriachne helmsii	3	80
	Euphorbia boophthona	+	70
	Maireana georgei	ADJ	
	Maireana pyramidata	8	150
	Minuria cunninghamii	+	150
	Monachather paradoxus	1	50
	Pimelea forrestiana	2	50
	Pterocaulon sphacelatum	ADJ	
	Ptilotus chamaecladus	+	1
	Ptilotus macrocephalus	+	30
	Ptilotus obovatus var. obovatus	3	80
	Sclerolaena obliquicuspis	+	35
	Senna artemisioides subsp. x sturtii	ADJ	
	Solanum lasiophyllum	1	80

Site BGQ10

Described by	KMc	**Date**	26/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259208 **mE**	6939143 **mN**			
Habitat	Crest of hill					
Soil	Red coarse sandy clay					
Rock Type	Basalt					

Vegetation *Acacia fuscaneura* and *A. xanthocarpa* Low Open Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Aristida contorta* Open Tussock Grassland

Veg Condition	Excellent		
Fire Age	>10 years		
Species List	Name	Cover	Height
	Acacia fuscaneura	4	400
	Acacia xanthocarpa	2	300
	Aristida contorta	30	30
	Cheilanthes lasiophylla	+	10
	Eremophila exilifolia	+	90
	Eremophila forrestii subsp. forrestii	3	90
	Eriachne mucronata	+	40
	Grevillea inconspicua	+	50
	Heliotropium inexplicitum	+	10
	Hibiscus burtonii	+	40
	Maireana planifolia	+	40
	Maireana sp.	+	40
	Marsdenia australis	+	cr
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	+	35
	Senna artemisioides subsp. helmsii	2	120
	Senna glaucifolia	+	20
	Sida calyxhymenia	+	60
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	40
	Solanum lasiophyllum	+	30

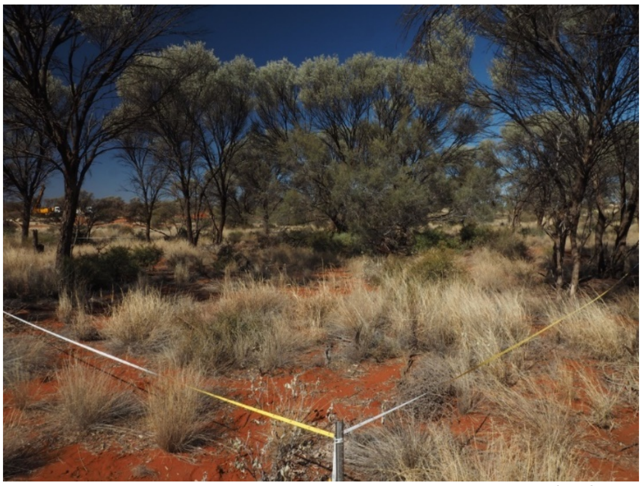
Site BGQ11

Described by	CG	**Date**	27/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258609 **mE**	6939935 **mN**			
Habitat	Clayey sand flat					
Soil	Red-brown sand					
Rock Type	Basalt					

Vegetation *Acacia aneura* Low Open Woodland over *A. ramulosa* var. *linophylla* Tall Sparse Shrubland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over mixed Open Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aneura	10	600
	Acacia ramulosa var. linophylla	5	250
	Acacia tetragonophylla	ADJ	
	Aristida contorta	+	25
	Cenchrus ciliaris	+	50
	Enchylaena tomentosa var. tomentosa	+	20
	Eragrostis eriopoda	1.5	60
	Eremophila exilifolia	ADJ	
	Eremophila forrestii subsp. forrestii	5	150
	Eremophila galeata	ADJ	
	Eriachne benthamii	2	60
	Hakea lorea subsp. lorea	ADJ	
	Maireana georgei	ADJ	
	Maireana pyramidata	+	130
	Maireana triptera	+	40
	Marsdenia australis	+	cr
	Monachather paradoxus	4	80
	Ptilotus obovatus var. obovatus	+	30
	Ptilotus schwartzii var. schwartzii	ADJ	50
	Sclerolaena obliquicuspis	ADJ	
	Senna artemisioides subsp. x sturtii	ADJ	
	Senna charlesiana	+	60
	Senna glaucifolia	ADJ	
	Solanum lasiophyllum	+	50
	Tribulus sp.	+	1

Site BGQ12

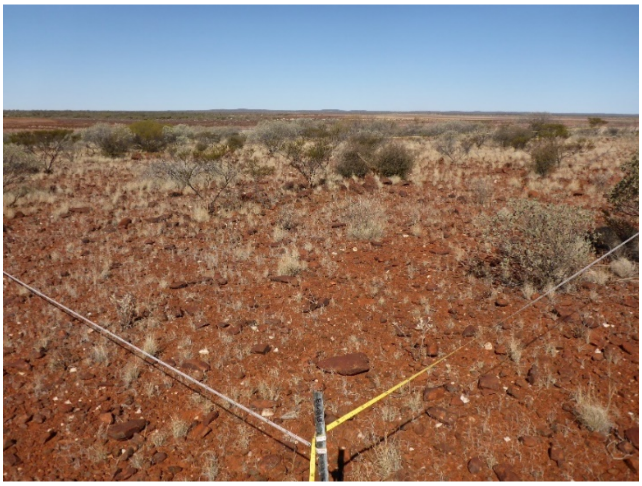


Described by	KMc	**Date**	27/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258577 **mE**	6939460 **mN**			
Habitat	Lower slope of hill					
Soil	Red sand					
Rock Type	Basalt					

Vegetation *Acacia minyura* Low Woodland over *Maireana pyramidata* and *Rhagodia spinescens* Mid Sparse Shrubland over *Aristida holathera* var. *holathera* and *Eragrostis* spp. Open Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	30
	Acacia ? *minyura* (hybrid)	+	200
	Acacia minyura	45	600
	Aristida contorta	1	30
	Aristida holathera var. holathera	25	50
	Calandrinia ptychosperma	ADJ	
	Cenchrus ciliaris	2	70
	Enchylaena tomentosa var. tomentosa	+	60
	Enneapogon caerulescens	+	30
	Enneapogon polyphyllus	+	30
	Eragrostis eriopoda	+	35
	Eragrostis lanipes	5	60
	Eragrostis xerophila	5	45
	Eremophila glabra subsp. glabra	ADJ	
	Eremophila longifolia	+	35
	Eriachne benthamii	2	60
	Hakea preissii	2	500
	Maireana pyramidata	2	90
	Marsdenia australis	+	150
	Monachather paradoxus	+	45
	Olearia humilis	ADJ	
	Pimelea microcephala subsp. microcephala	+	30
	Ptilotus exaltatus	+	30
	Ptilotus obovatus var. obovatus	+	70
	Rhagodia spinescens	1	90
	Scaevola spinescens	+	110
	Sclerolaena deserticola	1	25
	Sclerolaena diacantha	+	20
	Senna charlesiana	+	30
	Sida calyxhymenia	+	70
	Solanum lasiophyllum	1	40

Site BGQ13

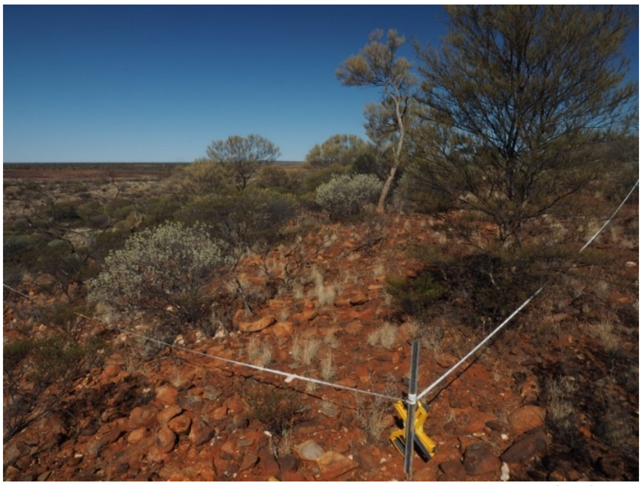


Described by	CG	**Date**	27/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259497 **mE**	6939177 **mN**			
Habitat	Lower slope of stony hill					
Soil	Red clay loam					
Rock Type	Basalt					

Vegetation *Senna artemisioides* subsp. *helmsii* and *Eremophila exilifolia* Mid Sparse Shrubland over *Ptilotus obovatus* Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia tetragonophylla	+	100
	Acacia xanthocarpa	+	2
	Aristida contorta	8	30
	Dodonaea rigida	ADJ	
	Enchylaena tomentosa var. tomentosa	+	60
	Enneapogon caerulescens	+	30
	Eremophila exilifolia	2.5	150
	Eremophila galeata	ADJ	
	Grevillea inconspicua	1	100
	Hibiscus sp. Gardneri	+	10
	Maireana georgei	ADJ	
	Maireana sp.	ADJ	
	Maireana triptera	ADJ	
	Ptilotus helipteroides	+	3
	Ptilotus obovatus var. obovatus	1.5	70
	Scaevola spinescens	ADJ	
	Sclerolaena densiflora	+	20
	Senna artemisioides subsp. helmsii	3.5	150
	Senna glaucifolia	+	100
	Senna sp. Meekatharra (E. Bailey 1-26)	+	40
	Sida sp.	ADJ	
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		+	40
	Solanum lasiophyllum	+	50

Site BGQ14

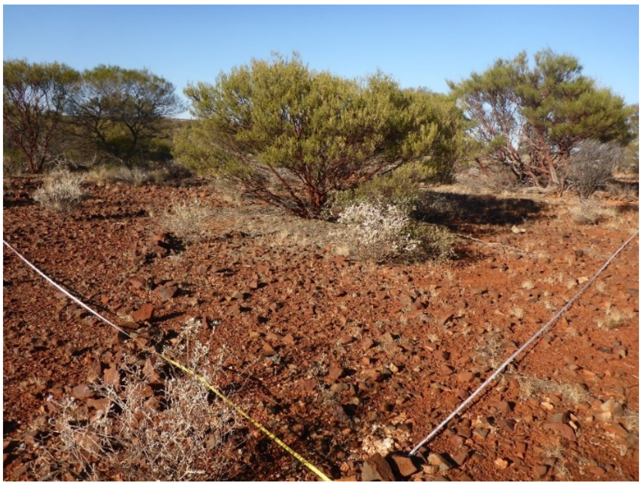


Described by	KMc	**Date**	27/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259334 **mE**	6939204 **mN**			
Habitat	Mid slope of stony hill					
Soil	Orange coarse sandy clay					
Rock Type	Basalt and quartz					

Vegetation *Acacia fuscaneura* Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Senna* spp., *Eremophila exilifolia* and *E. forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon oxycarpum	+	4
	Acacia fuscaneura	3	500
	Acacia tetragonophylla	+	70
	Acacia xanthocarpa	4	250
	Aristida contorta	10	30
	Boerhavia coccinea	+	2
	Cheilanthes lasiophylla	1	15
	Cymbopogon ambiguus	+	70
	Digitaria brownii	+	40
	Enchylaena tomentosa var. tomentosa	+	30
	Enneapogon caerulescens	+	20
	Eremophila exilifolia	4	100
	Eremophila forrestii subsp. forrestii	1	40
	Eremophila serrulata	+	60
	Eriachne mucronata	+	20
	Eriachne pulchella subsp. pulchella	+	3
	Maireana planifolia	+	60
	Marsdenia australis	+	cr
	Portulaca oleracea	+	2
	Ptilotus aervoides	+	2
	Ptilotus helipteroides	+	3
	Ptilotus obovatus var. obovatus	+	40
	Santalum spicatum	ADJ	200
	Sclerolaena deserticola	+	15
	Senna artemisioides subsp. helmsii	4	120
	Senna glaucifolia	3	180
	Sida calyxhymenia	+	60
	Solanum lasiophyllum	+	40
	Tribulus astrocarpus	+	1

Site BGQ15



Described by	CG	**Date**	28/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259303 **mE**	6940199 **mN**			
Habitat	Mid to lower slope of stony hill					
Soil	Red sandy loam					
Rock Type	Basalt					

Vegetation *Acacia doreta* (long phyllode form) and *A. fuscaneura* Low Open Woodland over *Senna glaucifolia*, *Ptilotus obovatus*, *Eremophila exilifolia* Mid Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia doreta (long phyllode form)	10	400
	Acacia fuscaneura	2	400
	Acacia tetragonophylla	+	200
	Acacia xanthocarpa	2	400
	Aristida contorta	2	35
	Enchylaena tomentosa var. tomentosa	+	90
	Enneapogon caerulescens	+	25
	Eremophila exilifolia	+	100
	Eremophila forrestii subsp. forrestii	+	100
	Eremophila oldfieldii subsp. angustifolia	ADJ	
	Goodenia sp.	+	5
	Grevillea inconspicua	+	100
	Maireana georgei	+	35
	Maireana triptera	+	40
	Portulaca oleracea	+	1
	Ptilotus aervoides	+	1
	Ptilotus exaltatus	+	30
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	5	70
	Roepera glauca	+	1
	Salsola australis	+	15
	Scaevola spinescens	ADJ	
	Sclerolaena diacantha	+	20
	Senna artemisioides subsp. helmsii	+	35
	Senna artemisioides subsp. x artemisioides	+	100
	Senna glaucifolia	1	100
	Solanum lasiophyllum	+	50

Site BGQ16

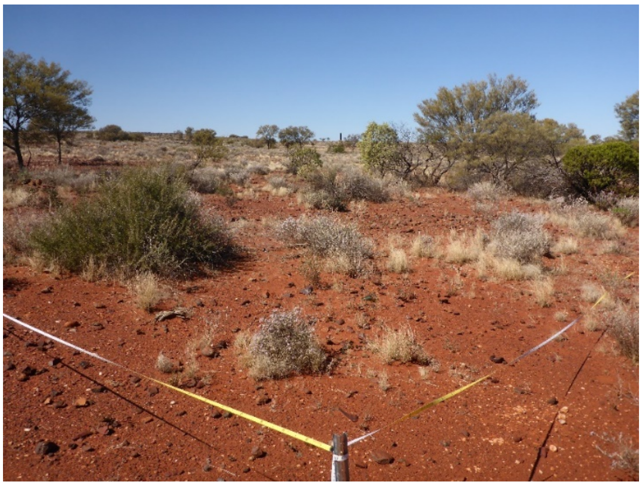
Described by	CG	**Date**	28/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259511 **mE**	6940286 **mN**			
Habitat	Lower slope of stony hill					
Soil	Red coarse sandy clay					
Rock Type	Basalt and quartz					

Vegetation *Acacia macraneura* and *Acacia doreta* (long phyllode form) Low Open Woodland over and *A. xanthocarpa* Tall Sparse Shrubland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Ptilotus obovatus* and *Maireana* spp. Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon ?cryptopetalum	+	35
	Abutilon oxycarpum subsp. Prostrate	+	10
	Acacia doreta (long phyllode form)	1	300
	Acacia macraneura	1	500
	Acacia tetragonophylla	+	200
	Acacia xanthocarpa	+	200
	Aristida contorta	10	30
	Boerhavia coccinea	+	10
	Cheilanthes lasiophylla	+	20
	Digitaria brownii	+	30
	Enchylaena tomentosa var. tomentosa	+	70
	Enneapogon caerulescens	1	20
	Enneapogon polyphyllus	+	20
	Eremophila exilifolia	+	110
	Eremophila forrestii subsp. forrestii	2	180
	Eremophila oldfieldii subsp. angustifolia	ADJ	
	Euphorbia boophthona	+	20
	Glycine canescens	+	cr
	Heliotropium inexplicitum	+	10
	Heliotropium sp.	+	3
	Maireana georgei	+	60
	Maireana planifolia	+	70
	Maireana triptera	+	40
	Maireana villosa	+	30
	Portulaca oleracea	+	1
	Ptilotus aervoides	+	1
	Ptilotus exaltatus	+	20
	Ptilotus helipteroides	+	10

Ptilotus obovatus var. obovatus	1	50
Salsola australis	+	20
Santalum acuminatum	ADJ	
Scaevola spinescens	+	180
Sclerolaena densiflora	+	20
Sclerolaena diacantha	+	20
Sclerolaena eriacantha	+	30
Senna artemisioides subsp. helmsii	+	40
Senna artemisioides subsp. x artemisioides	+	120
Senna charlesiana	+	20
Senna glaucifolia	+	40
Senna sp. Meekatharra (E. Bailey 1-26)	+	10
Sida calyxhymenia	+	90
Sida sp. Exidentifolia (J.L. Egan 1925)	+	15
Solanum lasiophyllum	+	40
Swainsona elegantoides	ADJ	

Site BGQ17



Described by	CG	**Date**	28/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258660 **mE**	6940800 **mN**			
Habitat	Stony flat					
Soil	Red sandy clay loam					
Rock Type	Basalt					

Vegetation *Acacia macraneura* Isolated Trees to Low Open Woodland over *Ptilotus obovatus*, *Sida calyxhymenia* and *Maireana* spp. Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland.

Veg Condition Very Good - Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Abutilon fraseri	+	7
	Acacia macraneura	5	550
	Acacia tetragonophylla	1	200
	Aristida contorta	7	40
	Cymbopogon ambiguus	1	90
	Enchylaena tomentosa var. tomentosa	+	40
	Enneapogon caerulescens	2	35
	Enneapogon polyphyllus	+	25
	Enteropogon ramosus	+	70
	Eremophila galeata	+	150
	Maireana georgei	1	45
	Maireana tomentosa subsp. tomentosa	1	60
	Maireana triptera	+	35
	Ptilotus aervoides	+	2
	Ptilotus exaltatus	+	20
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	10	100
	Roepera compressa	ADJ	
	Santalum lanceolatum	+	240
	Scaevola spinescens	+	140
	Sclerolaena cuneata	+	15
	Sclerolaena densiflora	+	30
	Senna artemisioides subsp. helmsii	+	10
	Senna glaucifolia	+	120
	Sida ?fibulifera	+	15
	Sida calyxhymenia	2	150
	Solanum lasiophyllum	+	30
	Stackhousia muricata	+	10

Site BGQ18

Described by	KMc	**Date**	28/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259174 **mE**	6940752 **mN**			
Habitat	Upper slope of stony hill					
Soil	Red coarse sandy clay					
Rock Type	Basalt					

Vegetation *Acacia fuscaneura* and *Acacia doreta* (long phyllode form) Low open Woodland over *Senna artemisioides* subsp. x *sturtii* and *Eremophila exilifolia* Mid to Tall Sparse Shrubland over *Ptilotus obovatus*, *Solanum lasiophyllum* and *Chenopod* spp. Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland and mixed Sparse Forbland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon oxycarpum	+	2
	Acacia doreta (long phyllode form)	3	400
	Acacia fuscaneura	2	450
	Acacia tetragonophylla	+	200
	Acacia xanthocarpa	2	200
	Aristida contorta	12	30
	Boerhavia *coccinea*	+	20
	Cymbopogon ambiguus	+	60
	Cymbopogon obtectus	+	60
	Duperreya commixta	1	cr
	Enchylaena tomentosa var. tomentosa	+	70
	Enneapogon caerulescens	5	20
	Enneapogon polyphyllus	+	25
	Eremophila exilifolia	1	90
	Eremophila forrestii subsp. forrestii	+	70
	Eremophila oldfieldii subsp. angustifolia	+	70
	Eriachne pulchella subsp. pulchella	+	3
	Haloragis *trigonocarpa*	+	10
	Hibiscus sp. Gardneri	+	60
	Maireana georgei	+	40
	Maireana pyramidata	ADJ	
	Maireana triptera	+	30
	Marsdenia australis	ADJ	
	Portulaca oleracea	+	1
	Ptilotus aervoides	+	1
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	3	70

Rhagodia drummondii	+	90
Roepera compressa	+	10
Salsola australis	+	20
Scaevola spinescens	+	90
Sclerolaena densiflora	+	10
Sclerolaena obliquicuspis	+	30
Senna artemisioides subsp. helmsii	+	50
Senna artemisioides subsp. x artemisioides	+	120
Senna artemisioides subsp. x sturtii	3	150
Sida calyxhymenia	+	90
Solanum lasiophyllum	+	40

Site BGQ19

Described by CG **Date** 28/08/2018 **Type** Quadrat 20 x 20

Location Bellevue Gold Project

MGA Zone 51 258987 **mE** 6941457 **mN**

Habitat Upper slope of stony hill

Soil Red sandy clay loam

Rock Type

Vegetation *Acacia pteraneura* Low Open Woodland with Isolated clumps of *A. doreta* (long phyllode form) over *A. xanthocarpa* Tall Isolated Shrums over *Senna artemesioides* Mid Sparse Shrubland over *Ptilotus obovatus* and *Maireana* spp. Low Sparse Shrubland over *Aristida contorta* Sparse Tussock

Veg Condition Excellent

Fire Age > 10 years

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	30
	Acacia doreta (long phyllode form)	ADJ	
	Acacia pteraneura	4	450
	Acacia tetragonophylla	ADJ	
	Acacia xanthocarpa	ADJ	
	Aristida contorta	2	30
	Cymbopogon ambiguus	ADJ	0
	Enneapogon caerulescens	+	30
	Enneapogon polyphyllus	+	20
	Eremophila exilifolia	+	120
	Eremophila forrestii subsp. forrestii	ADJ	
	Eremophila oldfieldii subsp. angustifolia	ADJ	
	Goodenia sp.	ADJ	
	Maireana georgei	+	20
	Maireana integra	+	25
	Maireana pyramidata	ADJ	
	Maireana sp.	+	40
	Maireana triptera	+	20
	Marsdenia australis	+	120
	Portulaca oleracea	+	1
	Ptilotus aervoides	+	1
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	3	70
	Rhagodia sp.	+	80
	Scaevola spinescens	+	10
	Sclerolaena densiflora	+	7
	Senna artemisioides subsp. helmsii	+	60
	Senna artemisioides subsp. x artemisioides	ADJ	

Senna glaucifolia	4	140
Senna glutinosa subsp. chatelainiana	ADJ	
Senna sp. Meekatharra (E. Bailey 1-26)	+	120
Sida ?calyxhymenia	+	60
Sida sp. dark green fruit (S. van Leeuwen 2260)	+	60
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	60
Solanum lasiophyllum	+	60

Site BGQ20

Described by	KMc	**Date**	28/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258787 **mE**	6941646 **mN**			
Habitat	Creek bed and bank					
Soil	Red coarse sandy clay					
Rock Type						

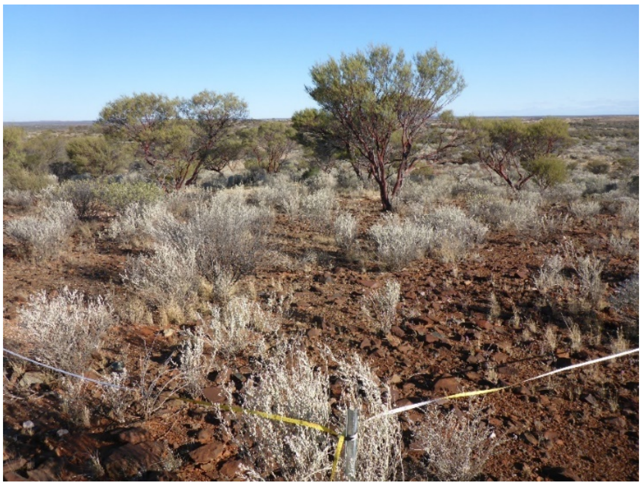
Vegetation *Acacia fuscaneura* and *A. pteraneura* Low Open Woodland over *A. tetragonophylla* Tall Sparse Shrubland over *Senna* spp. Mid Sparse Shrubland over *Ptilotus obovatus* and *Enchylaena tomentosa* Low Sparse Shrubland over *Digitaria brownii*, *Eriachne benthamii* and *Aristida contorta* open Tussock Grassland

Veg Condition	Excellent
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	30
	Acacia doreta (long phyllode form)	1	400
	Acacia fuscaneura	15	900
	Acacia pteraneura	3	900
	Acacia tetragonophylla	3	300
	Acacia xanthocarpa	+	50
	Aristida contorta	5	30
	Boerhavia coccinea	+	10
	Cymbopogon ambiguus	+	60
	Dactyloctenium radulans	+	20
	Digitaria brownii	5	40
	Duperreya commixta	+	220
	Enchylaena tomentosa var. tomentosa	1	70
	Enneapogon caerulescens	1	30
	Enneapogon sp.	+	20
	Eremophila exilifolia	+	70
	Eremophila forrestii subsp. forrestii	+	70
	Eremophila glabra subsp. glabra	+	70
	Eremophila longifolia	+	40
	Eremophila sp.	+	120
	Eriachne benthamii	2	70
	Eriachne pulchella subsp. dominii	+	10
	Glycine canescens	+	cr
	Heliotropium inexplicitum	+	10
	Hibiscus sp. Gardneri	+	60
	Iseilema eremaeum	+	15
	Maireana villosa	+	30
	Marsdenia australis	+	130

Portulaca oleracea	+	1
Ptilotus helipteroides	+	10
Ptilotus obovatus var. obovatus	3	70
Rhagodia eremaea	+	60
Salvia verbenaca	+	10
Scaevola spinescens	+	20
Sclerolaena diacantha	+	20
Senna artemisioides subsp. filifolia	+	130
Senna artemisioides subsp. helmsii	1	150
Senna artemisioides subsp. x artemisioides	+	60
Senna charlesiana	+	70
Senna sp. Meekatharra (E. Bailey 1-26)	+	60
Sida calyxhymenia	+	90
Sida sp. Exidentifolia (J.L. Egan 1925)	1	25
Solanum lasiophyllum	+	40
Swainsona elegantoides	+	10

Site BGQ21

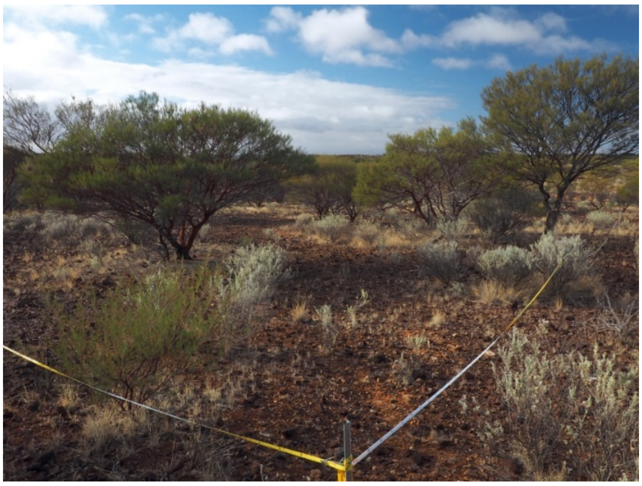


Described by	CG	**Date**	28/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258874 **mE**	6942269 **mN**			
Habitat	Ridge and upper slopes of stony hill					
Soil	Red sandy clay loam					
Rock Type	Basalt and quartz					

Vegetation *Acacia doreta* (long phyllode form) and *A. pteraneura* Low Open Woodland over *Ptilotus obovatus* and *Senna* spp. Low Open Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia doreta (long phyllode form)	8	450
	Acacia pteraneura	ADJ	
	Acacia tetragonophylla	ADJ	
	Acacia xanthocarpa	ADJ	
	Aristida contorta	2	30
	Cymbopogon ambiguus	ADJ	
	Enchylaena tomentosa var. tomentosa	+	50
	Enneapogon caerulescens	+	30
	Eremophila exilifolia	ADJ	
	Eremophila oldfieldii subsp. angustifolia	+	200
	Maireana georgei	+	30
	Maireana triptera	ADJ	
	Ptilotus aervoides	+	1
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	25	100
	Roepera compressa	ADJ	0
	Salsola australis	+	60
	Scaevola spinescens	ADJ	0
	Sclerolaena densiflora	+	15
	Senna artemisioides subsp. helmsii	1	60
	Senna artemisioides subsp. x sturtii	ADJ	
	Senna charlesiana	ADJ	0
	Senna glaucifolia	+	100
	Sida sp.	+	15
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		+	15
	Solanum lasiophyllum	+	80

Site BGQ22



Described by KMc **Date** 29/08/2018 **Type** Quadrat 20 x 20
Location Bellevue Gold Project
MGA Zone 51 258980 **mE** 6942934 **mN**
Habitat Upper slope of hill
Soil Red coarse sandy clay loam
Rock Type
Vegetation *Acacia aptaneura* and *A. doreta* (long phyllode form) Low Open Woodland over *Ptilotus obovatus* Low Sparse Shrubland over *Enneapogon caerulescens*, *Enneapogon polyphyllus* and *Aristida contorta* Sparse Tussock Grassland
Veg Condition Excellent
Fire Age > 10 years

Species List Name	Cover	Height
Abutilon cryptopetalum	+	25
Abutilon oxycarpum subsp. Prostrate	+	10
Acacia aptaneura	2	500
Acacia doreta (long phyllode form)	4	350
Acacia xanthocarpa	ADJ	
Aristida contorta	1	25
Enchylaena tomentosa var. tomentosa	+	60
Enneapogon caerulescens	2	20
Enneapogon polyphyllus	1	40
Eremophila oldfieldii subsp. angustifolia	+	350
Maireana triptera	ADJ	
Maireana villosa	+	15
Marsdenia australis	+	cr
Portulaca oleracea	+	1
Ptilotus aervoides	+	1
Ptilotus helipteroides	+	5
Ptilotus obovatus var. obovatus	3	90
Rhagodia drummondii	+	120
Roepera lobulata	+	3
Salsola australis	+	5
Santalum spicatum	ADJ	
Sclerolaena densiflora	ADJ	
Senna artemisioides subsp. filifolia	+	40
Senna artemisioides subsp. helmsii	+	40
Senna artemisioides subsp. x sturtii	+	110
Senna sp. Meekatharra (E. Bailey 1-26)	+	120
Sida sp. Exidentifolia (J.L. Egan 1925)	+	20
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	35
Solanum lasiophyllum	+	40

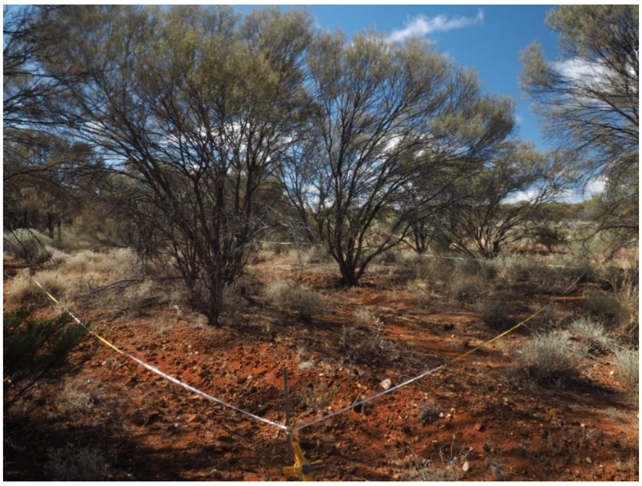
Site BGQ23

Described by	CG	**Date**	29/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258744 **mE**	6942589 **mN**			
Habitat	Low undulating stony hill					
Soil	Red sandy clay loam					
Rock Type	Basalt					

Vegetation *Acacia doreta* (long phyllode form), *A. xanthocarpa* and *Eremophila oldfieldii* subsp. *angustifolia* Low Open Woodland over *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon ?cryptopetalum	+	25
	Abutilon oxycarpum	+	30
	Acacia doreta (long phyllode form)	3	550
	Acacia pteraneura	ADJ	
	Acacia tetragonophylla	ADJ	
	Acacia xanthocarpa	1	250
	Aristida contorta	3	30
	Austrostipa scabra	+	60
	Enchylaena tomentosa var. tomentosa	+	80
	Enneapogon caerulescens	+	25
	Enneapogon sp.	+	15
	Eremophila exilifolia	+	100
	Eremophila forrestii subsp. forrestii	ADJ	
	Eremophila galeata	ADJ	
	Eremophila oldfieldii subsp. angustifolia	1	200
	Hibiscus sp. Gardneri	+	70
	Maireana georgei	+	60
	Maireana tomentosa x	+	60
	Maireana triptera	+	40
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	12	100
	Roepera lobulata	+	10
	Salsola australis	+	100
	Santalum spicatum	ADJ	
	Scaevola spinescens	ADJ	
	Sclerolaena densiflora	+	50
	Senna artemisioides subsp. helmsii	7	140
	Senna artemisioides subsp. x artemisioides	+	100
	Senna sp. Meekatharra (E. Bailey 1-26)	2	120
	Sida calyxhymenia	+	90
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	50
	Solanum lasiophyllum	1	80

Site BGQ24



Described by	KMc	**Date**	29/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258640 **mE**	6942857 **mN**			
Habitat	Creekline on mid slope of stony hill					
Soil	Red stony loam					
Rock Type						

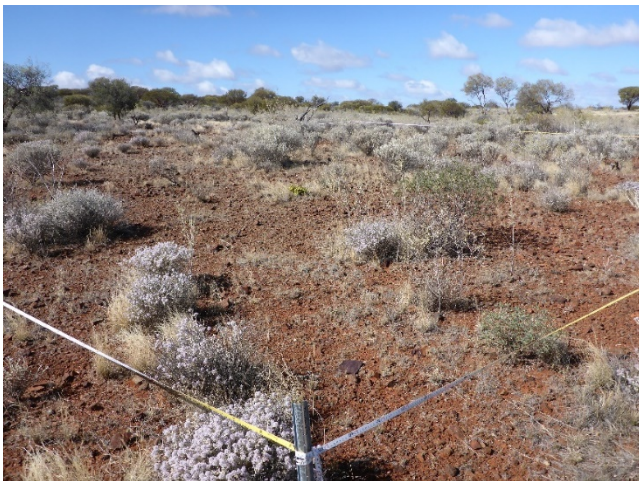
Vegetation *Acacia minyura*, *A. fuscaneura* and *Hakea lorea* subsp. *lorea* Low Woodland over *Senna* spp. Mid Sparse Shrubland over *Ptilotus obovatus* Low Sparse Shrubland over *Enneapogon caerulescens* and *Cymbopogon ambiguus* Sparse Tussock Grassland

Veg Condition	Excellent
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	30
	Abutilon otocarpum	+	20
	Acacia doreta (long phyllode form)	ADJ	
	Acacia fuscaneura	15	500
	Acacia minyura	6	400
	Acacia tetragonophylla	+	40
	Acacia xanthocarpa	+	120
	Aristida contorta	+	30
	Boerhavia coccinea	+	10
	Cymbopogon ambiguus	1	70
	Digitaria brownii	+	25
	Duperreya commixta	+	cr
	Enchylaena tomentosa var. tomentosa	1	80
	Enneapogon caerulescens	1	30
	Enneapogon polyphyllus	+	40
	Eremophila exilifolia	+	60
	Eremophila forrestii subsp. forrestii	ADJ	
	Eremophila glabra subsp. glabra	ADJ	
	Erodium cygnorum	+	2
	Euphorbia australis var. subtomentosa	+	10
	Euphorbia boophthona	+	2
	Glycine canescens	+	cr
	Hakea lorea subsp. *lorea*	2	400
	Haloragis trigonocarpa	+	2
	Heliotropium inexplicitum	+	10
	Helipterum craspedioides	ADJ	
	Hibiscus sp. Gardneri	+	80
	Maireana sp.	1	40

Maireana triptera	+	30
Marsdenia australis	+	cr
Phyllanthus erwinii	+	2
Portulaca oleracea	+	1
Ptilotus aervoides	+	2
Ptilotus helipteroides	+	5
Ptilotus obovatus var. obovatus	5	80
Rhagodia eremaea	+	60
Sclerolaena deserticola	1	20
Sclerolaena diacantha	+	20
Senna artemisioides subsp. helmsii	+	100
Senna charlesiana	+	30
Sida calyxhymenia	+	130
Sida sp. Exidentifolia (J.L. Egan 1925)	+	20
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	60
Solanum lasiophyllum	+	40
Tribulus astrocarpus	+	2

Site BGQ25

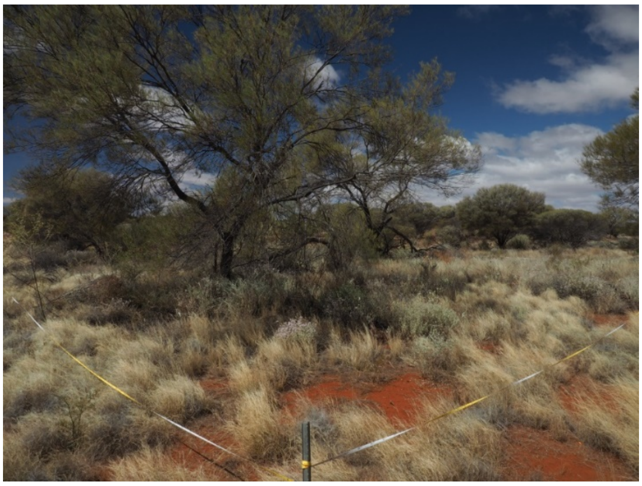


Described by	CG	**Date**	29/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258556 **mE**	6942622 **mN**			
Habitat	Lower to mid slopes of stony hill					
Soil	Red sandy clay loam					
Rock Type	Basalt					

Vegetation *Ptilotus obovatus* Low Open Shrubland over *Aristida contorta*, *Enneapogon caerulescens* and *Enneapogon polyphyllus* Sparse Tussock Grassland over mixed Sparse Forbland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon otocarpum	+	70
	Abutilon oxycarpum subsp. Prostrate	+	20
	Aristida contorta	2	30
	Enneapogon caerulescens	2	40
	Enneapogon polyphyllus	+	30
	Eremophila oldfieldii subsp. angustifolia	+	20
	Maireana georgei	+	30
	Ptilotus aervoides	+	1
	Ptilotus helipteroides	+	4
	Ptilotus obovatus var. obovatus	35	100
	Rhagodia drummondii	ADJ	
	Roepera lobulata	+	5
	Salsola australis	+	15
	Sclerolaena densiflora	+	15
	Sclerolaena obliquicuspis	+	10
	Senna artemisioides subsp. helmsii	+	40
	Senna artemisioides subsp. x sturtii	+	100
	Senna charlesiana	+	50
	Sida calyxhymenia	2	150
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	30
	Sida sp. Exidentifolia (J.L. Egan 1925)	+	15
	Solanum lasiophyllum	+	60

Site BGQ26



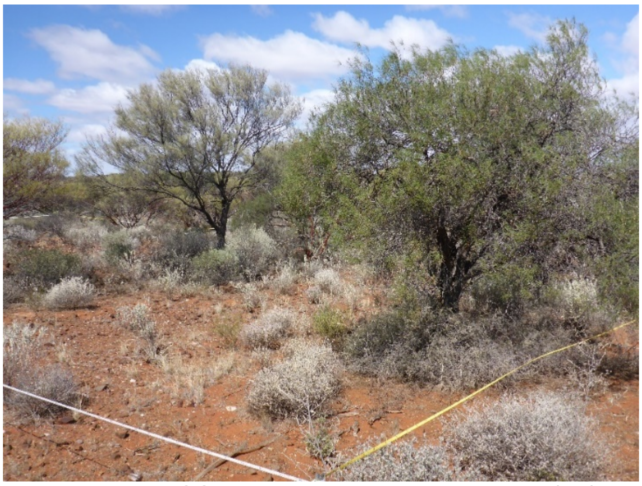
Described by	KMc	**Date**	29/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258365 **mE**	6942584 **mN**			
Habitat	Lower slope to flat					
Soil	Red coarse sandy clay					
Rock Type						

Vegetation Acacia aptaneura Low Woodland over Ptilotus obovatus and Chenopod spp. Low Sparse Shrubland over Aristida contorta, Enneapogon caerulescens, Eragrostis eriopoda and Enneapogon polyphyllus Open Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	25	700
	Acacia ramulosa var. linophylla	1	350
	Aristida contorta	15	30
	Citrullus amarus	+	cr
	Dactyloctenium radulans	ADJ	
	Enchylaena tomentosa var. tomentosa	+	70
	Enneapogon caerulescens	15	30
	Enneapogon polyphyllus	1	40
	Eragrostis eriopoda	5	50
	Eragrostis lanipes	+	40
	Eremophila forrestii subsp. forrestii	+	30
	Eremophila longifolia	+	70
	Eremophila oldfieldii subsp. angustifolia	+	60
	Euphorbia drummondii	+	2
	Haloragis trigonocarpa	+	5
	Helipterum craspedioides	+	10
	Hibiscus sp. Gardneri	+	70
	Iseilema eremaeum	+	20
	Lepidium rotundum	+	3
	Lysiana murrayi	+	-
	Maireana georgei	+	60
	Maireana triptera	ADJ	
	Maireana villosa	+	40
	Marsdenia australis	+	cr
	Monachather paradoxus	3	70
	Ptilotus aervoides	+	1
	Ptilotus chamaecladus	+	2
	Ptilotus gaudichaudii	ADJ	

Ptilotus helipteroides	+	5
Ptilotus macrocephalus	+	20
Ptilotus obovatus var. obovatus	8	70
Rhagodia eremaea	+	90
Salsola australis	+	40
Sclerolaena deserticola	+	20
Sclerolaena diacantha	+	20
Senna artemisioides subsp. helmsii	+	50
Sida calyxhymenia	+	90
Sida sp. Exidentifolia (J.L. Egan 1925)	+	20
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	1	180
Solanum lasiophyllum	1	40

Site BGQ27

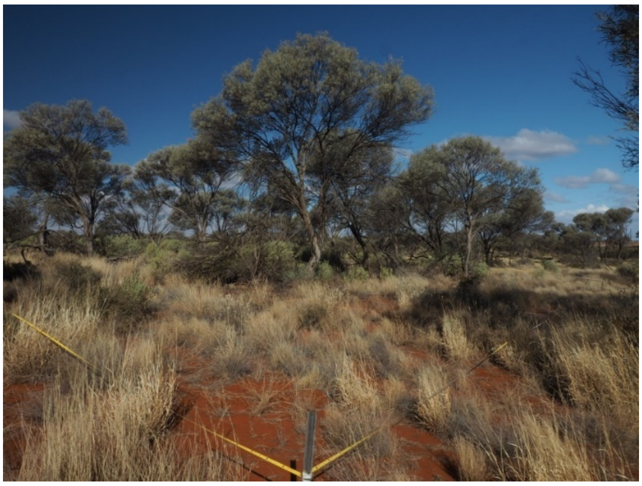


Described by	CG	**Date**	29/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258589 **mE**	6942945 **mN**			
Habitat	Upper slope of stony hill					
Soil	Red sandy clay loam					
Rock Type	Basalt					

Vegetation *Acacia doreta* (long phyllode form) Low Open Woodland with *A. pteraneura* Isolated Trees and *Eremophila oldfieldii* subsp. *angustifolia* Isolated Clumps of Trees over *Acacia xanthocarpa* Tall Sparse Shrubland over *Senna artemisioides* Mid Sparse Shrubland over *Ptilotus obovatus* Low Sparse Shrubland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon ?cryptopetalum	+	10
	Acacia doreta (long phyllode form)	4	500
	Acacia pteraneura	5	800
	Acacia tetragonophylla	+	130
	Acacia xanthocarpa	1.5	400
	Aristida contorta	ADJ	
	Duperreya commixta	ADJ	
	Enchylaena tomentosa var. tomentosa	1	150
	Enneapogon caerulescens	+	30
	Eremophila exilifolia	+	130
	Eremophila oldfieldii subsp. angustifolia	6	600
	Eriochiton sclerolaenoides	ADJ	
	Glycine canescens	+	cr
	Hibiscus sp. Gardneri	+	150
	Maireana pyramidata	ADJ	
	Maireana triptera	+	50
	Marsdenia australis	+	cr
	Portulaca oleracea	+	1
	Ptilotus aervoides	+	1
	Ptilotus exaltatus	+	5
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	12	80
	Rhagodia drummondii	+	140
	Roepera lobulata	+	3
	Salsola australis	+	20
	Santalum spicatum	+	300
	Sclerolaena densiflora	+	20
	Sclerolaena diacantha	ADJ	
	Senna artemisioides subsp. helmsii	1.5	140
	Senna artemisioides subsp. x artemisioides	1	120
	Senna glaucifolia	1.5	140
	Sida calyxhymenia	1	150
	Sida sp. Exidentifolia (J.L. Egan 1925)	+	25
	Solanum lasiophyllum	+	60

Site BGQ28



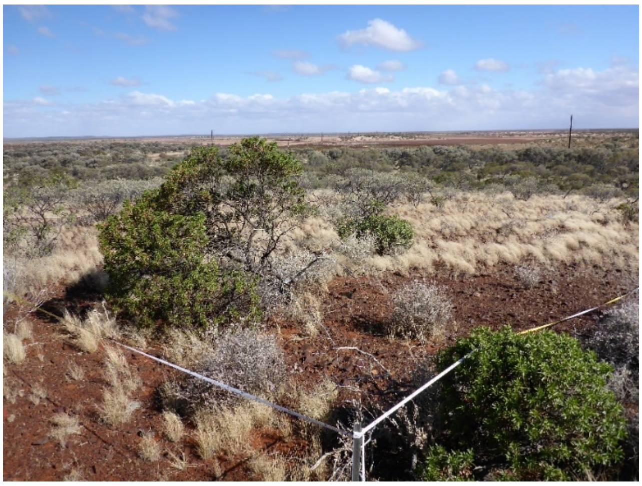
Described by	KMc	**Date**	29/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258183 **mE**	6939811 **mN**			
Habitat	Red dune, sandsheet					
Soil	Red sand					
Rock Type						

Vegetation Acacia caesaneura Low Open Woodland over Eremophila forrestii subsp. forrestii Mid Sparse Shrubland over Solanum lasiophyllum Low Sparse Shrubland over Eriachne benthamii, Aristida contorta, Eragrostis lanipes, Enneapogon polyphyllus, Aristida holathera var. holathera and Enneapogon caerulescens Open Tussock Grassland

Veg Condition	Very Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon otocarpum	+	35
	Acacia aptaneura	ADJ	0
	Acacia caesaneura	9	800
	Aristida contorta	3	30
	Aristida holathera var. holathera	1	40
	Cenchrus ciliaris	+	80
	Cenchrus setiger	+	40
	Dactyloctenium radulans	+	10
	Enchylaena tomentosa var. tomentosa	+	70
	Enneapogon caerulescens	+	20
	Enneapogon polyphyllus	+	30
	Eragrostis lanipes	2	50
	Eremophila forrestii subsp. forrestii	4	150
	Eriachne benthamii	2	70
	Hakea preissii	ADJ	
	Maireana pyramidata	1	90
	Maireana villosa	+	40
	Monachather paradoxus	7	70
	Poaceae sp.	2	40
	Ptilotus chamaecladus	ADJ	
	Ptilotus macrocephalus	+	5
	Scaevola spinescens	ADJ	
	Senna charlesiana	+	40
	Sida calyxhymenia	+	130
	Sida sp. Exidentifolia (J.L. Egan 1925)	+	10
	Solanum lasiophyllum	1	50

Site BGQ29



Described by	CG	**Date**	29/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258250 **mE**	6940023 **mN**			
Habitat	Upper slope of stony hill					
Soil	Red sandy clay loam					
Rock Type	Basalt					

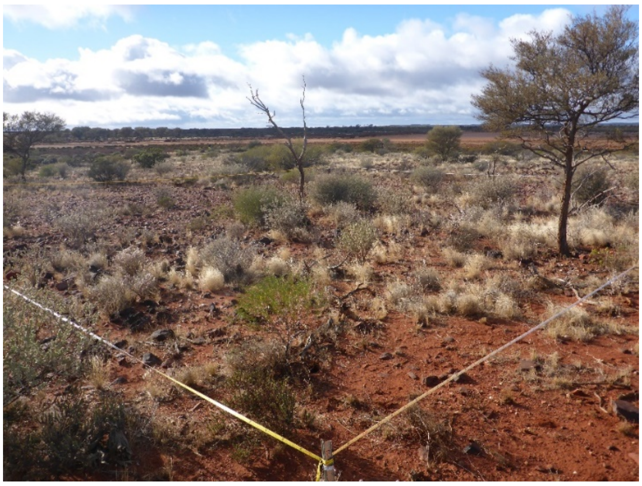
Vegetation *Eremophila galeata*, *E. forrestii* subsp. *forrestii* and *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia tetragonophylla	+	10
	Aristida contorta	10	35
	Enneapogon caerulescens	+	30
	Enneapogon polyphyllus	+	30
	Eremophila forrestii subsp. forrestii	+	100
	Eremophila galeata	3	200
	Maireana georgei	+	40
	Maireana triptera	ADJ	
	Portulaca oleracea	+	1
	Ptilotus aervoides	+	1
	Ptilotus obovatus var. obovatus	3	50
	Rhagodia drummondii	ADJ	
	Senna artemisioides subsp. helmsii	3	150
	Senna glaucifolia	+	50
	Sida calyxhymenia	+	100
	Solanum lasiophyllum	+	60

Site BGQ30

Described by	KMc	**Date**	30/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259767 **mE**	6940301 **mN**			
Habitat	Margins of salt lake					
Soil	Orange coarse sandy clay - saline					
Rock Type						
Vegetation	*Tecticornia peltata* and *T. undulata* and Open Samphire Shrubland					
Veg Condition	Excellent					
Fire Age	> 10 years					
Species List	Name			Cover	Height	
	Tecticornia peltata			35	50	
	Tecticornia pruinosa			ADJ		
Tecticornia sp. Burnerbinmah (D. Edinger et al. 101)			+	5		

Site BGQ31



Described by	CG	**Date**	30/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259637 **mE**	6940405 **mN**			
Habitat	Lower east facing slope of stony hill					
Soil	Red sandy clay loam					
Rock Type	Basalt					

Vegetation Acacia macraneura Isolated Trees over and A. xanthocarpa Tall Isolated Shrubs over Eremophila forrestii subsp. forrestii, Grevillea inconspicua and Senna artemisioides subsp. helmsii Mid Sparse Shrubland over Ptilotus obovatus Low Sparse Shrubland over Aristida contorta Sparse Tussock Grassland

Veg Condition	Excellent
Fire Age	> 10 years

Species List	Name	Cover	Height
	Acacia macraneura	1	450
	Acacia tetragonophylla	+	100
	Acacia xanthocarpa	+	250
	Aristida contorta	3	40
	Cymbopogon ambiguus	+	100
	Digitaria brownii	+	30
	Enneapogon caerulescens	+	30
	Enneapogon polyphyllus	+	35
	Eremophila alternifolia	ADJ	
	Eremophila exilifolia	+	30
	Eremophila forrestii subsp. forrestii	1.5	120
	Eremophila metallicorum	+	100
	Eremophila ramiflora	ADJ	
	Grevillea inconspicua	1	150
	Maireana georgei	+	40
	Maireana planifolia	+	60
	Maireana triptera	+	60
	Maireana villosa	+	15
	Marsdenia australis	ADJ	
	Pittosporum angustifolium	ADJ	
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	1.5	70
	Ptilotus roei	+	4
	Scaevola spinescens	+	110
	Sclerolaena densiflora	+	15
	Sclerolaena eriacantha	+	20
	Senna artemisioides subsp. helmsii	+	90
	Senna artemisioides subsp. x artemisioides	+	90
	Senna glaucifolia	+	100
	Senna glutinosa subsp. chatelainiana	+	40
	Sida calyxhymenia	+	150
	Solanum lasiophyllum	1	80

Site BGQ32

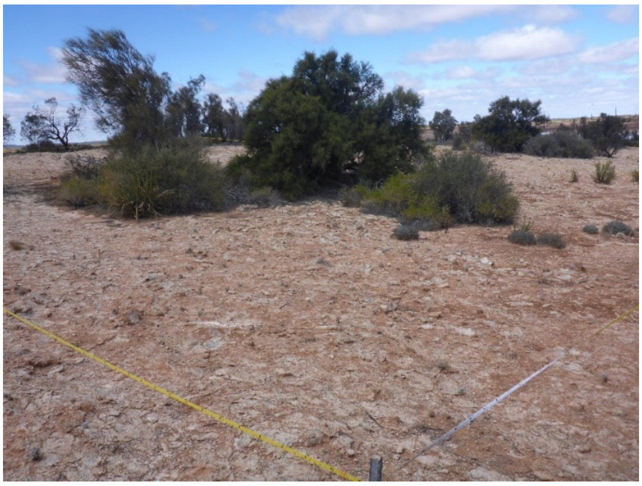
Described by	KMc	**Date**	30/08/2018	**Type**	Quadrat	10 x 40
Location	Bellevue Gold Project					
MGA Zone	51	259657 **mE**	6940268 **mN**			
Habitat	Lower hill slopes					
Soil	Orange coarse sandy loam with clay patches					
Rock Type						

Vegetation *Maireana pyramidata* Tall Sparse Shrubland over mixed Low Sparse Chenopod Shrubland over *Enneapogon* spp. Sparse Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia fuscaneura	+	40
	Acacia tetragonophylla	ADJ	
	Aristida contorta	+	20
	Atriplex codonocarpa	+	10
	Boerhavia coccinea	+	3
	Calotis multicaulis	ADJ	
	Cratystylis subspinescens	+	60
	Dactyloctenium radulans	+	10
	Dissocarpus paradoxus	+	30
	Enneapogon caerulescens	+	15
	Enneapogon polyphyllus	+	20
	Eragrostis dielsii	+	3
	Eremophila exilifolia	+	5
	Eremophila forrestii subsp. forrestii	+	30
	Eremophila galeata	+	30
	Euphorbia sp.	+	2
	Euphorbia tannensis subsp. eremophila	+	10
	Gnephosis arachnoidea	+	10
	Goodenia mimuloides	ADJ	
	Lawrencia densiflora	+	10
	Lycium australe	+	110
	Maireana pyramidata	5	110
	Maireana triptera	1	20
	Nicotiana rotundifolia	+	10
	Polygala glaucifolia	+	3
	Portulaca oleracea	+	2
	Ptilotus exaltatus	+	30
	Ptilotus helipteroides	+	3

Ptilotus obovatus var. obovatus	+	50
Ptilotus sp.	ADJ	
Roepera similis	+	2
Santalum spicatum	+	140
Scaevola spinescens	+	100
Sclerolaena cuneata	+	20
Sclerolaena densiflora	+	10
Sclerolaena eriacantha	+	15
Senna artemisioides subsp. x sturtii	+	30
Sida calyxhymenia	+	120
Sida sp. Exidentifolia (J.L. Egan 1925)	+	10
Solanum lasiophyllum	+	30
Streptoglossa liatroides	+	10
Swainsona kingii	+	30
Tecticornia disarticulata	+	60

Site BGQ33

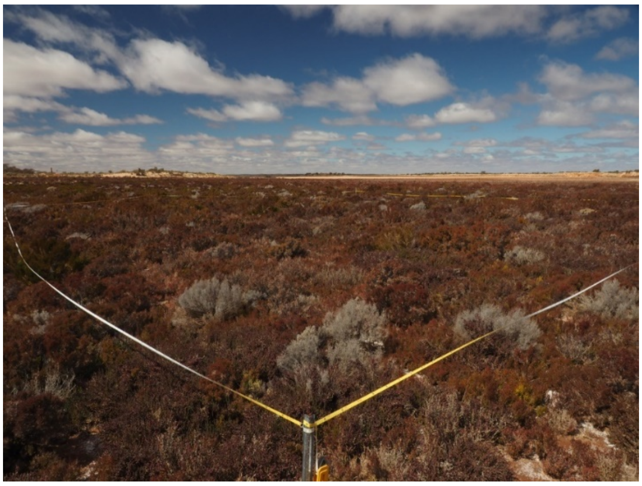


Described by	CG	**Date**	30/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258198 **mE**	6938638 **mN**			
Habitat	Crest and upper slopes of gypsum dune					
Soil	White-brown powdery loam, gypsum					
Rock Type						

Vegetation Casuarina pauper Low Open Woodland with Eremophila oldfieldii subsp. angustifolia Isolated Trees over Lycium australe Mid Isolated Shrubs over Lawrencia helmsii Low Isolated Shrubs over Aristida contorta, Enneapogon caerulescens and Asteridea chaetopoda Isolated Grasses / Forbs

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Aristida contorta	+	30
	Asteridea *chaetopoda*	+	20
	Casuarina pauper	2	550
	Dysphania glomulifera subsp. eremaea	+	2
	Enchylaena tomentosa var. tomentosa	+	60
	Enneapogon caerulescens	+	30
	Eragrostis xerophila	+	25
	Eremophila oldfieldii subsp. angustifolia	ADJ	
	Euphorbia drummondii	+	1
	Exocarpos aphyllus	4	500
	Frankenia cinerea	1	40
	Grevillea sarissa subsp. bicolor	+	180
	Lawrencia helmsii	1.5	100
	Lycium australe	1.5	150
	Lysiana murrayi	+	-
	Maireana erioclada	+	100
	Maireana sp.	+	60
	Roepera compressa	+	20
	Roepera reticulata	1	100
	Sclerolaena fimbriolata	+	20
	Senna charlesiana	ADJ	
	Solanum lasiophyllum	ADJ	

Site BGQ34



Described by	KMc	**Date**	30/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258404 **mE**	6939076 **mN**			
Habitat	Margins of salt lake					
Soil	Orange sandy clay					
Rock Type						

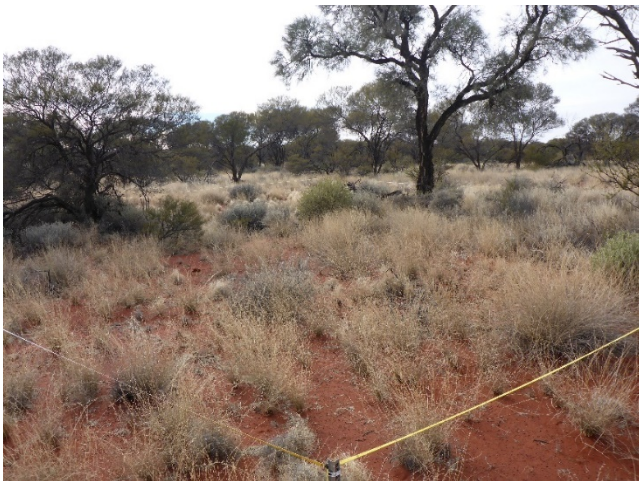
Vegetation Tecticornia halocnemoides, T. indica subsp. leiostachya, T. undulata, T. lepidosperma and T. peltata Closed Samphire Shrubland

Veg Condition Excellent

Fire Age > 10 years

Species List	Name		Cover	Height
	Tecticornia aff. undulata		20	50
	Tecticornia halocnemoides subsp. catenulata		65	70
	Tecticornia peltata		+	60
Tecticornia sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)		+	50	
	Tecticornia sp. flowers 2		1	60
	Tecticornia undulata		20	30

Site BGQ35



Described by	CG	**Date**	31/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258302 **mE**	6940938 **mN**			
Habitat	Sand flat and low sandy rises					
Soil	Red sand					
Rock Type						

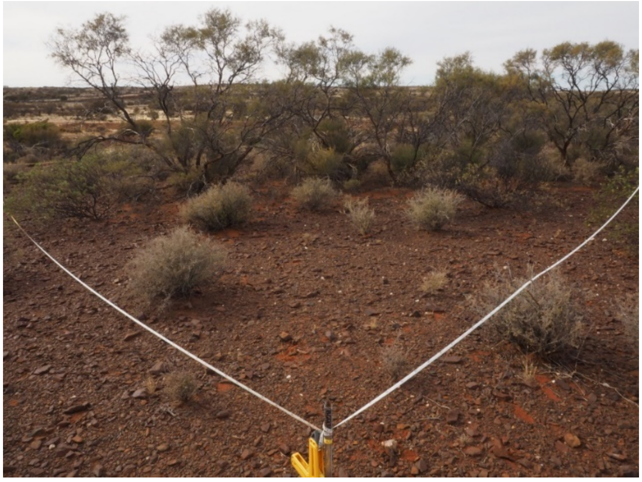
Vegetation Acacia aptaneura and A. minyura Low Open Woodland over Eremophila forrestii subsp. forrestii Mid Isolated Shrubs to Mid Sparse Shrubland over Eragrostis eriopoda, Eriachne benthamii, Aristida contorta, Enneapogon caerulescens, Enneapogon polyphyllus and Monachather paradoxus Open Tussock Grassland

Veg Condition Excellent to Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Acacia ? *minyura* (hybrid)	ADJ	
	Acacia aptaneura	3.5	550
	Acacia minyura	+	90
	Acacia tetragonophylla	2	200
	Aristida contorta	10	30
	Dactyloctenium radulans	+	5
	Enchylaena tomentosa var. tomentosa	1	70
	Enneapogon caerulescens	5	40
	Enneapogon polyphyllus	3	35
	Eragrostis eriopoda	10	60
	Eremophila forrestii subsp. forrestii	+	100
	Eriachne benthamii	1	80
	Hakea lorea subsp. *lorea*	10	1000
	Maireana tomentosa x	+	10
	Monachather paradoxus	15	80
	Portulaca oleracea	+	1
	Ptilotus obovatus var. obovatus	1.5	70
	Rhagodia drummondii	+	60
	Sclerolaena deserticola	+	60
	Senna artemisioides subsp. filifolia	ADJ	
	Senna artemisioides subsp. petiolaris	+	90
	Sida calyxhymenia	+	100
	Solanum lasiophyllum	+	80

Site BGQ36

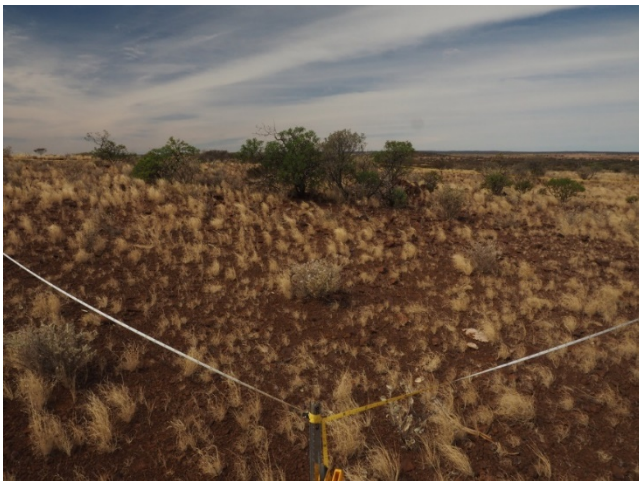


Described by	KMc	**Date**	31/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258183 **mE**	6941339 **mN**			
Habitat	Upper slopes of hill					
Soil	Red sandy clay					
Rock Type						

Vegetation *Hakea* preissii Tall Sparse Shrubland over *Senna artemisioides* subsp. x *sturtii* and *Maireana pyramidata* Mid Sparse Shrubland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia tetragonophylla	+	110
	Aristida contorta	+	30
	Boerhavia coccinea	+	10
	Cymbopogon ambiguus	ADJ	
	Dissocarpus paradoxus	ADJ	
	Duperreya commixta	+	cr
	Enchylaena tomentosa var. tomentosa	+	30
	Enneapogon caerulescens	+	20
	Enneapogon polyphyllus	+	20
	Enteropogon ramosus	+	30
	Eremophila galeata	ADJ	
	Hakea lorea subsp. lorea	ADJ	
	Hakea preissii	6	400
	Haloragis trigonocarpa	+	1
	Maireana pyramidata	5	80
	Maireana sp.	+	50
	Maireana triptera	ADJ	
	Marsdenia australis	+	cr
	Ptilotus aervoides	+	1
	Ptilotus sp.	+	5
	Rhagodia drummondii	+	70
	Sclerolaena densiflora	+	3
	Sclerolaena fimbriolata	+	3
	Senna artemisioides subsp. helmsii	ADJ	0
	Senna artemisioides subsp. x sturtii	1	120
	Senna sp. Meekatharra (E. Bailey 1-26)	+	60
	Solanum lasiophyllum	+	50
	Vincetoxicum *lineare*	+	cr

Site BGQ37



Described by	KMc	**Date**	31/08/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258288 **mE**	6940391 **mN**			
Habitat	Upper slope of stony hill					
Soil	Red sandy clay loam					
Rock Type						

Vegetation Eremophila galeata, E. forrestii subsp. forrestii, E. exilifolia and Senna artemisioides subsp. helmsii Mid Sparse Shrubland over Ptilotus obovatus Low Sparse Shrubland over Aristida contorta Open Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon ?cryptopetalum	+	10
	Abutilon ?otocarpum	+	20
	Acacia aptaneura	+	40
	Aristida contorta	+	30
	Enneapogon polyphyllus	+	20
	Eremophila exilifolia	1	100
	Eremophila forrestii subsp. forrestii	1	100
	Eremophila galeata	2.5	150
	Eriachne pulchella subsp. dominii	+	10
	Heliotropium inexplicitum	+	10
	Hibiscus sp. Gardneri	+	40
	Marsdenia australis	+	cr
	Portulaca oleracea	+	1
	Ptilotus aervoides	+	2
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	1.5	40
	Sclerolaena cuneata	+	40
	Sclerolaena densiflora	+	10
	Senna artemisioides subsp. helmsii	1	150
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	30
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		+	40
	Solanum lasiophyllum	+	30

Site BGQ38

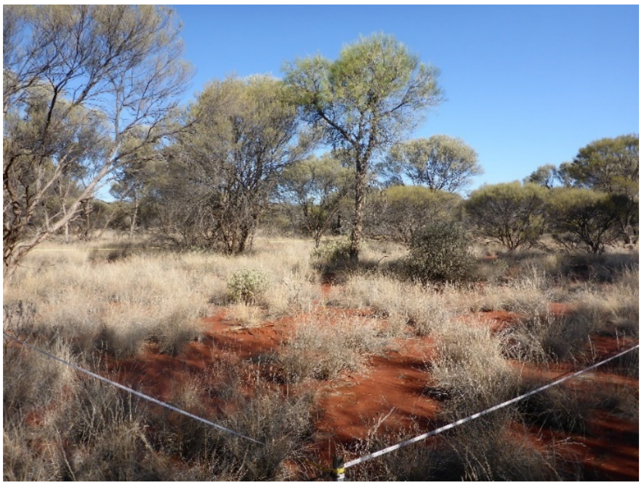
Described by	BRM	**Date**	23/10/2018	**Type**	Quadrat 20 x 20
Location	Bellevue Gold Project				
MGA Zone	51	258076 **mE**	6943590 **mN**		
Habitat	Crest / upper slope of low stony hill				
Soil	Reddish-brown sandy loam				
Rock Type	Basalt				

Vegetation *Acacia ?xanthocarpa* and *A. doreta* (long phyllode form) Tall Shrubland over *Senna* sp. Meekatharra and *Scaevola spinescens* Mid Open Shrubland over *Ptilotus obovatus* Isolated Low Shrubs over *Enneapogon caerulescens* and *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Excellent
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon ?cryptopetalum	+	45
	Abutilon oxycarpum subsp. Prostrate	+	
	Acacia doreta (long phyllode form)	2	300
	Acacia xanthocarpa	10	240
	Aristida contorta	1	20
	Boerhavia coccinea	+	20
	Duperreya commixta	+	cr
	Enchylaena tomentosa var. tomentosa	+	40
	Enneapogon caerulescens	3	35
	Enneapogon polyphyllus	+	20
	Eremophila exilifolia	1	140
	Eremophila forrestii subsp. forrestii	+	140
	Eremophila metallicorum	+	40
	Eriachne pulchella	+	12
	Haloragis trigonocarpa	+	4
	Marsdenia australis	+	120
	Poaceae sp.	+	30
	Portulaca oleracea	+	3
	Ptilotus exaltatus	+	20
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	1	70
	Ptilotus roei	+	3
	Rhagodia eremaea	+	130
	Roepera sp.	+	20
	Salsola australis	+	4
	Santalum spicatum	+	230
	Scaevola spinescens	+	90
	Senna artemisioides subsp. helmsii	+	100
	Senna artemisioides subsp. x artemisioides	+	15
	Senna sp. Meekatharra (E. Bailey 1-26)	3	190
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	50
	Solanum lasiophyllum	+	40

Site BGQ39



Described by	CG	**Date**	23/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	257611 **mE**	6943927 **mN**			
Habitat	Flat to low undulating sand plain					
Soil	Red sand					
Rock Type						

Vegetation *Acacia ayersiana* and *A. aptaneura* Low Open Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Isolated Shrubs to Mid Sparse Shrubland over *Monachather paradoxus* and *Eragrostis eriopoda* Tussock Grassland.

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	5	800
	Acacia ayersiana	2	800
	Acacia ramulosa var. linophylla	3	350
	Aristida holathera var. holathera	+	70
	Eragrostis eriopoda	2	60
	Eremophila forrestii subsp. forrestii	2	150
	Eremophila longifolia	+	20
	Hakea lorea subsp. *lorea*	2	750
	Marsdenia australis	+	cr
	Monachather paradoxus	50	70
	Ptilotus obovatus var. obovatus	+	60
	Rhagodia eremaea	+	130
	Santalum lanceolatum	ADJ	200
	Solanum lasiophyllum	+	50
	Triodia basedowii	+	90

Site BGQ40

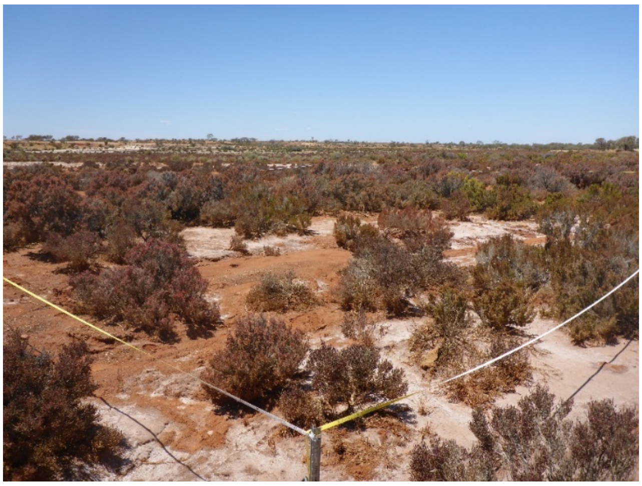
Described by	BRM	**Date**	23/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	257602 **mE**	6943534 **mN**			
Habitat	Sand plain					
Soil	Reddish-brown sand					
Rock Type						

Vegetation *Acacia caesaneura* Low Open Woodland over *A. ramulosa* var. *linophylla* Tall Isolated Shrubs to Tall Sparse Shrubland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Monachather paradoxus*, *Eriachne helmsii* and *Eragrostis eriopoda* Tussock Grassland

Veg Condition	Excellent
Fire Age	> 10 years

Species List	Name	Cover	Height
	Acacia ayersiana	+	50
	Acacia caesaneura	15	800
	Acacia ramulosa var. linophylla	2	250
	Aristida holathera var. holathera	+	30
	Eragrostis eriopoda	2	60
	Eremophila forrestii subsp. forrestii	8	170
	Eriachne helmsii	10	60
	Maireana triptera	+	30
	Marsdenia australis	+	30
	Monachather paradoxus	20	40
	Poaceae sp.	1	40
	Ptilotus obovatus var. obovatus	+	50
	Rhagodia eremaea	+	100
	Rhagodia sp.	+	90
	Solanum lasiophyllum	+	40
	Triodia basedowii	ADJ	

Site BGQ41

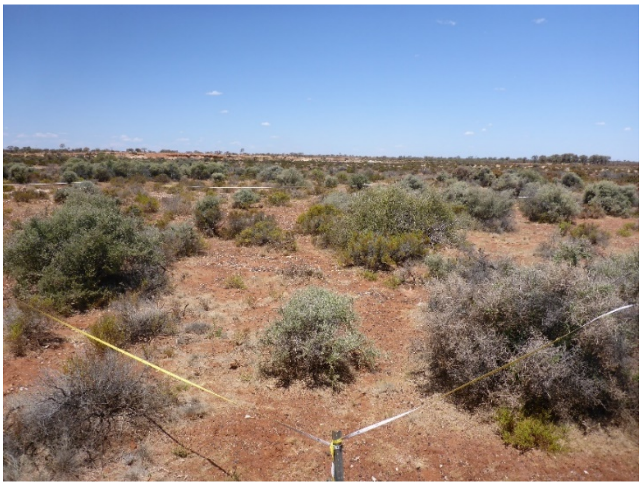


Described by	CG	**Date**	24/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259863 **mE**	6940622 **mN**			
Habitat	Samphire flat					
Soil	Brown saline clay loam					
Rock Type	Gypsum					
Vegetation	*Tecticornia halocnemoides*, *T. indica* subsp. *bidens* and *T. doliiformis* Open Samphire Shrubland					
Veg Condition	Excellent to Very Good					
Fire Age	> 10 years					
Species List	Name			Cover	Height	
	Tecticornia doliiformis			2	50	
	Tecticornia halocnemoides subsp. catenulata			3	90	
	Tecticornia indica subsp. bidens			3	30	
	Tecticornia peltata			1	45	
Tecticornia sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)			20	100		

Site BGQ42

Described by	BRM	**Date**	24/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	260022 **mE**	6940700 **mN**			
Habitat	Plain - elevated edges of samphire flat					
Soil	Pale brown powdery loam (gypsum)					
Rock Type	Quartz and ironstone					
Vegetation	*Tecticornia* sp. Low Sparse Samphire Shrubland					
Veg Condition	Very Good					
Fire Age	> 10 years					
Species List	Name			Cover	Height	
	Aristida contorta			+	20	
	Brachyscome ciliaris			+	15	
	Cratystylis subspinescens			+	70	
	Enchylaena tomentosa x Maireana georgei			+	10	
	Enneapogon caerulescens			+	25	
	Enteropogon ramosus			+	40	
	Eragrostis ?*falcata*			+	25	
	Eragrostis pergracilis			+	20	
	Eremophila galeata			ADJ		
	Eremophila pantonii			ADJ		
	Euphorbia sp.			+	4	
	Fimbristylis sp.			+	20	
	Lawrencia densiflora			+	20	
	Lawrencia glomerata			+	40	
	Lycium australe			ADJ		
	Maireana appressa			+	10	
	Maireana glomerifolia			+	35	
	Maireana pyramidata			ADJ		
	Maireana triptera			+	15	
	Podolepis capillaris			+	30	
	Ptilotus helichrysoides			+	6	
	Ptilotus obovatus var. obovatus			+	30	
	Rhagodia sp.		+	20		
	Scaevola spinescens			ADJ		
	Sclerolaena cornishiana			+	20	
	Sclerolaena cuneata			+	20	
	Senna sp. Meekatharra (E. Bailey 1-26)			+	20	
	Solanum lasiophyllum			+	35	
	Tecticornia sp.			8	60	

Site BGQ43



Described by	CG	**Date**	24/10/2018	**Type**	Quadrat 20 x 20
Location	Bellevue Gold Project				
MGA Zone	51	259856 **mE**	6940833 **mN**		
Habitat	Broad drainage channel adjacent to samphire flat				
Soil	Reddish-brown sandy loam, gypsum				
Rock Type	Nil				

Vegetation *Cratystylis subspinescens* Mid Sparse Shrubland over *Tecticornia* sp. Low Sparse Samphire Shrubland over *Eragrostis falcata* Sparse Tussock Grassland and *Lawrencia densiflora* Sparse Forbland

Veg Condition Excellent to Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Austrostipa scabra	ADJ	180
	Cratystylis subspinescens	6	130
	Eragrostis dielsii	+	10
	Eragrostis falcata	7	30
	Eragrostis pergracilis	+	30
	Frankenia irregularis	+	40
	Lawrencia densiflora	2	30
	Lycium australe	+	140
	Maireana lobiflora	+	15
	Schenkia clementii	+	20
	Sclerolaena cuneata	+	25
	Tecticornia disarticulata	3	80
	Tecticornia indica subsp. bidens	+	30
	Tecticornia sp. Dennys Crossing (K.A. Shepherd & J. English KS 552)	+	50

Site BGQ44

Described by	BRM	**Date**	24/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259486 **mE**	6941276 **mN**			
Habitat	Moderately steep east facing mid slope of low hill					
Soil	Reddish-brown sandy loam					
Rock Type	Basalt					

Vegetation *Acacia aptaneura* Low Isolated Trees over *A. xanthocarpa* and *Eremophila oldfieldii* subsp. *angustifolia* Tall Sparse Shrubland over E. *exilifolia* and *Senna artemisioides* subsp. *helmsii* Low Isolated Shrubs to Low Open Shrubland over *Ptilotus obovatus* Low Sparse Shrubland over *Aristida contorta* and *Enneapogon caerulescens* Sparse Tussock Grassland

Veg Condition	Very Good to Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon oxycarpum subsp. Prostrate	+	10
	Acacia aptaneura	1	350
	Acacia xanthocarpa	6	350
	Aristida contorta	5	30
	Boerhavia coccinea	+	15
	Cymbopogon obtectus	+	40
	Duperreya commixta	+	110
	Enneapogon caerulescens	3	30
	Eremophila exilifolia	2	130
	Eremophila forrestii subsp. forrestii	+	40
	Eremophila oldfieldii subsp. angustifolia	1	320
	Maireana georgei	+	15
	Maireana integra	+	20
	Maireana triptera	+	30
	Marsdenia australis	+	30
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	4	40
	Ptilotus roei	+	5
	Rhagodia eremaea	+	130
	Salsola australis	+	10
	Scaevola spinescens	+	50
	Sclerolaena cornishiana	+	10
	Sclerolaena densiflora	+	12
	Senna artemisioides subsp. helmsii	+	90
	Senna artemisioides subsp. x artemisioides	+	50
	Senna glaucifolia	+	60
	Sida calyxhymenia	+	60
	Sida ectogama	+	120
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	40
	Solanum lasiophyllum	+	40

Site BGQ45

Described by	CG	**Date**	24/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259616 **mE**	6941088 **mN**			
Habitat	Lower slopes of basalt and quartz hill					
Soil	Reddish-brown sandy clay loam					
Rock Type						

Vegetation *Hakea preissii* Mid Sparse Shrubland over *Maireana pyramidata* Low Sparse Chenopod Shrubland over mixed Sparse Tussock Grassland / Forbland

Veg Condition Very Good to Excellent

Fire Age > 10 years

Species List	Name	Cover	Height
	Acacia tetragonophylla	+	90
	Aristida contorta	+	25
	Atriplex codonocarpa	+	2
	Dissocarpus paradoxus	+	20
	Enneapogon caerulescens	+	30
	Enneapogon polyphyllus	+	35
	Euphorbia drummondii	+	3
	Hakea preissii	4	200
	Maireana carnosa	1	10
	Maireana pyramidata	2	100
	Maireana triptera	1	50
	Pimelea microcephala subsp. microcephala	+	120
	Ptilotus exaltatus	+	15
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	+	40
	Ptilotus sp.	+	30
	Rumex vesicarius	+	10
	Scaevola spinescens	+	100
	Sclerolaena cuneata	+	25
	Sclerolaena densiflora	+	20
	Sclerolaena diacantha	+	15
	Senna sp. Meekatharra (E. Bailey 1-26)	+	90
	Sida calyxhymenia	+	50
	Sida sp. Exidentifolia (J.L. Egan 1925)	+	20
	Solanum lasiophyllum	+	25
	Tecticornia disarticulata	1	40

Site BGQ46

Described by	BRM	**Date**	24/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259863 **mE**	6941258 **mN**			
Habitat	Gently sloping lower slope of low rise at edge of samphire flat					
Soil	Orange loam					
Rock Type	Ironstone and quartz					
Vegetation	*Tecticornia* sp. Low Sparse Samphire Shrubland					
Veg Condition	Very Good					
Fire Age	> 10 years					

Species List	Name	Cover	Height
	Aristida contorta	+	30
	Atriplex codonocarpa	+	20
	Cratystylis subspinescens	ADJ	
	Dissocarpus paradoxus	+	20
	Enneapogon caerulescens	+	30
	Enteropogon ramosus	+	40
	Lawrencia glomerata	ADJ	
	Maireana carnosa	+	12
	Maireana pyramidata	+	60
	Maireana sp.	+	30
	Maireana tomentosa	+	20
	Maireana triptera	+	20
	Sclerolaena cuneata	+	20
	Sclerolaena eriacantha	+	25
	Sclerolaena sp.	+	15
	Senna artemisioides subsp. x sturtii	+	35
	Sida sp. Exidentifolia (J.L. Egan 1925)	+	20
	Solanum lasiophyllum	+	45
	Tecticornia sp.	7	50

Site BGQ47

Described by	CG	**Date**	25/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259663 **mE**	6941439 **mN**			
Habitat	Broad creek / drainage channel					
Soil	Reddish-brown sand with areas of gypsum loam on banks					
Rock Type	Basalt and quartz					

Vegetation *Acacia pteraneura* Low Open Woodland over *A. minyura*, *Cratystylis* sub*spinescens*, *Scaevola spinescens* and *Senna artemisioides* subsp. x sturtii Mid Sparse Shrubland over *Maireana pyramidata* Low Sparse Shrubland

Veg Condition	Very Good to Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia minyura	1	200
	Acacia pteraneura	7	500
	Acacia tetragonophylla	+	100
	Aristida contorta	+	25
	Atriplex codonocarpa	+	10
	Cratystylis subspinescens	2	160
	Duperreya commixta	+	100
	Enchylaena tomentosa var. tomentosa	+	40
	Enneapogon caerulescens	+	20
	Enteropogon ramosus	+	40
	Eragrostis falcata	+	30
	Eremophila forrestii subsp. forrestii	ADJ	160
	Eremophila galeata	ADJ	70
	Eriachne helmsii	+	30
	Euphorbia sp.	+	2
	Hakea preissii	1	300
	Lawrencia glomerata	+	30
	Maireana carnosa	+	15
	Maireana pyramidata	1	80
	Maireana triptera	+	30
	Ptilotus exaltatus	+	10
	Ptilotus obovatus var. obovatus	+	50
	Scaevola spinescens	1	100
	Sclerolaena cuneata	+	25
	Sclerolaena diacantha	+	20
	Senna artemisioides subsp. filifolia	ADJ	200
	Senna artemisioides subsp. helmsii	ADJ	50
	Senna artemisioides subsp. x artemisioides	ADJ	60

Senna artemisioides subsp. x sturtii	2	100
Sida ?fibulifera	+	20
Sida calyxhymenia	+	90
Sida sp.	+	2
Sida sp. Exidentifolia (J.L. Egan 1925)	+	15
Solanum lasiophyllum	+	40
Streptoglossa liatroides	+	3
Tecticornia disarticulata	+	60

Site BGQ48

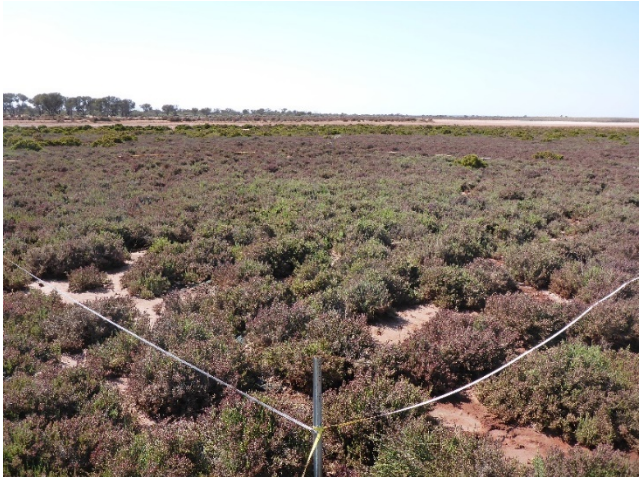
Described by	BRM	**Date**	25/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258548 **mE**	6941918 **mN**			
Habitat	Slope of low dune					
Soil	Reddish-brown sand					
Rock Type						

Vegetation *Acacia pteraneura* Low Open Forest to Low Woodland over *A. doreta* (long phyllode form) Tall Sparse Shrubland over *Sida calyxhymenia* and *Senna artemisioides* subsp. x *sturtii* Mid Sparse Shrubland over *Ptilotus obovatus* Low Sparse Shrubland over *Eragrostis eriopoda* and *Monachather paradoxus* Open Tussock Grassland

Veg Condition	Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon otocarpum	+	60
	Acacia doreta (long phyllode form)	4	400
	Acacia pteraneura	45	600
	Calandrinia polyandra	+	3
	Calandrinia sp.	+	3
	Cenchrus ciliaris	1	60
	Enchylaena tomentosa var. tomentosa	+	40
	Enneapogon caerulescens	+	30
	Enneapogon polyphyllus	+	20
	Eragrostis eriopoda	1	45
	Eremophila forrestii subsp. forrestii	+	60
	Eriochiton sclerolaenoides	+	45
	Euphorbia drummondii	+	4
	Frankenia sp.	+	30
	Hibiscus sp. Gardneri	+	60
	Maireana thesioides	+	30
	Monachather paradoxus	1	60
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	6	40
	Ptilotus roei	+	4
	Rhagodia eremaea	+	70
	Roepera eremaea	+	30
	Salsola australis	+	20
	Sclerolaena convexula	+	20
	Senna artemisioides subsp. x sturtii	+	130
	Senna charlesiana	+	20
	Sida calyxhymenia	3	150
	Sida fibulifera	+	25
	Solanum lasiophyllum	2	60

Site BGQ49



Described by	CG	**Date**	28/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	259818 **mE**	6940422 **mN**			
Habitat	Samphire flats on lake margins					
Soil	Reddish-brown sandy loam to clay loam					
Rock Type						
Vegetation	*Tecticornia undulata* Low Closed Samphire Shrubland					
Veg Condition	Excellent					
Fire Age	> 10 years					
Species List	Name			Cover	Height	
	Tecticornia halocnemoides subsp. catenulata			+	70	
	Tecticornia sp. flowers 1			80	50	

Site BGQ50

Described by	BRM	**Date**	26/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258300 **mE**	6942506 **mN**			
Habitat	Plain adjacent to creek bed					
Soil	Reddish-brown loamy sand					
Rock Type						

Vegetation *Acacia pteraneura* and *A. caesaneura* Low Woodland over *A. ayersiana* Tall Sparse Shrubland over *A. ramulosa* var. *linophylla* Mid Isolated Shrubs over *Enchylaena tomentosa* var. *tomentosa* and *Ptilotus obovatus* Low Sparse Shrubland over *Aristida contorta*, *Monachather paradoxus* and *Eragrostis eriopoda* Tussock Grassland

Veg Condition	Very Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon otocarpum	+	45
	Acacia ayersiana	6	300
	Acacia caesaneura	4	700
	Acacia mulganeura	+	110
	Acacia pteraneura	8	700
	Acacia ramulosa var. linophylla	+	120
	Acacia xanthocarpa	+	190
	Aristida contorta	35	30
	Cleome viscosa	+	60
	Dissocarpus paradoxus	+	20
	Duperreya commixta	+	120
	Enchylaena tomentosa var. tomentosa	+	70
	Enneapogon polyphyllus	+	30
	Eragrostis eriopoda	2	40
	Eremophila forrestii subsp. forrestii	+	50
	Eremophila longifolia	+	30
	Hakea lorea subsp. lorea	+	80
	Lysiana murrayi	+	120
	Maireana thesioides	+	30
	Monachather paradoxus	7	45
	Ptilotus obovatus var. obovatus	+	60
	Scaevola spinescens	+	50
	Sclerolaena convexula	+	20
	Senna artemisioides subsp. helmsii	+	110
	Senna artemisioides subsp. x sturtii	+	35
	Senna sp. Meekatharra (E. Bailey 1-26)	+	30
	Solanum lasiophyllum	+	40

Site BGQ51

Described by	CG	**Date**	26/10/2018	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	51	258642 **mE**	6941608 **mN**			
Habitat	Sandy and stoney flat adjacent to creekline					
Soil	Reddish-brown sandy clay loam					
Rock Type						

Vegetation *Acacia pteraneura* and *A. aptaneura* Low Open Woodland over *Ptilotus obovatus* Low Sparse Shrubland over *Aristida contorta* Open Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon otocarpum	+	35
	Acacia aptaneura	4	600
	Acacia pteraneura	5	600
	Acacia tetragonophylla	+	200
	Aristida contorta	11	30
	Enchylaena tomentosa var. tomentosa	+	50
	Enchylaena tomentosa x Maireana georgei	+	80
	Enneapogon caerulescens	+	30
	Enneapogon polyphyllus	+	30
	Eragrostis eriopoda	+	80
	Eremophila forrestii subsp. forrestii	ADJ	70
	Eremophila galeata	+	100
	Eremophila serrulata	+	110
	Haloragis odontocarpa	ADJ	5
	Maireana pyramidata	+	100
	Poaceae sp.	+	40
	Ptilotus aervoides	+	2
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	4	90
	Rhagodia eremaea	+	90
	Salsola australis	+	5
	Sclerolaena convexula	+	30
	Sclerolaena diacantha	+	20
	Senna artemisiodes subsp. X sturtii Hybrid	ADJ	160
	Senna artemisioides subsp. helmsii	+	70
	Senna artemisioides subsp. x artemisioides	ADJ	80
	Senna sp. Meekatharra (E. Bailey 1-26)	+	100
	Sida calyxhymenia	+	110
	Sida sp. Exidentifolia (J.L. Egan 1925)	+	20
	Solanum lasiophyllum	+	70
	Tribulus terrestris	+	2

Site BGRCG01

Described by	CG	**Date**	26/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	259222 **mE**	6938619 **mN**		
Habitat	Mid and lower slopes of red sand dune - ecotonal between dune crest and stony plain adjacent				
Soil	Red sand				
Rock Type					

Vegetation Acacia fuscaneura and Eremophila oldfieldii subsp. angustifolia Isolated trees over A. ramulosa var. linophylla, E. galeata and Senna artemisioides subsp. filifolia Isolated Tall Shrubs over Aristida holathera var. holathera and Eragrostis eriopoda Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon otocarpum	+	50
	Acacia fuscaneura	+	400
	Acacia ramulosa var. linophylla	+	200
	Alyogyne pinoniana	+	200
	Aristida holathera var. holathera	50	70
	Atriplex sp.	+	100
	Eragrostis eriopoda	10	60
	Eremophila forrestii subsp. forrestii	+	160
	Eremophila galeata	+	150
	Eremophila oldfieldii subsp. angustifolia	+	300
	Helipterum craspedioides	+	10
	Maireana georgei	+	60
	Marsdenia australis	+	100
	Millotia incurva	+	5
	Pimelea microcephala subsp. microcephala	+	250
	Ptilotus obovatus var. obovatus	+	60
	Sclerolaena obliquicuspis	+	50
	Senna artemisioides subsp. filifolia	+	200
	Sida calyxhymenia	+	100
	Solanum lasiophyllum	+	50

Site BGRCG02

Described by	CG	**Date**	27/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258683 **mE**	6938877 **mN**		
Habitat	Ridge and upper slopes of gypsum dune adjacent to salt lake				
Soil	White-brown powdery clay loam, gypsum				
Rock Type					

Vegetation *Grevillea sarissa* subsp. bicolor Tall Sparse Shrubland over *Scaevola spinescens* and *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and *Eragrostis falcata* Sparse Tussock Grassland and *Frankenia* sp. Forbland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia tetragonophylla	+	200
	Aristida contorta	+	20
	Aristida holathera var. holathera	+	40
	Atriplex codonocarpa	+	30
	Atriplex sp.	+	80
	Enchylaena tomentosa var. tomentosa	+	100
	Enneapogon caerulescens	+	25
	Enneapogon polyphyllus	+	20
	Eragrostis falcata	2	25
	Eucalyptus striaticalyx	+	1000
	Exocarpos aphyllus	+	200
	Frankenia sp.	3	20
	Grevillea sarissa subsp. bicolor	8	200
	Lawrencia helmsii	5	100
	Lycium australe	+	140
	Maireana erioclada	+	100
	Maireana pentatropis	+	100
	Maireana pyramidata	+	100
	Melaleuca xerophila	+	350
	Ptilotus obovatus var. obovatus	+	80
	Rhagodia drummondii	+	30
	Roepera compressa	+	5
	Scaevola spinescens	2	150
	Senna charlesiana	+	120
	Solanum lasiophyllum	+	70
	Swainsona sp.	+	5

Site BGRCG03

Described by	CG	**Date**	30/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258549 **mE**	6939524 **mN**		
Habitat	Clay pan				
Soil	Red-brown clay				
Rock Type					
Vegetation	*Atriplex* sp. and *Maireana pyramidata* Low isolated Shrubs over a mixed Open Forbland				
Veg Condition	Excellent				
Fire Age	> 10 years				
Species List	Name			Cover	Height
	Abutilon otocarpum			+	20
	Abutilon oxycarpum subsp. Prostrate			+	5
	Aristida contorta			+	25
	Asphodelus fistulosus			+	15
	Atriplex sp.			+	90
	Boerhavia coccinea			+	30
	Bulbostylis barbata			+	2
	Calandrinia ptychosperma			+	2
	Calotis multicaulis			+	1
	Cenchrus ciliaris			+	40
	Cuscuta planiflora			+	1
	Dactyloctenium radulans			+	10
	Enneapogon caerulescens			+	20
	Enneapogon polyphyllus			+	25
	Enteropogon ramosus			+	50
	Eremophila longifolia			+	150
	Euphorbia drummondii			+	2
	Helipterum craspedioides			+	20
	Iseilema eremaeum			+	5
	Maireana pyramidata			+	100
	Marsdenia australis			+	100
	Phyllanthus erwinii			+	1
	Polygala glaucifolia			+	2
	Portulaca oleracea			+	100
	Pterocaulon sphacelatum			+	60
	Ptilotus aervoides			+	1
	Ptilotus obovatus var. obovatus			+	50
	Rhodanthe charsleyae			+	20
	Rumex vesicarius			+	30

Sida calyxhymenia	+	100
Solanum lasiophyllum	+	30
Sonchus oleraceus	+	4
Streptoglossa liatroides	+	2
Swainsona kingii	+	3
Swainsona microphylla	+	3
Synaptantha tillaeacea var. tillaeacea	+	20
Tragus australianus	+	10
Tribulus forrestii	+	1
Triraphis mollis	+	100

Site BGRCG04

Described by	CG	**Date**	31/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258316 **mE**	6941103 **mN**		
Habitat	Stony plain between drainage channel and Mulga sand plain and low sandy rises				
Soil	Red sandy clay loam				
Rock Type	Basalt				

Vegetation *Acacia aptaneura* and *Hakea preissii* Tall Sparse Shrubland over *Ptilotus obovatus* and *Maireana triptera* Low Sparse Shrubland over *Enneapogon caerulescens* Sparse Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	6	250
	Acacia tetragonophylla	+	200
	Cymbopogon ambiguus	+	100
	Enneapogon caerulescens	3	30
	Eremophila serrulata	+	150
	Hakea preissii	5	300
	Maireana pyramidata	+	100
	Maireana triptera	2	40
	Pterocaulon sphacelatum	+	80
	Ptilotus exaltatus	+	30
	Ptilotus obovatus var. obovatus	2	40
	Sclerolaena densiflora	+	20
	Senna artemisioides subsp. filifolia	+	100
	Senna artemisioides subsp. helmsii	+	100
	Senna artemisioides subsp. x artemisioides	+	200
	Senna artemisioides subsp. x sturtii	+	100
	Sida calyxhymenia	+	100
	Solanum lasiophyllum	+	80

Site BGRCG05

Described by	CG	**Date**	23/10/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258078 **mE**	6943480 **mN**		
Habitat	Drainage line on lower stony hillslope				
Soil	Red stony loam				
Rock Type	Basalt				

Vegetation Acacia aptaneura and A. xanthocarpa Low Open Forest over Senna artemisioides subsp. helmsii and Eremophila exilifolia Mid Sparse Shrubland over Ptilotus obovatus Low Sparse Shrubland over Enneapogon caerulescens and Cymbopogon ambiguus Sparse Tussock Grassland.

Veg Condition Excellent

Fire Age > 10 years

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	40
	Acacia aptaneura	25	900
	Acacia ayersiana	+	600
	Acacia minyura	+	200
	Acacia xanthocarpa	15	600
	Aristida contorta	+	25
	Cymbopogon ambiguus	+	120
	Duperreya commixta	+	100
	Enchylaena tomentosa var. tomentosa	+	60
	Enneapogon caerulescens	2	30
	Enneapogon polyphyllus	+	30
	Eragrostis eriopoda	+	60
	Eremophila exilifolia	1	100
	Eremophila forrestii subsp. forrestii	+	100
	Eremophila longifolia	+	40
	Eremophila metallicorum	+	200
	Eriachne sp.	+	40
	Hibiscus sp. Gardneri	+	80
	Marsdenia australis	+	100
	Monachather paradoxus	+	60
	Ptilotus aervoides	+	2
	Ptilotus helipteroides	+	3
	Ptilotus obovatus var. obovatus	1	80
	Rhagodia eremaea	+	220
	Sclerolaena convexula	+	30
	Senna artemisioides subsp. helmsii	2	200
	Senna artemisioides subsp. x artemisioides	1	150
	Senna glaucifolia	2	140
	Sida ?calyxhymenia	+	90
Sida ?sp. dark green fruits (S. van Leeuwen 2260)	+	90	
	Sida sp.	+	30
	Solanum lasiophyllum	+	70

Site BGRCG06

Described by	CG	**Date**	24/10/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258015 **mE**	6943978 **mN**		
Habitat	Broad stony creek bed				
Soil	red-brown sand				
Rock Type					

Vegetation Acacia aptaneura and A. xanthocarpa Low Open Forest over Senna artemisioides subsp. x artemisioides and Eremophila exilifolia Mid Sparse Shrubland over Ptilotus obovatus Low Sparse Shrubland over Enneapogon caerulescens, Cymbopogon ambiguus and Aristida contorta Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon oxycarpum subsp. Prostrate	+	30
	Acacia aptaneura	40	800
	Acacia tetragonophylla	+	100
	Acacia xanthocarpa	5	500
	Aristida contorta	2	25
	Cymbopogon ambiguus	7	100
	Duperreya commixta	+	80
	Enneapogon caerulescens	2	30
	Enneapogon polyphyllus	+	35
	Eremophila exilifolia	2	110
	Eremophila forrestii subsp. forrestii	+	130
	Eremophila sp.	+	20
	Glycine canescens	+	cr
	Hakea lorea subsp. *lorea*	+	600
	Maireana sp. +	80	
	Monachather paradoxus	+	80
	Poaceae sp.	2	60
	Ptilotus obovatus var. obovatus	8	80
	Santalum spicatum	+	180
	Sclerolaena convexula	+	5
	Senna artemisioides subsp. filifolia	+	150
	Senna artemisioides subsp. helmsii	+	1.5
	Senna artemisioides subsp. x artemisioides	2	130
	Senna glaucifolia	+	100
Sida ?sp. dark green fruits (S. van Leeuwen 2260)	+	120	
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	60
	Solanum lasiophyllum	2	70

Site BGRCG07

Described by	CG	**Date**	25/10/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	259622 **mE**	6941474 **mN**		
Habitat	Broad wash plain adjacent to drainage channel				
Soil	Red-brown sand				
Rock Type	Basalt and quartz				

Vegetation *Maireana pyramidata* Low Sparse Shrubland over Low Isolated Chenopod Shrubs over a mixed Sparse Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Atriplex sp.	+	7
	Dissocarpus paradoxus	+	10
	Enneapogon caerulescens	+	40
	Eragrostis sp.	+	35
	Euphorbia australis var. subtomentosa	+	1
	Goodenia maideniana	+	5
	Maireana carnosa	+	10
	Maireana pyramidata	3	100
	Sclerolaena cuneata	+	20
	Solanum lasiophyllum	+	30
	Tecticornia disarticulata	+	100

Site BGRCG08

Described by	CG	**Date**	25/10/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258411 **mE**	6942353 **mN**		
Habitat	Drainage line on stony mid to low hillslopes				
Soil	Red-brown sand				
Rock Type	Basalt				

Vegetation *Acacia doreta* (long phyllode form) and *A. aptaneura* Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Senna artemisioides* subsp. *helmsii* Mid Sparse Shrubland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	9	500
	Acacia doreta (long phyllode form)	8	400
	Acacia fuscaneura	+	500
	Acacia tetragonophylla	+	150
	Acacia xanthocarpa	2	300
	Enneapogon caerulescens	+	25
	Enneapogon polyphyllus	+	35
	Eremophila forrestii subsp. forrestii	+	100
	Marsdenia australis	+	100
	Ptilotus exaltatus	+	30
	Ptilotus obovatus var. obovatus	2	90
	Sclerolaena densiflora	+	20
	Senna artemisiodes subsp. X *sturtii* Hybrid	+	130
	Senna artemisioides subsp. filifolia	+	100
	Senna artemisioides subsp. helmsii	2	120
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		+	150
	Solanum lasiophyllum	+	60

Site BGRCG09

Described by	CG	**Date**	25/10/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258517 **mE**	6942077 **mN**		
Habitat	Crest of hill				
Soil	Red-brown loamy sand				
Rock Type					

Vegetation Acacia aptaneura and A. fuscaneura Low Open Woodland over Eremophila forrestii subsp. forrestii Mid Sparse Shrubland over Ptilotus obovatus and Senna artemisioides subsp. petiolaris Low Sparse Shrubland over Aristida holathera var. holathera Open Tussock Grassland

Veg Condition Very Good to Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Abutilon otocarpum	+	25
	Acacia aptaneura	3	450
	Acacia fuscaneura	2	500
	Acacia ramulosa var. linophylla	+	200
	Acacia tetragonophylla	+	200
	Aristida holathera var. holathera	20	50
	Enchylaena tomentosa var. tomentosa	+	60
	Enneapogon polyphyllus	+	30
	Eragrostis eriopoda	1	60
	Eremophila forrestii subsp. forrestii	3	150
	Eriachne benthamii	+	80
	Haloragis trigonocarpa	+	5
	Maireana integra	+	40
	Monachather paradoxus	+	70
	Ptilotus obovatus var. obovatus	2	60
	Scaevola spinescens	+	200
	Senna artemisioides subsp. petiolaris	2	100
	Sida calyxhymenia	+	200
	Solanum lasiophyllum	+	80

Site BGRCG10

Described by	CG	**Date**	28/10/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	260054 **mE**	6941839 **mN**		
Habitat	Gently undulating slope - stony plain				
Soil	Red-brown loam				
Rock Type	Ironstone, quartz pebbles / cobbles				

Vegetation *Acacia fuscaneura* Isolated Trees over *Eremophila galeata* Tall Sparse Shrubland over *Maireana triptera* Low Sparse Shrubland

Veg Condition	Good - Degraded
Fire Age	> 10 years

Species List	Name	Cover	Height
	Acacia fuscaneura	+	190
	Acacia tetragonophylla	1	220
	Aristida contorta	+	25
	Enneapogon caerulescens	+	10
	Eremophila galeata	3	200
	Hakea preissii	+	240
	Maireana pyramidata	+	80
	Maireana triptera	2	40
	Ptilotus obovatus var. obovatus	+	60
	Salsola australis	+	30
	Scaevola spinescens	+	80
	Sclerolaena cuneata	+	20
	Sclerolaena eriacantha	+	20
	Senna sp. Meekatharra (E. Bailey 1-26)	+	120
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	40
	Solanum lasiophyllum	+	50

Site BGRJH01

Described by	JNH	**Date**	2/04/2019	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258791 **mE**	6937558 **mN**		
Habitat	Gypsum Kopi Dune				
Soil	Pale beige loam/gypsum				
Rock Type	Gypsum				

Vegetation Eucalyptus striaticalyx Isolated Trees over *Grevillea* sarissa ssp. bicolour Mid Sparse Shrubland over *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and Frankenia cinerea Sparse Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Aristida contorta	2	25
	Asteridea chaetopoda	+	15
	Enneapogon caerulescens	+	15
	Eucalyptus striaticalyx	+	1000
	Frankenia cinerea	+	25
	Frankenia setosa	+	20
	Grevillea sarissa subsp. bicolor	1	200
	Lawrencia helmsii	4	90
	Lycium australe	+	100
	Maireana erioclada	+	60
	Pittosporum angustifolium	ADJ	500
	Scaevola spinescens	+	70
	Sclerolaena fimbriolata	+	10
	Velleia rosea	+	3

Site BGRKM01

Described by	KMc	**Date**	25/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	257929 **mE**	6938065 **mN**		
Habitat	Clay depression on gypsum dune				
Soil	Red-orange sandy clay, gypsum				
Rock Type					
Vegetation	*Atriplex vesicaria* Low Chenopod Shrubland				
Veg Condition	Excellent				
Fire Age	> 10 years				
Species List	Name			Cover	Height
	Atriplex vesicaria			60	60
	Disphyma crassifolium subsp. clavellatum			+	5
	Lawrencia glomerata			+	60
	Lawrencia helmsii			+	50
	Lycium australe			1	70
	Menkea australis			+	20
	Minuria cunninghamii			1	60
	Roepera tetraptera			+	10
	Salsola australis			+	15
	Scaevola spinescens			+	160
	Sclerolaena articulata			+	10
	Swainsona paradoxa			2	20

Site BGRKM02

Described by	KMc	**Date**	25/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258506 **mE**	6939108 **mN**		
Habitat	Gypsum dunes adjacent to salt lake				
Soil	Red-orange sandy loam, gypsum				
Rock Type					

Vegetation *Lawrencia helmsii* Low Sparse Shrubland over *Aristida holathera* var. holathera, *A. contorta* and *Eragrostis eriopoda* Open Tussock Grassland

Veg Condition	Excellent to Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Alyogyne pinoniana	+	
	Aristida contorta	3	30
	Aristida holathera var. holathera	15	60
	Enneapogon polyphyllus	+	
	Eragrostis eriopoda	+	40
	Eragrostis falcata	+	0
	Eriachne aristidea	+	
	Frankenia cinerea	3	30
	Lawrencia helmsii	10	100
	Lycium australe	+	
	Menkea sphaerocarpa	+	10
	Roepera reticulata	+	
	Sclerolaena fimbriolata	1	20
	Sclerolaena obliquicuspis	+	

Site BGRKM03

Described by	KMc	**Date**	27/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258567 **mE**	6939154 **mN**		
Habitat	Red sand dune				
Soil	Red sand				
Rock Type					

Vegetation *Dodonaea viscosa* subsp. angustissima Tall Sparse Shrubland over *Alyogyne pinoniana* Mid Sparse Shrubland over *Aristida holathera* var. *holathera*, *Eragrostis eriopoda* and *Eriachne aristidea* Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia ramulosa var. linophylla		
	Acacia tetragonophylla		
	Alyogyne pinoniana	3	120
	Aristida holathera var. holathera	65	50
	Dodonaea viscosa subsp. angustissima	1	250
	Enchylaena tomentosa var. tomentosa		
	Eragrostis *eriopoda*		
	Eremophila forrestii subsp. forrestii		
	Eremophila glabra subsp. tomentosa		
	Eremophila longifolia		
	Eriachne aristidea		
	Maireana pyramidata		
	Menkea sphaerocarpa		
	Pimelea microcephala subsp. microcephala		
	Ptilotus obovatus var. obovatus		
	Rhagodia drummondii		
	Roepera reticulata		
	Roepera similis		
	Santalum acuminatum		
	Scaevola spinescens		
	Sclerolaena deserticola		
	Senna artemisioides subsp. filifolia		
	Solanum lasiophyllum		
	Triodia basedowii		
	Wurmbea deserticola		

Site BGRKM04

Described by	KMc	**Date**	27/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	259435 **mE**	6939250 **mN**		
Habitat	Creek bed and adjacent flood plain				
Soil	Red sand in creek bed and clay on bank				
Rock Type					

Vegetation *Acacia fuscaneura* Low Isolated Trees over *A. xanthocarpa* and *Eremophila galeata* Tall Open Shrubland over *Aristida contorta* Sparse Tussock Grassland in creek bed. *Eremophila galeata* Tall to Mid Isolated Shrubs over *Aristida contorta* Sparse Tussock Grassland and mixed Forbland on floodplain.

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia fuscaneura	1	500
	Acacia xanthocarpa	1	300
	Aristida contorta	5	20
	Asphodelus fistulosus	5	10
	Atriplex holocarpa		
	Brachyscome ciliaris		
	Bulbine sp.		
	Centipeda thespidioides		
	Cucumis myriocarpus		
	Eragrostis dielsii		
	Eragrostis leptocarpa		
	Eremophila exilifolia	3	120
	Eremophila galeata		
	Euphorbia australis var. subtomentosa		
	Euphorbia drummondii	1	150
	Euphorbia tannensis subsp. eremophila		
	Goodenia mimuloides		
	Helipterum craspedioides		
	Iseilema eremaeum		
	Lepidium muelleri-ferdinandii		
	Marsdenia australis		
	Myriocephalus rudallii		
	Nicotiana rotundifolia		
	Phyllanthus erwinii		
	Pimelea trichostachya		
	Pterocaulon sphacelatum		
	Ptilotus obovatus var. obovatus		
	Rumex vesicarius		

Sclerolaena diacantha		
Sclerolaena patenticuspis		
Senecio *lacustrinus*		
Senna glaucifolia	+	120
Sida calyxhymenia		
Solanum lasiophyllum		
Stackhousia muricata		
Stemodia florulenta		
Streptoglossa liatroides		
Swainsona elegantoides		
Wahlenbergia tumidifructa		

Site BGRKM05

Described by	KMc	**Date**	28/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258641 **mE**	6941470 **mN**		
Habitat	Drainage channel				
Soil	Red sand with gravel				
Rock Type					

Vegetation *Acacia fuscaneura* Low Woodland over *Sida calyxhymenia* and *Senna artemisioides* subsp. x *artemisioides* Mid Sparse Shrubland over *Ptilotus obovatus* Low Sparse Shrubland over *Aristida contorta* Open Tussock Grassland

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia fuscaneura	15	500
	Acacia pteraneura	1	500
	Aristida contorta	20	30
	Asphodelus fistulosus	+	
	Calotis multicaulis	+	
	Cenchrus ciliaris	+	60
	Cleome viscosa	+	
	Cucumis myriocarpus	+	
	Cymbopogon ambiguus	1	60
	Enchylaena tomentosa var. tomentosa	+	
	Enneapogon caerulescens	3	30
	Eragrostis eriopoda	+	
	Eragrostis minor	+	
	Eriachne benthamii	+	
	Eriochiton sclerolaenoides	+	
	Glycine canescens	+	
	Hakea preissii	+	400
	Haloragis trigonocarpa	+	
	Maireana triptera	+	
	Portulaca oleracea	+	
	Ptilotus chamaecladus	+	
	Ptilotus obovatus var. obovatus	2	70
	Salsola australis	+	
	Scaevola spinescens	+	
	Sclerolaena deserticola	+	
	Sclerolaena fimbriolata	+	
	Senna artemisioides subsp. filifolia	+	
	Senna artemisioides subsp. x artemisioides	1	100
	Sida calyxhymenia	1	180
	Solanum lasiophyllum	+	
	Swainsona elegantoides	+	

Site BGRKM06

Described by	KMc	**Date**	30/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	259755 **mE**	6939753 **mN**		
Habitat	Rehabilitation area at historical Tailings Storage Facility. Graded basalt waste rock				
Soil	No topsoil				
Rock Type	Basalt				
Vegetation	*Maireana pyramidata* and *Melaleuca leiocarpa* Isolated Clumps of Shrubs over *Aristida contorta* Tussock Grassland				
Veg Condition	Degraded				
Fire Age	> 10 years				
Species List	Name			Cover	Height
	Aristida contorta			70	30
	Hakea lorea subsp. lorea			+	
	Maireana pyramidata			+	100
	Melaleuca leiocarpa			+	100
	Ptilotus obovatus var. obovatus			+	
	Rumex vesicarius			+	

Site BGRKM07

Described by	KMc	**Date**	31/08/2018	**Type**	Relevé
Location	Bellevue Gold Project				
MGA Zone	51	258127 **mE**	6941589 **mN**		
Habitat	Ridge and upper slopes of stony hill				
Soil	Red sandy clay				
Rock Type					

Vegetation *Hakea preissii* Tall Sparse Shrubland with *H. lorea* subsp. *lorea* and *Eremophila galeata* Tall Sparse Shrubland appearing towards crest of hill

Veg Condition	Excellent		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia tetragonophylla	+	
	Aristida contorta	20	20
	Enneapogon caerulescens	2	20
	Eremophila galeata	1	300
	Hakea lorea subsp. *lorea*	1	400
	Hakea preissii	5	300
	Ptilotus obovatus var. obovatus	+	40
	Rhagodia eremaea	+	
	Senna artemisioides subsp. helmsii	+	
	Senna artemisioides subsp. x sturtii	2	150
	Solanum lasiophyllum	+	

Site KVQ01

Described by	CG	**Date**	15/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257284 **mE**	6948235 **mN**			
Habitat	Creek line on stony hill					
Soil	Red sandy loam clay					
Rock Type	Basalt and quartz					

Vegetation *Acacia aptaneura* and *A. craspedocarpa* hybrid Low Open Forest over *Eremophila galeata* Tall Sparse Shrubland over *Cymbopogon obtectus* and *Aristida contorta* Sparse to Open Tussock Grassland

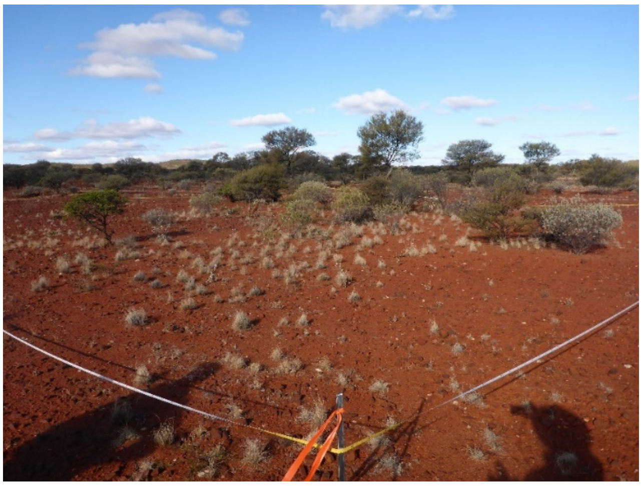
Veg Condition Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Abutilon sp.	+	50
	Acacia aptaneura	25	800
	Acacia burkittii	+	50
	Acacia craspedocarpa hybrid	10	500
	Acacia tetragonophylla	1	500
	Acacia xanthocarpa	+	50
	Aristida contorta	0.5	30
	Cymbopogon obtectus	10	80
	Digitaria brownii	1	30
	Dodonaea petiolaris	+	60
	Duperreya commixta	+	180
	Enchylaena tomentosa var. tomentosa	+	20
	Enneapogon caerulescens	+	20
	Eragrostis pergracilis	+	25
	Eremophila forrestii subsp. forrestii	+	100
	Eremophila galeata	2.5	250
	Eremophila granitica	+	170
	Eremophila longifolia	ADJ	350
	Eremophila serrulata	+	30
	Eriachne helmsii	+	60
	Euphorbia tannensis subsp. eremophila	+	10
	Haloragis trigonocarpa	+	5
	Heliotropium inexplicitum	+	20
	Helipterum craspedioides	+	15
	Hibiscus burtonii	+	30
	Hibiscus sp. Gardneri	+	100
	Indigofera georgei	+	1
	Marsdenia australis	+	40

Monachather paradoxus	+	30
Psydrax rigidula	+	15
Psydrax suaveolens	+	40
Ptilotus helipteroides	+	5
Ptilotus obovatus var. obovatus	+	60
Santalum lanceolatum	2	500
Senna artemisioides subsp. oligophylla x helmsii	+	20
Senna artemisioides subsp. x artemisioides	+	80
Senna artemisioides subsp. x sturtii	+	90
Senna glaucifolia	+	90
Sida ectogama	1	180
Sida fibulifera	+	25
Sida sp. dark green fruit (S. van Leeuwen 2260)	+	45
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	+	60
Solanum lasiophyllum	+	60
Stackhousia muricata	+	15
Swainsona kingii	+	1
Thyridolepis mitchelliana	+	40
Vincetoxicum lineare	+	60

Site KVQ02



Described by	CG	**Date**	15/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257325 **mE**	6948187 **mN**			
Habitat	Gently north sloping north facing stony hardpan plain adjacent to creek bed					
Soil	Red sandy loam clay					
Rock Type	Basalt and quartz					

Vegetation *Acacia pteraneura* Isolated Trees over *Eremophila galeata*, *Senna artemisioides* subsp. *helmsii*, and *S artemisioides* subsp. x *artemisioides* Mid Sparse to Open Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia pteraneura	2	400
	Acacia tetragonophylla	+	60
	Acacia xanthocarpa	+	45
	Aristida contorta	3	25
	Cymbopogon obtectus	+	50
	Duperreya commixta	+	cr
	Enneapogon caerulescens	+	10
	Eragrostis setifolia	+	30
	Eremophila galeata	0.15	180
	Haloragis trigonocarpa	+	2
	Indigofera georgei	+	30
	Maireana georgei	+	30
	Maireana sp.	+	10
	Ptilotus helipteroides	+	3
	Ptilotus obovatus var. obovatus	+	90
	Ptilotus roei	+	3
	Scaevola spinescens	+	30
	Sclerolaena diacantha	+	10
	Sclerolaena fusiformis	+	10
	Senna artemisioides subsp. helmsii	+	90
	Senna artemisioides subsp. x artemisioides	0.5	120
	Senna artemisioides subsp. x sturtii	0.5	160
	Senna glaucifolia	+	160
	Senna sp. Meekatharra (E. Bailey 1-26)	+	160
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	20
	Solanum lasiophyllum	+	40

Site KVQ03

Described by	BRM	**Date**	15/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	256997 **mE**	6947994 **mN**			
Habitat	Gentle south-east facing lower slope of hill					
Soil	Reddish-brown loamy clay					
Rock Type	Calcrete					

Vegetation *Eremophila pantonii* and *E. galeata* Tall Open Shrubland over *Senna* sp. Meekatharra Mid Open Shrubland over S. *artemisioides* subsp. x *artemisioides* and *Ptilotus obovatus* var. *obovatus* Low Open Shrubland

Veg Condition Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Acacia aptaneura	+	30
	Acacia oswaldii	ADJ	500
	Aristida contorta	+	30
	Enchylaena tomentosa var. tomentosa	+	110
	Enchylaena tomentosa x Maireana georgei	+	35
	Enneapogon caerulescens	+	25
	Enneapogon cylindricus	0.25	15
	Eremophila galeata	0.5	170
	Eremophila pantonii	7	350
	Maireana georgei	+	30
	Maireana tomentosa	+	35
	Maireana triptera	ADJ	35
	Marsdenia australis	+	130
	Ptilotus obovatus var. obovatus	+	40
	Roepera kochii	+	5
	Salsola australis	+	40
	Sclerolaena densiflora	+	10
	Sclerolaena lanicuspis	+	10
	Sclerolaena patenticuspis	+	25
	Senna artemisioides subsp. filifolia	+	70
	Senna artemisioides subsp. helmsii	+	30
	Senna artemisioides subsp. x artemisioides	1.5-2	45
	Senna sp. Meekatharra (E. Bailey 1-26)	3	120
	Sida calyxhymenia	+	60
	Solanum lasiophyllum	+	40

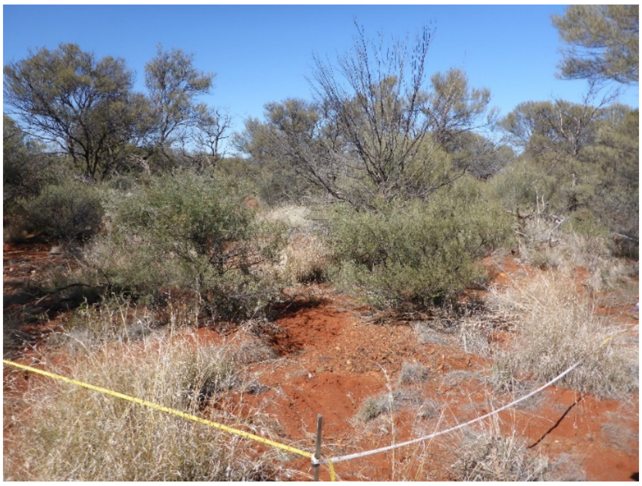
Site KVQ04

Described by	CG	**Date**	16/08/2019	**Type**	Quadrat 20 x 20
Location	Bellevue Gold Project				
MGA Zone	50	257175 **mE**	6947906 **mN**		
Habitat	Gently sloping south-west facing stony hardpan plain beside creek line				
Soil	Red loamy clay				
Rock Type	Basalt (90%) and quartz (5%). Small stones and pebbles 10-40mm				

Vegetation *Acacia aptaneura* Isolated Trees over *Eremophila pantonii*, *E. galeata* and *Senna artemisioides* subsp. *filifolia* Tall Sparse Shrubland over *S.* sp. Meekatharra and *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Aristida contorta* Sparse Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon otocarpum	+	25
	Acacia aptaneura	ADJ	400
	Acacia tetragonophylla	+	120
	Aristida contorta	<2	25
	Cymbopogon obtectus	+	40
	Enchylaena tomentosa var. tomentosa	+	20
	Enchylaena tomentosa x Maireana georgei	+	30
	Enneapogon caerulescens	+	20
	Enneapogon polyphyllus	+	30
	Eremophila galeata	0.5	160
	Eremophila pantonii	1-2	220
	Haloragis trigonocarpa	+	5
	Maireana georgei	+	30
	Maireana tomentosa	+	25
	Maireana triptera	+	20
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	+	70
	Ptilotus roei	+	2
	Roepera aurantiaca subsp. aurantiaca	+	5
	Salsola australis	+	40
	Sclerolaena eriacantha	+	20
	Sclerolaena fusiformis	+	10
	Sclerolaena lanicuspis	+	15
	Senna artemisioides subsp. filifolia	+	30
	Senna sp. Meekatharra (E. Bailey 1-26)	2.5	100
	Sida ?ectogama	+	50
	Solanum lasiophyllum	+	60

Site KVQ05



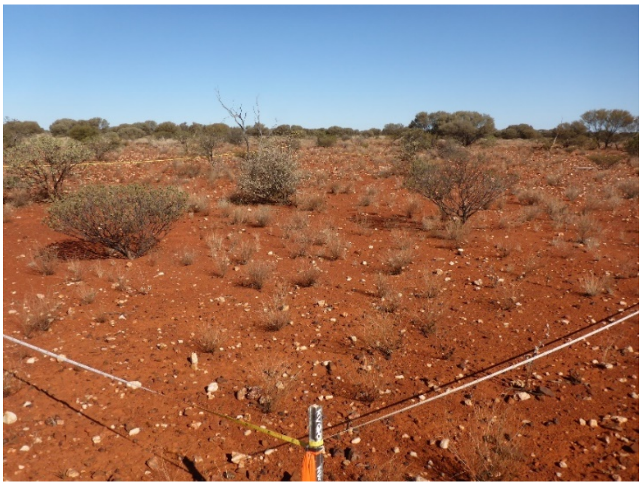
Described by	BRM	**Date**	16/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257075 **mE**	6947924 **mN**			
Habitat	Broad flow line of multiple small creek beds and low islands / banks					
Soil	Reddish-brown sandy loam					
Rock Type	Basalt, quartz and ironstone					

Vegetation Acacia craspedocarpa hybrid and A. aptaneura Low Woodland over A. tetragonophylla Sparse Tall Shrubland over Eremophila serrulata, A. xanthocarpa and Senna artemisioides subsp. x artemisioides Open Shrubland over Themeda triandra, Cymbopogon obtectus and Aristida contorta Open Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	6	600
	Acacia craspedocarpa	ADJ	400
	Acacia craspedocarpa hybrid	15	500
	Acacia tetragonophylla	+	300
	Acacia xanthocarpa	0.5	170
	Aristida contorta	1	>5
	Calandrinia ptychosperma	+	6
	Calotis hispidula	+	15
	Cymbopogon obtectus	0.5	60
	Digitaria brownii	+	40
	Dodonaea petiolaris	+	80
	Duperreya commixta	0.5	170
Dysphania rhadinostachya subsp. rhadinostachya		+	15
	Enneapogon caerulescens	+	30
	Eragrostis eriopoda	+	35
	Eremophila forrestii subsp. forrestii	+	70
	Eremophila galeata	+	70
	Eremophila granitica	+	180
	Eremophila serrulata	2	120-180
	Erodium crinitum	+	6
	Erodium sp.	+	3
	Euphorbia drummondii	+	1
	Euphorbia tannensis subsp. eremophila	+	20
	Glycine canescens	+	25
	Goodenia mimuloides	+	15
	Goodenia prostrata	+	3
	Haloragis trigonocarpa	+	15

Helipterum craspedioides	+	20
Hibiscus burtonii	+	20
Hibiscus sp. Perrinvale Station	+	170
Indigofera georgei	+	45
Indigofera sp.	+	3
Lysimachia arvensis	+	4
Marsdenia australis	+	30
Nicotiana rotundifolia	+	15
Phyllanthus erwinii	+	5
Psydrax latifolia	+	40
Ptilotus chamaecladus	+	2
Ptilotus helipteroides	+	12
Ptilotus obovatus var. obovatus	+	40
Ptilotus roei	+	2
Rhodanthe battii	+	15
Rumex vesicarius	+	15
Santalum lanceolatum	+	550
Senna artemisioides subsp. filifolia	+	140
Senna artemisioides subsp. helmsii	+	150
Senna artemisioides subsp. x artemisioides	0.5	50-110
Senna artemisioides subsp. x sturtii	+	70
Senna glaucifolia	+	90
Senna sp. Meekatharra (E. Bailey 1-26)	+	45
Sida ectogama	0.5	150
Sida sp. Exidentifolia (J.L. Egan 1925)	+	10
Solanum lasiophyllum	+	40
Stackhousia muricata	+	20
Swainsona incei	+	25
Swainsona kingii	+	3
Themeda triandra	15	70
Trichodesma zeylanicum	+	10
Vincetoxicum lineare	+	30
Wahlenbergia tumidifructa	+	10

Site KVQ06



Described by	CG	**Date**	16/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257021 **mE**	6947651 **mN**			

Habitat Gently sloping west facing stony hardpan plain adjacent to creek line. Scattered mulga upslope and in creek line but not part of this unit.

Soil Red clay loam (hardpan)

Rock Type Basalt and quartz

Vegetation *Eremophila galeata*, *E. latrobei* subsp. *latrobei* and *Senna* sp. Meekatharra Mid Sparse Shrubland over *S.* sp. Meekatharra Mid Open Shrubland over *Ptilotus schwartzii* var. *schwartzii* Sparse Low Shrubland

Veg Condition Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Acacia aneura	+	40
	Acacia tetragonophylla	+	180
	Aristida contorta	ADJ	25
	Eragrostis setifolia	1-2	25
	Eremophila forrestii subsp. forrestii	+	130
	Eremophila galeata	1	160
	Eremophila latrobei subsp. latrobei	+	90
	Maireana georgei	+	20
	Maireana planifolia (hairy variant)	+	90
	Maireana villosa	+	20
	Monachather paradoxus	ADJ	40
	Ptilotus aervoides	+	60
	Ptilotus roei	+	3
	Ptilotus schwartzii var. schwartzii	4	50
	Sclerolaena diacantha	+	25
	Senna artemisioides subsp. filifolia	+	25
	Senna glaucifolia	ADJ	120
	Senna sp. Meekatharra (E. Bailey 1-26)	1-2	90
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	30
	Solanum lasiophyllum	+	60

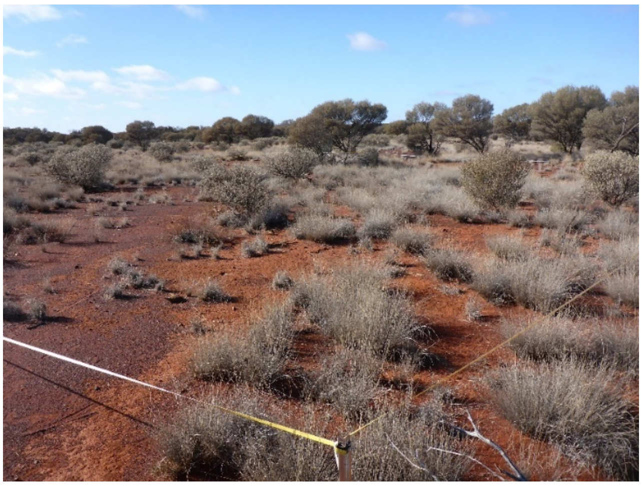
Site KVQ07

Described by	BRM	**Date**	16/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	256876 **mE**	6947718 **mN**			
Habitat	Narrow flat plain adjacent to mulga flow line					
Soil	Reddish-brown loamy sand					
Rock Type	NA					

Vegetation *Acacia aptaneura* and *A. craspedocarpa* hybrid Low Open Woodland over *Eremophila galeata* Tall Sparse Shrubland over *E. forrestii* subsp. *forrestii* Mid Isolated Shrubs Low Sparse Shrubland over *Eragrostis setifolia*, *Monachather paradoxus* and *E. eriopoda* Tussock Grassland

Veg Condition	Good			
Fire Age	> 10 years			
Species List	Name		Cover	Height
	Acacia aptaneura		7	600
	Acacia craspedocarpa		0.5	170
	Acacia craspedocarpa hybrid		1.5	280
	Aristida contorta	+	30	
	Cymbopogon ambiguus		+	80
	Digitaria brownii	+	40	
	Duperreya commixta		+	160
	Enchylaena tomentosa var. tomentosa		+	45
	Eragrostis eriopoda		+	35
	Eragrostis setifolia		25	30
	Eremophila forrestii subsp. forrestii		0.5	140
	Eremophila galeata		1	230
	Eremophila latrobei subsp. latrobei		+	105
Eremophila platycalyx ?subsp. Leonora (J. Morrisey 252)		+	40	
	Eriochiton sclerolaenoides		+	12
	Hibiscus burtonii		+	30
	Maireana georgei		+	40
	Maireana planifolia		+	35
	Maireana pyramidata		+	60
	Marsdenia australis		+	280
	Monachather paradoxus		1	30
	Ptilotus gaudichaudii		+	15
	Ptilotus obovatus var. obovatus		+	45
	Santalum spicatum		1	380
	Sclerolaena convexula		+	20
	Sclerolaena diacantha		+	6
	Senna artemisioides subsp. filifolia		+	80
	Senna glaucifolia		+	80
	Sida fibulifera		+	30
	Solanum lasiophyllum		+	35

Site KVQ08



Described by	CG	**Date**	17/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	256986 **mE**	6946381 **mN**			
Habitat	Flat hardpan plain with a surface of small (4-10mm) basalt / ironstone pebbles					
Soil	Red loamy clay					
Rock Type	Basalt and ironstone					

Vegetation *Acacia aptaneura* Low Isolated Trees over *A. mulganeura* Tall Isolated Shrubs over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda* and *Monachather paradoxus* Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	ADJ	300
	Acacia mulganeura	1	250
	Eragrostis eriopoda	25	50
	Eremophila foliosissima	+	70
	Eremophila forrestii subsp. forrestii	2-3	130
	Eriachne helmsii	+	40
	Maireana planifolia (hairy variant)	+	30
	Monachather paradoxus	2-3	50
	Ptilotus schwartzii var. schwartzii	+	40
	Solanum lasiophyllum	+	60

Site KVQ09

Described by	BRM	**Date**	17/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	256881 **mE**	6946856 **mN**			
Habitat	Broad flow area of minor channels and flood banks					
Soil	Reddish-brown sandy loam					
Rock Type	NA					

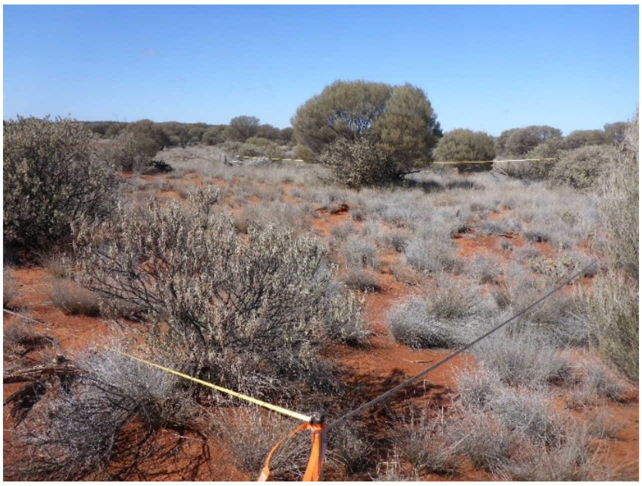
Vegetation Acacia aptaneura Low Woodland over Eremophila galeata and Santalum lanceolatum Tall Open Shrubland over Senna artemisioides subsp. x sturtii, S. artemisioides subsp. x artemisioides, Senna artemisioides subsp. filifolia, Eremophila forrestii subsp. forrestii Mid Open Shrubland over Indigofera georgei and Ptilotus obovatus var. obovatus Low Sparse Shrubland over Eragrostis eriopoda, Eriachne helmsii, Themeda triandra, Aristida contorta and Monachather paradoxus Tussock Grassland

Veg Condition	Very Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	50
	Acacia aptaneura	1.5	280
	Acacia caesaneura	+	170
	Acacia craspedocarpa	ADJ	3
	Acacia craspedocarpa hybrid	+	35
	Acacia fuscaneura	15	450
	Aristida contorta	1	30
	Calotis hispidula	+	6
	Cymbopogon obtectus	+	40
	Digitaria brownii	+	30
	Duperreya commixta	+	cr
	Dysphania melanocarpa	+	3
	Enchylaena tomentosa var. tomentosa	+	30
	Eragrostis eriopoda	35	40
	Eremophila exilifolia	+	30
	Eremophila forrestii subsp. forrestii	0.5	100
	Eremophila galeata	2	250
	Eremophila latrobei subsp. latrobei	+	60
	Eriachne helmsii	2	60
	Erodium cygnorum	+	10
	Euphorbia tannensis subsp. eremophila	+	10
	Glycine *canescens*	+	180
	Goodenia mimuloides	+	5
	Goodenia prostrata	+	12
	Hakea lorea subsp. lorea	+	45
	Haloragis trigonocarpa	+	15

Helipterum craspedioides	+	15
Hibiscus burtonii	+	35
Indigofera georgei	0.5	35
Maireana planifolia	+	20
Monachather paradoxus	2-3	50
Ptilotus aervoides	+	1
Ptilotus gaudichaudii	+	6
Ptilotus helipteroides	+	4
Ptilotus obovatus var. obovatus	3	80
Ptilotus polystachyus	+	10
Rhodanthe battii	+	15
Santalum lanceolatum	0.5	400
Sclerolaena deserticola	4	500
Senna artemisioides subsp. filifolia	+	170
Senna artemisioides subsp. helmsii	+	30
Senna artemisioides subsp. x artemisioides	0.5	180
Senna artemisioides subsp. x sturtii	2.5	140
Sida fibulifera	+	30
Sida sp. dark green fruit (S. van Leeuwen 2260)	+	60
Solanum lasiophyllum	0.5	40
Swainsona kingii	+	4
Themeda triandra	1	90
Velleia rosea	ADJ	3
Vincetoxicum lineare	+	30

Site KVQ10



Described by	CG	**Date**	17/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257144 **mE**	6945733 **mN**			
Habitat	Flat hardpan plain with small ironstone pebbles					
Soil	Red loamy clay					
Rock Type	Ironstone					

Vegetation Acacia aptaneura and A. caesaneura Low Open Woodland over Eremophila forrestii subsp.forrestii Mid Sparse Shrubland over Eragrostis eriopoda and Monachather paradoxus Tussock

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	1.5	400
	Acacia caesaneura	ADJ	300
	Eragrostis eriopoda	15	50
	Eremophila foliosissima	+	80
	Eremophila forrestii subsp. forrestii	4	130
	Eriachne helmsii	+	50
	Hibiscus burtonii	+	40
	Maireana planifolia (hairy variant)	+	30
	Monachather paradoxus	10	40
	Psydrax suaveolens	ADJ	100
	Ptilotus obovatus var. obovatus	+	70
	Ptilotus schwartzii var. schwartzii	+	60
	Solanum lasiophyllum	+	60
	Thyridolepis mitchelliana	+	40
	Triodia basedowii	ADJ	90

Site KVQ11

Described by	BRM	**Date**	17/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257220 **mE**	6945443 **mN**			
Habitat	Plain					
Soil	Reddish-brown loamy sand					
Rock Type	NA					

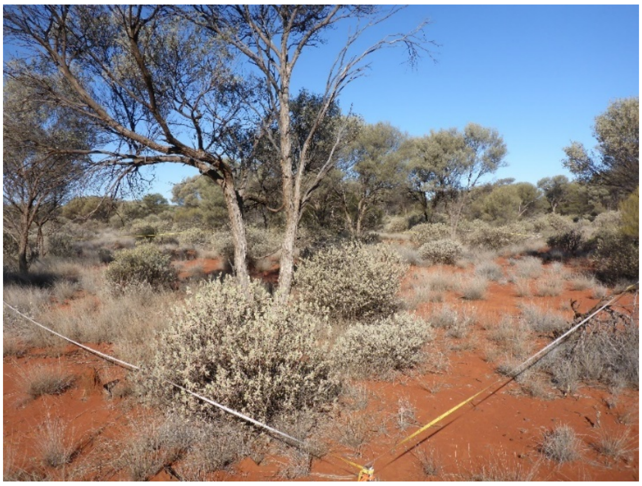
Vegetation Acacia caesaneura Low Woodland over Eremophila forrestii subsp. forrestii and E. foliosissima Mid Open Shrubland over Monachather paradoxus, Eragrostis eriopoda and Eriachne helmsii Tussock Grassland

Veg Condition Very Good to Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Acacia ayersiana	ADJ	500
	Acacia caesaneura	25	450
	Eragrostis eriopoda	10	45
	Eremophila foliosissima	2	80-120
	Eremophila forrestii subsp. forrestii	6	120
	Eremophila latrobei subsp. latrobei	+	30
	Eriachne helmsii	3	60
	Maireana planifolia	+	50
	Monachather paradoxus	30	40
	Psydrax latifolia	+	35
	Ptilotus obovatus var. obovatus	+	20
	Solanum lasiophyllum	+	25

Site KVQ12



Described by	CG	**Date**	17/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257466 **mE**	6944913 **mN**			
Habitat	Flat plain, red sand over hardpan, some areas have deeper sand layer, others clay hardpan					
Soil	Red-brown sand over clay					
Rock Type	NA					

Vegetation *Acacia ayersiana*, *A. caesaneura* and *A. caesaneura* (narrow phyllode variant) Low Open Woodland over *Acacia ramulosa* var. *linophylla* Tall Isolated Shrubs over *Eremophila forrestii* subsp. *forrestii* Mid Shrubland *Eragrostis eriopoda* and *Monachather paradoxus* Tussock

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	ADJ	500
	Acacia ayersiana	5	600
	Acacia caesaneura	1.5	600
	Acacia caesaneura (narrow phyllode variant)	3	500
	Acacia ramulosa var. linophylla	0.5	220
	Enchylaena tomentosa var. tomentosa	+	60
	Eragrostis eriopoda	15	50
	Eremophila forrestii subsp. forrestii	6	150
	Eucalyptus kingsmillii subsp. kingsmillii	ADJ	500
	Exocarpos aphyllus	+	60
	Maireana georgei	+	35
	Maireana planifolia (hairy variant)	+	60
	Monachather paradoxus	10	50
	Ptilotus obovatus var. obovatus	+	60
	Rhagodia drummondii	+	130
	Salsola australis	+	40
	Santalum lanceolatum	+	170
	Solanum lasiophyllum	+	70
	Thyridolepis mitchelliana	+	25

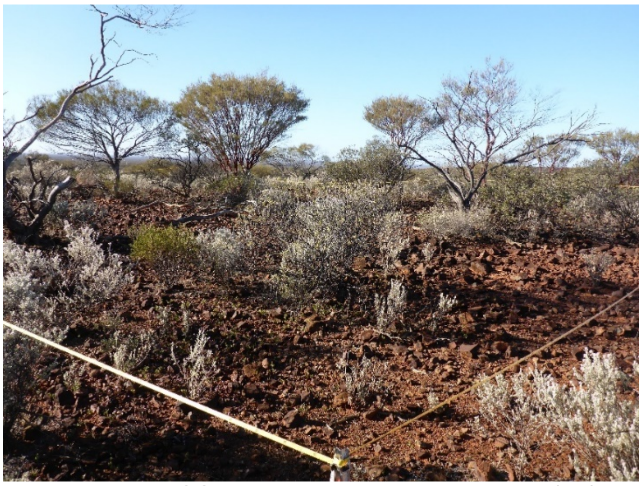
Site KVQ13

Described by	BRM	**Date**	18/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259514 **mE**	6944850 **mN**			
Habitat	Long gentle south facing slope of low rise					
Soil	Reddish-brown sandy clay loam					
Rock Type	Ironstone and quartz gravels, pebbles and cobbles					

Vegetation *Acacia aneura* Low Open Woodland over *Eremophila pantonii*, *Senna* sp. Meekatharra, *Scaevola spinescens* and S. *artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* and mixed Chenopod Low Sparse Shrubland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aneura	2	400
	Acacia mulganeura	ADJ	180
	Acacia ramulosa var. linophylla	+	25
	Acacia tetragonophylla	+	70
	Aristida contorta	+	25
	Enchylaena tomentosa x Maireana georgei	+	25
	Eragrostis sp.	+	35
	Eremophila pantonii	2.5	110-190
	Maireana georgei	+	20
	Maireana triptera	0.25	40
	Ptilotus obovatus var. obovatus	0.25	30-40
	Scaevola spinescens	0.5	50-80
	Sclerolaena diacantha	+	15
	Sclerolaena eriacantha	+	12
	Senna artemisioides subsp. helmsii	0.3	160
	Senna artemisioides subsp. x artemisioides	+	25
	Senna sp. Meekatharra (E. Bailey 1-26)	1.5	100
	Sida fibulifera	+	20
	Solanum lasiophyllum	+	30

Site KVQ14



Described by	CG	**Date**	18/08/2019	**Type**	Quadrat	20 x 20	
Location	Bellevue Gold Project						
MGA Zone	50	258845 **mE**	6944553 **mN**				
Habitat	Crest of stony hill (elevation 511m), slightly north-west facing but otherwise fairly flat crest						
Soil	Red skeletal sandy clay loam						
Rock Type	Basalt gravel (~10mm) to rocks (250mm)						

Vegetation *Eremophila oldfieldii* subsp. *angustifolia* Low Isolated Trees with *Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Senna* sp. Meekatharra and S. *artemisioides* subsp. *helmsii* Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland

Veg Condition	Very Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Acacia aptaneura	0.5	200
	Acacia doreta (long phyllode form)	3	400
	Acacia tetragonophylla	ADJ	90
	Acacia xanthocarpa	2-3	350
	Aristida contorta	+	20
	Duperreya commixta	+	cr
	Enchylaena tomentosa var. tomentosa	+	50
	Enneapogon caerulescens	+	10
	Eremophila granitica	0.5	200
	Eremophila oldfieldii subsp. angustifolia	+	40
	Hibiscus sp. Gardneri	ADJ	80
	Maireana georgei	+	20
	Maireana pyramidata	ADJ	60
	Maireana tomentosa	+	20
	Maireana triptera	+	25
	Marsdenia australis	+	100
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	12	90
	Roepera iodocarpa	+	10
	Salsola australis	+	10
	Santalum spicatum	ADJ	300
	Scaevola spinescens	ADJ	100
	Sclerolaena densiflora	+	15
	Sclerolaena eriacantha	+	25
	Senna artemisioides subsp. helmsii	+	100
	Senna glaucifolia	+	60
	Senna sp. Meekatharra (E. Bailey 1-26)	3	150
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	30
	Solanum lasiophyllum	+	30

Site KVQ15

Described by	BRM	**Date**	18/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257739 **mE**	6944460 **mN**			
Habitat	Plain (flat)					
Soil	Reddish-brown loamy sand					
Rock Type	NA					

Vegetation Acacia caesaneura, A. aptaneura and A. ayersiana Low Woodland over Eremophila forrestii subsp. forrestii Mid Sparse Shrubland over Eragrostis eriopoda and Monachather paradoxus Tussock Grassland

Veg Condition Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Acacia aptaneura	4-5	600
	Acacia ayersiana	3	600-700
	Acacia caesaneura	20	700
	Acacia ramulosa var. linophylla	4	300
	Eragrostis eriopoda	20	45
	Eremophila forrestii subsp. forrestii	2.5	180
	Eriachne helmsii	+	70
	Exocarpos aphyllus	+	45
	Monachather paradoxus	20	45
	Ptilotus obovatus var. obovatus	+	25-60
	Rhagodia drummondii	+	60
	Senna artemisioides subsp. helmsii	+	60
	Senna glutinosa subsp. luerssenii	+	80
	Solanum lasiophyllum	+	45
	Thyridolepis mitchelliana	0.5	30

Site KVQ16

Described by	CG	**Date**	18/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	258165 **mE**	6944687 **mN**			
Habitat	Midslope of south-west facing stony hill					
Soil	Red skeletal sandy clay loam					
Rock Type	Basalt stones and gravel and quartz					

Vegetation *Santalum spicatum* Low Isolated Trees with *Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Senna artemisioides* subsp. *helmsii* and *S.* sp. Meekatharra Mid Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Aristida contorta* Open to Sparse Tussock Grassland

Veg Condition Very Good

Fire Age > 10 years

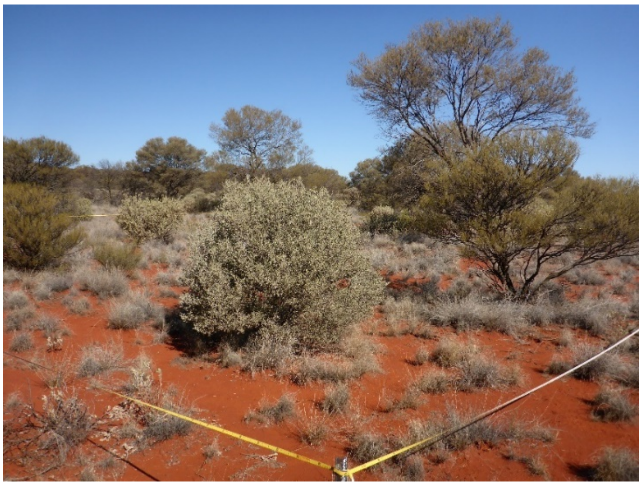
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	20
	Abutilon fraseri	+	20
	Abutilon otocarpum	+	20
	Acacia aptaneura	+	10
	Acacia doreta (long phyllode form)	6	400
	Acacia tetragonophylla	+	100
	Acacia xanthocarpa	1-2	260
	Aristida contorta	3-4	25
	Calandrinia eremaea	+	1
	Enneapogon caerulescens	+	15
	Eremophila forrestii subsp. forrestii	ADJ	<100
	Erodium cygnorum	+	4
	Euphorbia australis	+	1
	Goodenia mimuloides	+	10
	Haloragis trigonocarpa	+	15
	Lepidium rotundum	+	3
	Maireana tomentosa	+	25
	Maireana triptera	+	30
	Marsdenia australis	+	cr
	Ptilotus helipteroides	0.5	5
	Ptilotus obovatus var. obovatus	+	100
	Ptilotus roei	+	2
	Roepera iodocarpa	+	15
	Salsola australis	+	10
	Santalum spicatum	0.5	300
	Scaevola spinescens	0.5	170
	Sclerolaena convexula	+	15
	Sclerolaena densiflora	+	10
	Senna artemisioides subsp. helmsii	7	130
	Senna sp. Meekatharra (E. Bailey 1-26)	0.25	90
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	30
	Solanum lasiophyllum	+	60

Site KVQ17

Described by	BRM	**Date**	18/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	258094 **mE**	6945572 **mN**			
Habitat	Stony plain					
Soil	Reddish-brown sandy clay loam					
Rock Type	Basalt, quartz and ironstone					
Vegetation	*Eremophila ramiflora* Tall Open Shrubland over *Senna* sp. Meekatharra Mid Isolated Shrubs					
Veg Condition	Very Good					
Fire Age	> 10 years					

Species List	Name	Cover	Height
	Acacia aneura	0.25	180
	Acacia tetragonophylla	+	60
	Aristida contorta	+	25
	Enchylaena tomentosa var. tomentosa	+	30
	Enteropogon ramosus	1	40-50
	Eremophila ramiflora	4	250
	Maireana planifolia	+	40-60
	Ptilotus obovatus var. obovatus	0.25	40
	Salsola australis	+	20
	Santalum lanceolatum	+	90
	Senna artemisioides subsp. helmsii	+	10
	Senna artemisioides subsp. x artemisioides	+	25
	Senna sp. Meekatharra (E. Bailey 1-26)	0.5	80
	Sida ?ectogama	+	90
	Solanum lasiophyllum	+	40

Site KVQ18



Described by	CG	**Date**	18/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	258046 **mE**	6945170**mN**			

Habitat Flat sandplain broad outwash plain braided drainage channels with sandy mounds and flats between deeper hardpan drainage lines. Mulga woodland.

Soil Red loamy sand to sand with clay hardpan in shallow drainage lines

Rock Type NA

Vegetation *Acacia caesaneura* and *A. aptaneura* Low Open Woodland over *A. ramulosa* var. *linophylla* Tall Sparse Shrubland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda* and *Monachather paradoxus* Tussock Grassland

Veg Condition Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Acacia aptaneura	ADJ	600
	Acacia ayersiana	0.5	250
	Acacia caesaneura	4	600
	Acacia ramulosa var. linophylla	3	400
	Aristida contorta	+	25
	Enchylaena tomentosa var. tomentosa	+	90
	Enchylaena tomentosa x Maireana georgei	+	70
	Eragrostis eriopoda	30	50
	Eremophila forrestii subsp. forrestii	3	120
	Eriachne helmsii	+	70
	Hakea lorea subsp. *lorea*	ADJ	500
	Haloragis trigonocarpa	+	2
	Maireana georgei	0.5	250
	Maireana suaedifolia	+	40
	Monachather paradoxus	20	50
	Ptilotus helipteroides	+	7
	Ptilotus obovatus var. obovatus	ADJ	70
	Ptilotus polystachyus	+	15
	Rhodanthe battii	+	5
	Santalum lanceolatum	+	120
	Scaevola spinescens	+	40
	Solanum lasiophyllum	+	60

Site KVQ19

Described by	BRM	**Date**	18/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	258841 **mE**	6945519 **mN**			
Habitat	Gentle north facing slope, midslope of low hill					
Soil	Reddish-brown sandy clay loam					
Rock Type	Dolerite (blue) conglomerate including granite and some calcrete					

Vegetation *Acacia xanthocarpa* and *A. doreta* (long phyllode form) Tall open Shrubland over *Senna* sp. Meekatharra and *S. artemisioides* subsp. *helmsii* Mid Isolated Shrubs over *Aristida contorta* Isolated Grasses

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	25
	Acacia doreta (long phyllode form)	1	260
	Acacia xanthocarpa	18	300
	Aristida contorta	1	25
	Enneapogon caerulescens	+	10
	Eremophila exilifolia	+	25
	Eremophila forrestii subsp. forrestii	+	50
	Exocarpos aphyllus	+	40
	Goodenia mimuloides	+	4
	Grevillea inconspicua	+	60
	Haloragis trigonocarpa	+	3
	Marsdenia australis	+	140
	Podolepis capillaris	+	30
	Ptilotus helipteroides	+	15
	Ptilotus obovatus var. obovatus	+	35
	Roepera iodocarpa	+	10
	Santalum spicatum	1	220
	Sclerolaena diacantha	+	20
	Senna artemisioides subsp. helmsii	0.25	120
	Senna sp. Meekatharra (E. Bailey 1-26)	0.25	50
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	45
	Solanum lasiophyllum	+	25-40
	Swainsona incei	+	4

Site KVQ20

Described by	CG	**Date**	18/08/2019	**Type**	Quadrat	10 x 40
Location	Bellevue Gold Project					
MGA Zone	50	258553 **mE**	6945253 **mN**			
Habitat	Drainage line on midslope of stony hill.					
Soil	Red loamy clay with pebbles on top					
Rock Type	Basalt and a little quartz					

Vegetation *Acacia aptaneura* Low Closed Forest over *A. xanthocarpa* Tall Isolated Shrubs over *Eremophila exilifolia* Mid Open Shrubland over *Aristida contorta* Open Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	30
	Abutilon fraseri	+	20
	Abutilon otocarpum	+	15
	Acacia aptaneura	80	800
	Acacia tetragonophylla	+	50
	Acacia xanthocarpa	1	400
	Aristida contorta	10	25
	Cymbopogon ambiguus	+	80
	Digitaria brownii	+	40
	Duperreya commixta	+	cr
	Enchylaena tomentosa var. tomentosa	+	60
	Enneapogon caerulescens	+	25
	Enneapogon polyphyllus	+	30
	Eremophila exilifolia	15	100
	Eremophila metallicorum	+	100
	Glycine canescens	+	cr
	Goodenia mimuloides	+	1
	Haloragis trigonocarpa	+	5
	Helipterum craspedioides	+	10
	Hibiscus burtonii	+	20
	Marsdenia australis	+	cr
	Psydrax rigidula	+	20
	Ptilotus aervoides	+	5
	Ptilotus obovatus var. obovatus	1	70
	Roepera iodocarpa	+	10
	Senna artemisioides subsp. filifolia	+	50
	Senna artemisioides subsp. helmsii	+	60
	Senna artemisioides subsp. x artemisioides	+	50
	Sida calyxhymenia	+	130
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	60
	Solanum lasiophyllum	+	50
	Stackhousia muricata	+	15

Site KVQ21

Described by	CG	**Date**	19/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259686 **mE**	6945146 **mN**			
Habitat	East facing slope on broad low rise					
Soil	Red-brown stones and pebbles					
Rock Type	Quartz, ironstone and some calcrete					

Vegetation *Acacia caesaneura* (narrow phyllode variant) Low Isolated Trees with *A. aneura* Low Open Woodland over *Scaevola spinescens* and *Sida ectogama* Mid Isolated Shrubs

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	40
	Abutilon otocarpum	+	40
	Acacia aneura	9	400
	Acacia caesaneura (narrow phyllode variant)	6	700
	Acacia tetragonophylla	1	250
	Acacia xanthocarpa	+	40
	Aristida contorta	+	20
	Austrostipa trichophylla	0.25	130
	Enchylaena tomentosa var. tomentosa	+	40
	Enchylaena tomentosa x Maireana georgei	+	60
	Eremophila galeata	0.25	130
	Eremophila latrobei subsp. latrobei	+	70
	Eremophila oldfieldii subsp. angustifolia	1.5	250
	Maireana georgei	+	35
	Marsdenia australis	+	10
	Monachather paradoxus	+	30
	Ptilotus obovatus var. obovatus	+	50
	Scaevola spinescens	0.5	110
	Sclerolaena diacantha	+	30
	Sclerolaena eriacantha	+	10
	Senna sp. Meekatharra (E. Bailey 1-26)	+	50
	Sida ?ectogama	0.25	130
	Sida ectogama	0.25	170
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	30
	Solanum lasiophyllum	+	60

Site KVQ22

Described by	CG	**Date**	19/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259274 **mE**	6945154 **mN**			
Habitat	Gentle west facing lower stony slope / plain					
Soil	Red-brown silty clay stones and pebbles					
Rock Type	Colluvial deposit of basalt and quartz					

Vegetation *Acacia doreta* (long phyllode form) Low Isolated Trees with *A. aptaneura* and *A. pteraneura* Low Woodland over *Senna* sp. Meekatharra, S. *artemisioides* subsp. *helmsii*, S. *artemisioides* subsp. x *artemisioides*, S. *artemisioides* subsp. *filifolia* and *Eremophila granitica* Mid Sparse Shrubland over *Aristida contorta* and *Austrostipa trichophylla* Open Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	60
	Abutilon fraseri	+	20
	Abutilon otocarpum	+	60
	Acacia aptaneura	15	500
	Acacia doreta (long phyllode form)	0.5	500
	Acacia pteraneura	2	800
	Acacia ramulosa var. linophylla	+	70
	Acacia tetragonophylla	0.5	150
	Aristida contorta	20	25
	Austrostipa trichophylla	2-3	40-50
	Enchylaena tomentosa var. tomentosa	+	50
	Enneapogon caerulescens	+	25
	Enneapogon polyphyllus	+	30
	Eremophila galeata	+	30
	Eremophila granitica	0.5	120
	Haloragis trigonocarpa	+	10
	Maireana georgei	+	60
	Maireana melanocoma	+	35
	Maireana tomentosa	+	50
	Maireana triptera	+	40
	Marsdenia australis	+	cr
	Psydrax suaveolens	+	70
	Ptilotus exaltatus	+	25
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	0.25	80
	Rhodanthe maryonii	+	20
	Roepera iodocarpa	+	8

Scaevola spinescens	+	60
Sclerolaena eriacantha	+	20
Senna artemisioides subsp. filifolia	+	70
Senna artemisioides subsp. helmsii	0.25	120
Senna artemisioides subsp. x artemisioides	+	100
Senna sp. Meekatharra (E. Bailey 1-26)	1	110
Sida sp. dark green fruit (S. van Leeuwen 2260)	+	45
Solanum lasiophyllum	1	50

Site KVQ23

Described by	BRM	**Date**	19/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259738 **mE**	6944291 **mN**			
Habitat	Very gentle east facing lower slope of low broad ridge or rise					
Soil	Reddish-brown sandy clay loam					
Rock Type	Quartz and ironstone					

Vegetation *Acacia pteraneura* Low Isolated Trees over *Eremophila pantonii*, *Senna* sp. Meekatharra and *Scaevola spinescens* Mid Isolated Shrubs over *Maireana georgei* Low Isolated Shrubs

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia oswaldii	ADJ	300
	Acacia pteraneura	1	400
	Acacia tetragonophylla	+	40
	Enchylaena tomentosa x Maireana georgei	+	20
	Eremophila galeata	+	10
	Eremophila pantonii	0.5	120-170
	Maireana georgei	0.25	25
	Maireana triptera	+	20
	Ptilotus obovatus var. obovatus	+	50
	Scaevola spinescens	0.25	120
	Sclerolaena eriacantha	+	10
	Sclerolaena lanicuspis	+	10
	Senna sp. Meekatharra (E. Bailey 1-26)	0.5	80-110
	Solanum lasiophyllum	+	30

Site KVQ24

Described by	CG	**Date**	19/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259531 **mE**	6943569 **mN**			
Habitat	Dry broad braided creek line on stony low rise					
Soil	Red sandy clay loam					
Rock Type	Basalt, quartz and ironstone					

Vegetation Acacia craspedocarpa hybrid, A. fuscaneura, A. pteraneura and A. aneura Low Open Forest over Senna artemisioides subsp. helmsii, S. artemisioides subsp. x artemisioides and S. sp. Meekatharra Mid Shrubland over Ptilotus obovatus var. obovatus Low Sparse Shrubland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	100
	Abutilon sp.	+	20
	Acacia aneura	2	700
	Acacia craspedocarpa	+	130
	Acacia craspedocarpa hybrid	16	600
	Acacia doreta (long phyllode form)	1	600
	Acacia fuscaneura	9	500
	Acacia pteraneura	8	700
	Acacia tetragonophylla	+	100
	Acacia xanthocarpa	+	220
	Aristida contorta	1	20
	Cephalipterum drummondii	+	10
	Cymbopogon ambiguus	+	60
	Digitaria brownii	+	30
	Duperreya commixta	+	cr
	Enchylaena tomentosa var. tomentosa	+	50
	Enneapogon caerulescens	+	10
	Enneapogon polyphyllus	+	25
	Eremophila exilifolia	+	80
	Eremophila oldfieldii subsp. angustifolia	2	500
	Eremophila serrulata	+	60
	Eriachne helmsii	+	50
	Glycine canescens	+	cr
	Hakea preissii	ADJ	250
	Haloragis trigonocarpa	+	10
	Maireana georgei	+	25
	Marsdenia australis	+	cr
	Psydrax rigidula	+	5

Psydrax suaveolens	+	130
Ptilotus obovatus var. obovatus	2.5	700
Rhagodia drummondii	+	80
Roepera iodocarpa	+	5
Santalum lanceolatum	+	120
Scaevola spinescens	+	130
Sclerolaena diacantha	+	30
Senna artemisioides subsp. filifolia	+	30
Senna artemisioides subsp. helmsii	4-5	120
Senna artemisioides subsp. x artemisioides	2.5	170
Senna artemisioides subsp. x sturtii	+	30
Senna glaucifolia	3	110
Senna sp. Meekatharra (E. Bailey 1-26)	2	60
Sida fibulifera	+	20
Sida sp. dark green fruit (S. van Leeuwen 2260)	+	40
Solanum lasiophyllum	+	50
Vincetoxicum lineare	+	cr

Site KVQ25

Described by	BRM	**Date**	19/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259619 **mE**	6943913 **mN**			
Habitat	Very gentle east facing lower slope of broad ridge / rise					
Soil	Red-brown stones and pebbles					
Rock Type	Quartz and ironstone (lots of gravels, pebbles, cobbles on surface)					

Vegetation *Acacia pteraneura* and *A. caesaneura* (narrow phyllode variant) Low Woodland over *Senna* sp. Meekatharra Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* and *Enchylaena tomentosa* x *Maireana georgei* Low Isolated Shrubs

Veg Condition	Very Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Acacia caesaneura (narrow phyllode variant)	1	600
	Acacia oswaldii	+	45
	Acacia pteraneura	9-10	600
	Acacia tetragonophylla	+	30
	Aristida contorta	+	20
	Enchylaena tomentosa x Maireana georgei	0.25	35
	Eragrostis sp.	+	30
	Eremophila galeata	0.25	70
	Hibiscus burtonii	+	30
	Maireana triptera	+	30
	Ptilotus obovatus var. obovatus	10-25	45
	Rhagodia drummondii	+	70
	Santalum lanceolatum	0.5	230
	Scaevola spinescens	0.25	90
	Sclerolaena eriacantha	+	12
	Senna artemisioides subsp. helmsii	0.5	40
	Senna sp. Meekatharra (E. Bailey 1-26)	7	140
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	20
	Solanum lasiophyllum	+	40

Site KVQ26

Described by	CG	**Date**	20/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259604 **mE**	6942760 **mN**			
Habitat	North facing lower slope of stony low rise					
Soil	Red sandy loamy clay					
Rock Type	Ironstone rocks and pebbles and some quartz					

Vegetation *Acacia aptaneura* Low Open Woodland over *Senna* sp. Meekatharra and *Scaevola spinescens* Mid Sparse Shrubland over mixed Chenopod Low Sparse Shrubland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	23	400
	Acacia ayersiana	ADJ	450
	Acacia craspedocarpa hybrid	ADJ	200
	Acacia tetragonophylla	+	170
	Aristida contorta	+	10
	Eremophila galeata	+	50
	Eremophila latrobei subsp. latrobei	ADJ	80
	Eremophila pantonii	ADJ	100
	Maireana georgei	+	25
	Maireana triptera	+	25
	Ptilotus obovatus var. obovatus	+	70
	Salsola australis	+	30
	Scaevola spinescens	0.25	80
	Sclerolaena diacantha	+	10
	Sclerolaena eriacantha	+	20
	Senna sp. Meekatharra (E. Bailey 1-26)	1.5	130
	Sida sp.	+	90
	Solanum lasiophyllum	+	40

Site KVQ27

Described by	BRM	**Date**	20/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259438 **mE**	6943045 **mN**			
Habitat	Moderate south-east facing lower slope of broad ridge					
Soil	Reddish-brown					
Rock Type	Calcrete granite. Also cobbles, lots of basalt, some dolomite and some quartz					

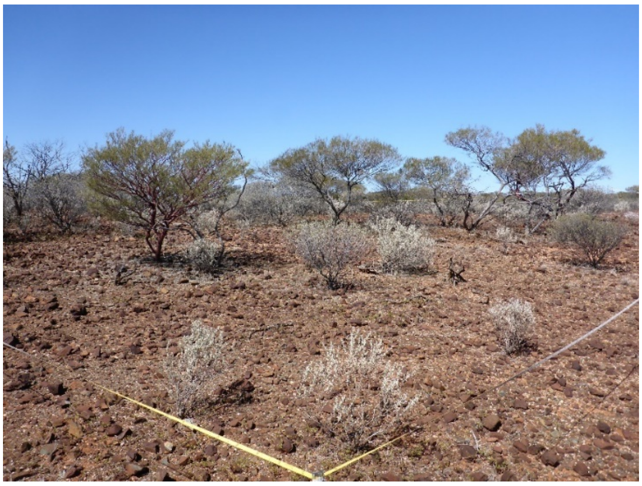
Vegetation *Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* and *A. tetragonophylla* Tall Open Shrubland over *Senna artemisioides* subsp. x *artemisioides* and *S. artemisioides* subsp. *helmsii* Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland

Veg Condition	Very Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	40
	Acacia doreta (long phyllode form)	11	300
	Acacia pteraneura	+	50
	Acacia tetragonophylla	1	330
	Acacia xanthocarpa	1.5	350
	Aristida contorta	+	25
	Cymbopogon ambiguus	+	70
	Duperreya commixta	+	40
	Enchylaena tomentosa var. tomentosa	+	60
	Enchylaena tomentosa x Maireana georgei	+	60
	Enneapogon caerulescens	+	5
	Eremophila granitica	+	30
	Eremophila oldfieldii	+	45
	Goodenia mimuloides	+	6
	Haloragis trigonocarpa	+	10
	Helipterum craspedioides	+	15
	Maireana georgei	+	35
	Maireana planifolia	+	45
	Maireana triptera	+	30
	Marsdenia australis	+	80
	Psydrax rigidula	+	35
	Ptilotus gaudichaudii	+	3
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	4-5	50
	Rhodanthe maryonii	+	3
	Roepera iodocarpa	+	10
	Salsola australis	+	12
	Sclerolaena diacantha	+	12

Sclerolaena eriacantha	+	15
Senna artemisioides subsp. helmsii	2	200
Senna artemisioides subsp. x artemisioides	4	130
Senna sp. Meekatharra (E. Bailey 1-26)	+	30
Sida calyxhymenia	+	110
Sida fibulifera	+	20
Sida sp. dark green fruit (S. van Leeuwen 2260)	+	20-50
Sida sp. Exidentifolia (J.L. Egan 1925)	+	60
Solanum lasiophyllum	+	40

Site KVQ28



Described by	CG	**Date**	20/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	258910 **mE**	6943672 **mN**			
Habitat	North-west facing spur on midslope of stony hill					
Soil	Red-brown sandy clay loam					
Rock Type	Basalt rocks (250m) to gravel (10mm) on surface					

Vegetation *Acacia doreta* (long phyllode form) Low Open Woodland over *A. xanthocarpa* Tall Sparse Shrubland over *Senna artemisioides* subsp. *helmsii* and *S.* sp. Meekatharra Mid Open Shrubland over *Ptilotus obovatus* var. *obovatus* Low Shrubland

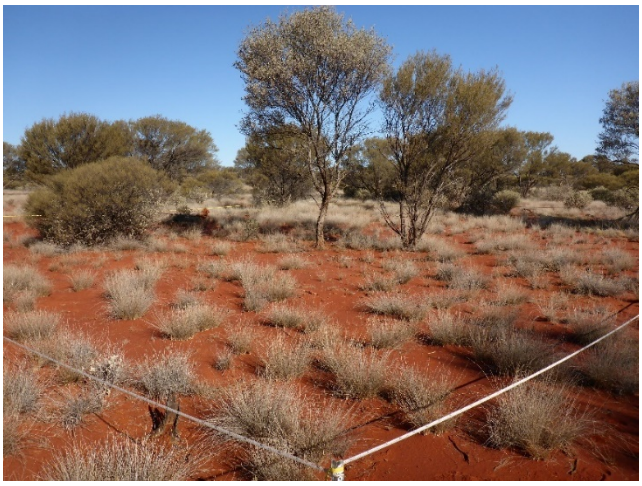
Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia doreta (long phyllode form)	4	500
	Acacia tetragonophylla	+	40
	Acacia xanthocarpa	9	400
	Aristida contorta	+	25
	Duperreya commixta	ADJ	cr
	Enneapogon caerulescens	+	15
	Enneapogon cylindricus	+	30
	Eremophila exilifolia	+	150
	Eremophila granitica	+	20
	Eremophila oldfieldii	+	20
	Goodenia mimuloides	+	5
	Haloragis trigonocarpa	+	3
	Maireana sp.	+	20
	Marsdenia australis	+	cr
	Pimelea microcephala subsp. microcephala	+	10
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	5	90
	Roepera iodocarpa	+	10
	Salsola australis	+	20
	Santalum spicatum	ADJ	250
	Scaevola spinescens	+	20
	Sclerolaena densiflora	+	10
	Sclerolaena diacantha	+	15
	Senna artemisioides subsp. helmsii	4	120
	Senna glaucifolia	0.25	90
	Senna sp. Meekatharra (E. Bailey 1-26)	0.25	110
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	30
	Solanum lasiophyllum	+	40

Site KVQ29

Described by	BRM	**Date**	20/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	258613 **mE**	6943941 **mN**			
Habitat	Moderate west facing upper slope of low ridge (just below crest)					
Soil	Reddish-brown sandy clay loam					
Rock Type	Basalt, dolorite and calcrete outcropping, gravels, pebbles and cobbles beneath cover of basalt					
Vegetation	Acacia xanthocarpa, Eremophila oldfieldii subsp. angustifolia and Santalum spicatum Tall Shrubland over Senna artemisioides subsp. helmsii Mid Isolated Shrubs over Ptilotus obovatus var. obovatus Low Isolated Shrubs					
Veg Condition	Very Good					
Fire Age	> 10 years					

Species List	Name	Cover	Height
	Abutilon fraseri	+	20
	Acacia tetragonophylla	+	40
	Acacia xanthocarpa	11	250
	Aristida contorta	+	25
	Cheilanthes brownii	+	20
	Cymbopogon ambiguus	+	35
	Duperreya commixta	+	200
	Enchylaena tomentosa var. tomentosa	+	60
	Enneapogon caerulescens	+	10
	Eremophila exilifolia	+	30
	Eremophila oldfieldii subsp. angustifolia	2	260
	Glycine canescens	+	cr
	Goodenia mimuloides	+	3
	Haloragis trigonocarpa	+	5
	Hyalosperma sp.	+	15
	Indigofera georgei	+	5
	Maireana pyramidata	+	35
	Maireana sp.	+	15
	Marsdenia australis	+	10
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	1.5	40
	Ptilotus roei	+	4
	Roepera iodocarpa	+	15
	Santalum spicatum	0.5	280
	Scaevola spinescens	+	60
	Sclerolaena diacantha	+	20
	Senna artemisioides subsp. filifolia	+	80
	Senna artemisioides subsp. helmsii	1	35
	Senna artemisioides subsp. x artemisioides	+	40
	Senna sp. Meekatharra (E. Bailey 1-26)	+	80
	Sida ?calyxhymenia	+	90
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	20
	Solanum lasiophyllum	+	30

Site KVQ30



Described by	CG	**Date**	20/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257126 **mE**	6944244	**mN**		
Habitat	Mulga sand plain					
Soil	Red-brown sand					
Rock Type	NA					

Vegetation *Acacia aptaneura* and *A. ayersiana* Low Open Woodland over *A. ramulosa* var. *linophylla* Tall Isolated Shrubs to Tall Sparse Shrubland over *Eremophila forrestii* subsp. *forrestii* Mid Sparse Shrubland over *Eragrostis eriopoda* and *Monachather paradoxus* Tussock Grassland with Isolated clumps of *Triodia basedowii* Hummock Grasses

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	3	450
	Acacia ayersiana	4	500
	Acacia caesaneura	ADJ	500
	Acacia mulganeura	+	40
	Acacia ramulosa var. linophylla	1	250
	Aristida contorta	+	20
	Eragrostis eriopoda	15	50
	Eremophila forrestii subsp. forrestii	2	160
	Marsdenia australis	+	cr
	Monachather paradoxus	10	50
	Solanum lasiophyllum	+	50
	Triodia basedowii	5	70

Site KVQ31

Described by	BRM	**Date**	20/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257099 **mE**	6944446 **mN**			
Habitat	Plain (flat)					
Soil	Reddish-brown loamy sand					
Rock Type	NA					

Vegetation *Acacia ayersiana* and *A. caesaneura* (narrow phyllode variant) Low Open Forest over *Eremophila forrestii* subsp. *forrestii* Mid Shrubland over *Ptilotus obovatus* var. *obovatus* Low Sparse Shrubland over *Eragrostis eriopoda* and *Monachather paradoxus* Tussock Grassland

Veg Condition	Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Acacia aneura	ADJ	550
	Acacia ayersiana	35	800
	Acacia caesaneura	ADJ	450
	Acacia caesaneura (narrow phyllode variant)	2	800
	Acacia ramulosa var. linophylla	3	260
	Enchylaena tomentosa var. tomentosa	+	40
	Eragrostis eriopoda	25	40
	Eremophila forrestii subsp. forrestii	25	180
	Eriachne helmsii	2	70
	Goodenia sp.	+	20
	Maireana sp.	+	45
	Monachather paradoxus	25	45
	Psydrax rigidula	+	20
	Psydrax suaveolens	+	240
	Ptilotus obovatus var. obovatus	0.5	30
	Scaevola spinescens	+	120
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	40
	Solanum lasiophyllum	+	40
	Thyridolepis mitchelliana	0.5	30

Site KVQ32

Described by	CG	**Date**	21/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257330 **mE**	6943331 **mN**			
Habitat	Mulga sand plain					
Soil	Red-brown loamy sand					
Rock Type	NA					

Vegetation *Acacia ayersiana*, *A. aptaneura* and *A. caesaneura* (narrow phyllode variant) Low Open Woodland over *Eremophila forrestii* subsp. *forrestii* Mid Open Shrubland over *Eragrostis eriopoda* and *Monachather paradoxus* Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia aptaneura	6	700
	Acacia ayersiana	8	800
	Acacia caesaneura	6	700
	Acacia caesaneura (narrow phyllode variant)	ADJ	700
	Acacia ramulosa var. linophylla	3	250
	Aristida contorta	+	20
	Brachychiton gregorii	ADJ	500
	Calotis hispidula	ADJ	7
	Enchylaena tomentosa var. tomentosa	+	60
	Eragrostis eriopoda	60	50
	Eragrostis sp.	+	30
	Eremophila forrestii subsp. forrestii	4-5	150
	Eucalyptus kingsmillii	ADJ	600
	Hakea lorea subsp. *lorea*	0.5	350
	Maireana convexa	+	50
	Monachather paradoxus	1-2	40
	Ptilotus obovatus var. obovatus	+	90
	Ptilotus polystachyus	+	10
	Rhagodia sp.	ADJ	120
	Sclerolaena deserticola	+	25
	Senna artemisioides subsp. x sturtii	+	30
	Solanum lasiophyllum	+	40

Site KVQ33

Described by	BRM	**Date**	21/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257556 **mE**	6943234 **mN**			
Habitat	Very gently sloping west facing 'flat' plain					
Soil	Reddish-brown loamy sand					
Rock Type	NA					

Vegetation Acacia ayersiana, A. aneura and A. caesaneura Low Open Forest over Eremophila forrestii subsp. forrestii Mid Open Shrubland over Monachather paradoxus, Eragrostis eriopoda, Thyridolepis mitchelliana and Eriachne helmsii Tussock Grassland

Veg Condition	Good
Fire Age	> 10 years

Species List	Name	Cover	Height
	Acacia aneura	11	600
	Acacia ayersiana	20	800
	Acacia caesaneura	6	800
	Acacia ramulosa var. linophylla	2-3	250
	Enchylaena tomentosa var. tomentosa	+	45
	Eragrostis eriopoda	15	40
	Eremophila forrestii subsp. forrestii	8	100
	Eriachne helmsii	1-2	60
	Eucalyptus comitae-vallis	ADJ	700
	Eucalyptus kingsmillii	ADJ	600
	Monachather paradoxus	20	45
	Ptilotus obovatus var. obovatus	+	40
	Rhagodia eremaea	0.5	110-180
	Scaevola spinescens	0.5	250
	Solanum lasiophyllum	+	45
	Thyridolepis mitchelliana	1-2	30

Site KVQ34

Described by	CG	**Date**	21/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257095 **mE**	6941496 **mN**			
Habitat	Elevated sandy plain					
Soil	Sandy clay loam					
Rock Type	Calcrete					

Vegetation *Acacia aptaneura* Low Open Forest over *A. craspedocarpa* Tall Sparse Shrubland over *Ptilotus obovatus* var. *obovatus* Low Open Shrubland over *Enneapogon caerulescens* Isolated Tussock Grasses

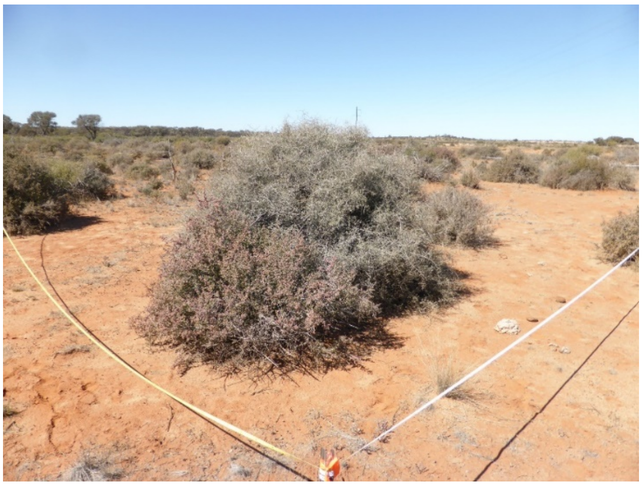
Veg Condition Very Good to Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Abutilon cryptopetalum	+	50
	Abutilon fraseri	+	15
	Abutilon sp.	+	50
	Acacia aptaneura	40	1000
	Acacia craspedocarpa	4	500
	Acacia tetragonophylla	ADJ	400
	Acacia victoriae subsp. victoriae	ADJ	130
	Aristida contorta	+	20
	Centipeda thespidioides	+	10
	Digitaria brownii	0.5	40
	Dissocarpus paradoxus	+	20
	Enchylaena tomentosa var. tomentosa	+	40
	Enneapogon caerulescens	15	25
	Enneapogon polyphyllus	+	15
	Eremophila decipiens subsp. decipiens	+	60
	Eremophila forrestii subsp. forrestii	+	40
	Eremophila galeata	ADJ	200
	Eremophila latrobei subsp. latrobei	ADJ	150
	Eremophila longifolia	ADJ	400
Eremophila platycalyx ?subsp. Leonora (J. Morrisey 252)		+	40
	Eremophila serrulata	0.5	70
	Exocarpos aphyllus	+	60
	Hakea lorea subsp. *lorea*	2	700
	Haloragis trigonocarpa	+	7
	Helipterum craspedioides	+	3
	Maireana pyramidata	+	80
	Maireana tomentosa	+	30
	Marsdenia australis	+	50

Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8)	+	<1
Pimelea microcephala subsp. microcephala	+	40
Psydrax suaveolens	+	40
Ptilotus aervoides	+	1
Ptilotus obovatus var. obovatus	2.5	60
Rhodanthe battii	+	10
Rhodanthe charsleyae	+	5
Scaevola spinescens	+	70
Sclerolaena costata	+	15
Sida fibulifera	0.5	20
Solanum lasiophyllum	+	50
Vincetoxicum lineare	+	cr

Site KVQ35



Described by	BRM	**Date**	21/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	256902 **mE**	6941301 **mN**			
Habitat	Very gently sloping plain on margins of salt lake and isolated gypsum islands					
Soil	Sand					
Rock Type	NA					

Vegetation Maireana pyramidata, Lycium australe and Cratystylis subspinescens Mid Open Shrubland over Rhagodia drummondii Low Isolated Shrubs over Poaceae sp. and Eragrostis pergracilis and E. dielsii Sparse Tussock Grassland

Veg Condition	Very Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Aristida contorta	1	20
	Cratystylis subspinescens	1	180
	Dissocarpus paradoxus	+	12
	Enneapogon caerulescens	+	5
	Enneapogon cylindricus	+	30
	Eragrostis dielsii	+	25
	Eragrostis pergracilis	0.5	30
	Eremophea spinosa	+	10
	Euphorbia drummondii	+	2
	Lycium australe	3	140
	Maireana georgei	+	30
	Maireana pyramidata	10	160
	Poaceae sp.	2-3	35
	Rhagodia drummondii	0.25	50
	Sclerolaena cornishiana	+	10
	Sclerolaena diacantha	+	10
	Sclerolaena fusiformis	+	20
	Sclerolaena gardneri	+	10
	Sclerolaena obliquicuspis	+	20
	Senna artemisioides subsp. filifolia	+	40
	Senna sp. Meekatharra (E. Bailey 1-26)	+	35
	Solanum lasiophyllum	+	25
	Swainsona kingii	+	3

Site KVQ36

Described by	CG	**Date**	21/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257342 **mE**	6940332 **mN**			
Habitat	Crest of gypsum dune on north side of Lake Miranda					
Soil	Beige-white powdery loam (gypsum)					
Rock Type	Basalt					

Vegetation *Casuarina pauper* Low Isolated Trees over *Grevillea sarissa* subsp. *bicolor* Tall Sparse Shrubland over *Scaevola spinescens* and *Lycium australe* Mid Sparse Shrubland over *Lawrencia helmsii* Low Sparse Shrubland over *Aristida contorta* and *Asteridea chaetopoda* Open Grassland / Forbland

Veg Condition Very Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Aristida contorta	7	25
	Asteridea chaetopoda	0.25	20
	Casuarina pauper	1	700
	Enneapogon caerulescens	+	20
	Exocarpos aphyllus	ADJ	500
	Goodenia sp.	+	2
	Grevillea sarissa subsp. bicolor	1.5	250
	Lawrencia helmsii	2.5	90
	Lycium australe	+	70
	Maireana georgei	ADJ	60
	Maireana pentatropis	+	60
	Maireana pyramidata	ADJ	100
	Maireana sp.	ADJ	50
	Pittosporum angustifolium	ADJ	400
	Rhagodia drummondii	ADJ	100
	Roepera reticulata	0.5	50
	Scaevola spinescens	0.5	160
	Sclerolaena fimbriolata	+	10
	Senna charlesiana	ADJ	40
	Solanum lasiophyllum	ADJ	60

Site KVQ37

Described by	BRM	**Date**	21/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257724 **mE**	6940433 **mN**			
Habitat	Plain					
Soil	Reddish-brown loamy sand					
Rock Type	NA					

Vegetation *Acacia caesaneura* Low Woodland over *Acacia* craspedocarpa hybrid Tall Sparse Shrubland over *Maireana pyramidata* Low Open Shrubland over *Aristida contorta* and *Eragrostis eriopoda* Tussock Grassland

Veg Condition	Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia caesaneura	20	700
	Acacia craspedocarpa hybrid	0.5	210-350
	Aristida contorta	30	30
	Digitaria brownii	+	40
	Enchylaena tomentosa var. tomentosa	+	40
	Enneapogon polyphyllus	+	30
	Eragrostis eriopoda	6	45
	Eremophila forrestii subsp. forrestii	+	80
	Eriachne helmsii	+	70
	Haloragis trigonocarpa	+	4
	Maireana pyramidata	4	80
	Maireana tomentosa	+	20
	Monachather paradoxus	0.5	40
	Pimelea microcephala subsp. microcephala	+	40
	Poaceae sp.	+	35
	Ptilotus obovatus var. obovatus	+	40
	Rhagodia drummondii	0.25	170
	Scaevola spinescens	+	40
	Sclerolaena convexula	+	20
	Senna artemisioides subsp. x sturtii	+	35
	Solanum lasiophyllum	+	40
	Vincetoxicum lineare	+	cr

Site KVQ38

Described by	CG	**Date**	21/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257291 **mE**	6941214 **mN**			
Habitat	Mulga sand plain					
Soil	Red-brown loamy sand					
Rock Type	NA					

Vegetation *Acacia ayersiana* and *A. caesaneura* (narrow phyllode variant) Low Woodland over *A. ramulosa* var. *linophylla* Tall open Shrubland over *Eragrostis eriopoda*, *Eriachne helmsii* and *Monachather paradoxus* Tussock Grassland

Veg Condition	Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia ayersiana	20	800
	Acacia caesaneura (narrow phyllode variant)	2	500
	Acacia ramulosa var. linophylla	1.5	250
	Aristida contorta	+	20
	Enchylaena tomentosa var. tomentosa	+	30
	Eragrostis eriopoda	25	50
	Eragrostis sp.	+	30
Eremophila platycalyx ?subsp. Leonora (J. Morrisey 252)		+	25
	Eriachne helmsii	5	60
	Eriachne sp.	+	25
	Hibiscus burtonii	+	40
	Marsdenia australis	+	cr
	Monachather paradoxus	2	45
	Ptilotus obovatus var. obovatus	+	60
	Rhagodia drummondii	+	70
	Scaevola spinescens	+	30
	Sclerolaena deserticola	0.25	40
	Sida calyxhymenia	+	110
	Solanum lasiophyllum	+	60
	Solanum nummularium	+	20
	Vincetoxicum lineare	+	60

Site KVQ39

Described by	BRM	**Date**	22/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259825 **mE**	6945575 **mN**			
Habitat	Stony hardpan flat with high ground to south, west and north					
Soil	Reddish-brown sandy clay loam					
Rock Type	Dense cover of gravels, pebbles, cobbles, mostly quartz and some					

Vegetation Senna sp. Meekatharra, Eremophila pantonii, Sida calyxhymenia Mid Isolated Shrubs over Ptilotus obovatus var. obovatus, Maireana triptera Low Isolated Shrubs over Aristida contorta and Enneapogon caerulescens Isolated Tussock Grasses

Veg Condition	Good		
Fire Age	> 10 years		
Species List	Name	Cover	Height
	Acacia tetragonophylla	+	45
	Aristida contorta	0.5	20
	Cephalipterum drummondii	+	5
	Enneapogon caerulescens	0.25	10
	Enneapogon polyphyllus	+	6
	Eremophila pantonii	0.25	120
	Haloragis trigonocarpa	+	3
	Maireana georgei	+	30
	Maireana triptera	0.25	35
	Ptilotus exaltatus	+	20
	Ptilotus helipteroides	+	10
	Ptilotus obovatus var. obovatus	0.25	40
	Ptilotus polystachyus	+	40
	Roepera iodocarpa	+	12
	Salsola australis	+	5
	Sclerolaena cuneata	+	15
	Sclerolaena diacantha	+	12
	Sclerolaena eriacantha	+	12
	Sclerolaena fusiformis	+	10
	Sclerolaena lanicuspis	+	15
	Senna sp. Meekatharra (E. Bailey 1-26)	1.5	110
	Sida calyxhymenia	0.5	120
	Sida fibulifera	+	20
	Solanum lasiophyllum	+	40

Site KVQ40

Described by	CG	**Date**	22/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	259640 **mE**	6945513 **mN**			
Habitat	Elevated slightly south-east facing lower slope of stony hill (almost flat terrace)					
Soil	Red-brown sandy clay loam					
Rock Type	Ironstone and quartz rocks and pebbles					
Vegetation	*Acacia pteraneura* Low Open Woodland over *Senna* sp. Meekatharra Mid Sparse Shrubland over mixed Chenopod Low Open Shrubland					
Veg Condition	Very Good to Good					
Fire Age	> 10 years					

Species List	Name	Cover	Height
	Abutilon fraseri	+	5
	Acacia doreta (long phyllode form)	ADJ	400
	Acacia oswaldii	ADJ	250
	Acacia pteraneura	7	400
	Acacia tetragonophylla	+	100
	Digitaria brownii	+	25
	Enchylaena tomentosa var. tomentosa	+	35
	Enneapogon caerulescens	+	25
	Enneapogon polyphyllus	+	30
	Hakea preissii	0.5	150
	Maireana georgei	+	40
	Maireana triptera	0.25	60
	Marsdenia australis	+	cr
	Ptilotus exaltatus	+	20
	Ptilotus helipteroides	+	5
	Ptilotus obovatus var. obovatus	+	25
	Ptilotus polystachyus	+	50
	Rhagodia drummondii	+	100
	Roepera sp.	+	5
	Scaevola spinescens	+	70
	Sclerolaena densiflora	+	10
	Sclerolaena eriacantha	+	20
	Senna artemisioides subsp. helmsii	0.25	100
	Senna sp. Meekatharra (E. Bailey 1-26)	6	<200
	Sida sp. dark green fruit (S. van Leeuwen 2260)	+	40
	Solanum lasiophyllum	+	45

Site KVQ41

Described by	BRM	**Date**	22/08/2019	**Type**	Quadrat	20 x 20
Location	Bellevue Gold Project					
MGA Zone	50	257955 **mE**	6941702 **mN**			
Habitat	Gentle south-west facing upper slope of low hill					
Soil	Reddish-brown sandy clay loam					
Rock Type	Basalt					

Vegetation *Eremophila galeata* and *Hakea lorea* subsp. *lorea* Tall Open Shrubland over *Senna artemisioides* subsp. *helmsii* Mid Isolated Shrubs over *Rhagodia drummondii* and *Ptilotus obovatus* var. *obovatus* Low Open Shrubland

Veg Condition Very Good to Good

Fire Age > 10 years

Species List	Name	Cover	Height
	Abutilon leucopetalum	+	20
	Acacia tetragonophylla	+	60
	Aristida contorta	+	20
	Boerhavia coccinea	+	10
	Enchylaena tomentosa var. tomentosa	+	50
	Enneapogon polyphyllus	+	10
	Enteropogon ramosus	+	40
	Eremophila galeata	2.5	250
	Eriachne helmsii	+	110
	Erodium cygnorum	+	3
	Euphorbia australis	+	2
	Hakea lorea subsp. *lorea*	1.5	300
	Hibiscus sp. Gardneri	+	110
	Maireana planifolia	+	20
	Maireana tomentosa	+	40
	Ptilotus obovatus var. obovatus	2	60
	Ptilotus roei	+	2
	Rhagodia drummondii	0.25	80
	Salsola australis	+	10
	Sclerolaena densiflora	+	5
	Senna artemisioides subsp. helmsii	1	90
	Senna sp. Meekatharra (E. Bailey 1-26)	+	30
	Sida fibulifera	+	5
	Solanum lasiophyllum	+	40
	Swainsona incei	+	3
	Tripogonella loliiformis	+	15

Appendix B.
Fauna and Habitat Survey

Bellevue Gold Limited
Level 2 Fauna Assessment 2018/2019
Bellevue Gold Project

Low shrubland over tussock grass on sandy loam, Kathleen Valley Transect, Bellevue Gold Project (photo: P. Smith).

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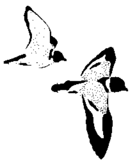

20th April 2020

Executive Summary

Introduction

Bamford Consulting Ecologists (BCE) was commissioned by Bellevue Gold Limited to conduct a Level 2 fauna assessment (desktop review and field investigation) for the Bellevue/Tribune Gold project. Comprehensive field investigations of the main lease areas were undertaken in spring 2018, and in spring 2019 further field investigations were carried out for an expansion of the initial development areas. The project is located approximately 40 kilometres (km) north of Leinster, 120km south of Wiluna and 400km north-west of Kalgoorlie in the Shire of Leonora Western Australia.

The purpose of this report is to provide information on the fauna values of project area, particularly for significant species, an overview of the ecological function of the site within the local and regional context and to provide discussion on the interaction of development on the site with these fauna values and functions. The report also presents results from the two field surveys (23rd October and 1st November 2018 and 21st to 28th October 2019. There was also a brief reconnaissance visit in August 2018.

BCE uses an impact assessment process with the following components:

- The identification of fauna values:
    - Assemblage characteristics: uniqueness, completeness and richness;
    - Species of conservation significance;
    - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
    - Patterns of biodiversity across the landscape; and
    - Ecological processes upon which the fauna depend.
- The review of impacting processes such as:
    - Habitat loss leading to population decline;
    - Habitat loss leading to population fragmentation;
    - Degradation of habitat due to weed invasion leading to population decline;
    - Ongoing mortality from operations;
    - Species interactions including feral and overabundant native species;
    - Hydrological change;
    - Altered fire regimes; and
    - Disturbance (dust, light, noise).
- The recommendation of actions to mitigate impacts.

Study objectives

Based on the impact assessment process above, the key objectives of the study are to:

1. Identify significant environments within the new survey area;
2. Identify any new ecological processes in the survey area upon which fauna may depend;
3. Identify general patterns of biodiversity within or adjacent to the survey area, and
4. Identify potential impacts upon fauna and propose recommendations to minimise impacts.

The information gathered from the level 2 field investigations, undertaken in October 2018 and October 2019, enabled a thorough understanding of the fauna assemblage on site and the habitats that support them.

Summary of fauna values

Overview

The survey area ranged from Kathleen Valley and the Violet Range in the north through to Lake Miranda in the south, encompassing rocky hills, sandy loam flats, old mine areas and the margins of Lake Miranda. Field investigations included a broad range of sampling techniques: pitfall and funnel trapping, bird censussing, spotlighting/head-torching, searching, aural recording, motion-sensitive cameras and walking line transects.

The desktop study identified 269 vertebrate fauna species as potentially occurring in the survey area: 10 frogs, 70 reptiles, 153 birds and 36 mammals (28 native and eight introduced species). The assemblage includes up to 35 species of conservation significance. The field investigations in 2018 and 2019 confirmed the presence of 110 vertebrate fauna species including: one frog, 32 reptiles, 64 birds and 12 mammals (eight native and four introduced). Four species of conservation significance were recorded: the listed migratory shorebirds the Common Greenshank and the Sharp-tailed Sandpiper, and the locally significant (CS3) Australian Bustard and Bush Stone-curlew. The 2019 survey added one mammal, two reptile and six bird species not recorded in 2018.

Fauna assemblage

Moderately rich and substantially intact, except for the loss of nine mammal species including the Chuditch, Bilby and Boodie. Overall, the fauna assemblage is likely to be well-represented in the region but is incomplete due to local species loss. Through field investigations, the survey area sampled contained only a subset of the fauna assemblage predicted for the entire region, but fauna is mobile and an assemblage can change over time. The lack of spinifex *Triodia* sp. in the project area may explain the lack of records of some reptile and mammal species that are linked to the presence of this plant.

Species of conservation significance

This list includes up to 34 species (two reptile, 26 bird and six mammal species). Some of the significant species returned from databases are widespread and occur in very extensive regional landscapes, and although possibly present in the broader region they appear to be absent (some may be vagrants following a succession of good seasons) from the project area. These include the Great Desert Skink, Malleefowl, Night Parrot and Black-footed Rock-Wallaby. Similarly, the Brush-tailed Mulgara, Peregrine Falcon and several CS3 parrot species are likely to be irregular visitors to the survey area. Targeted surveys for Malleefowl nesting mounds in mulga woodland and Slender-billed Thornbill in samphire flats were undertaken during the field investigation. Results found no evidence for either species. Audio recording devices were used on the margins of Lake Miranda (on the southern edge of the lease area) in October 2018 to search for the Night Parrot, but no calls were detected.

Up to 10 species of migratory waterbirds are likely to occur on an occasional basis (following heavy rain and flooding) on the adjacent Lake Miranda. They could be very numerous at such times but conditions were not generally suitable in 2018 and 2019. Waterbirds had been recorded by Bellevue staff in early 2018 and one migratory species, the Common Greenshank, was present during a preliminary site visit in August 2019. A second listed migratory species, the Sharp-tailed Sandpiper, was recorded (a single bird) on Lake Miranda in October 2019.

Vegetation and Substrate Associations (VSAs). Six VSAs were identified:

1. Long-leaf Mulga over shrubs and tussock grass on rocks and loam of undulating hills.
2. Broad-leaf Mulga over shrubs and tussock grass on sandy-loam plains.
3. Isolated trees over open shrubland on gypsum soils close to Lake Miranda.
4. Samphire marsh in loam clay on margins and across parts of Lake Miranda.
5. Lake Miranda.
6. Degraded areas.

Patterns of biodiversity

VSAs can be very distinctive, particularly with regard to substrate, and this is likely to result in very different reptile assemblages between them. Sampling in both October 2018 and 2019 yielded low numbers of records, probably due to persistent dry conditions, but there were some patterns of distribution apparent. For example, the restricted VSA3 had a distinctive reptile assemblage including a species well out of range: the legless-lizard *Aprasia repens*. Reptiles of the sandy-loam plains of VSA2 were also a distinctive assemblage, with species such as the Midline Knob-tailed Gecko *Nephrurus vertebralis* found virtually only in this environment at different sampling locations in 2018 and 2019. Limited sampling of invertebrates also found distinct species of slaters (isopods) related to substrate types. Lake Miranda will attract a large number of waterbird and shorebird species following heavy rains.

Key ecological processes

The main processes which may affect the fauna assemblage are likely to be fire regimes and the presence and abundance of feral species, and to a lesser degree landscape connectivity and local hydrology. Inappropriate fire regimes i.e. infrequent, extensive fires compared with a mosaic of fire ages (including long-unburnt areas) created by small, frequent fires have probably contributed to low levels of abundance and possibly local extinction of a number of species of conservation significance. The effect of feral predators (Cat and Fox) is complicated as it interacts with the fire regime, and the feral species interact with each other. Rabbits, goats and camels cause widespread damage to vegetation and habitat.

Impacting processes

Impacting processes (listed above) have to be considered in the context of fauna values and the nature of the proposed action. The impacts of greatest concern are those of habitat loss leading to population decline, feral species, hydrological change and altered fire regimes. Some of these can occur regardless if a project proceeds or not.

Recommendations

While the development footprint is small in the context of a very broad and continuous landscape, some impacts are of concern because of the potential for significant species to be present, and the landscape-scale ecological processes that may be affected by the proposal. Mining projects can affect the abundance of these species and also provide opportunities for active conservation management. Key management actions can be related to impacting processes as outlined below. Many of these strategies are now considered best practice at most mine sites. Although impacts are mostly expected to be minor to moderate, any reduction in impacts is desirable.

Habitat loss leading to population decline and fragmentation

- Minimise the disturbance footprint and maintain large trees where possible. Large Eucalypt trees are important for fauna, including providing hollows;
- Clearly delineate areas to be cleared to minimise unnecessary vegetation loss;
- Maintain linkages to adjacent vegetation where possible; and
- Rehabilitate as soon as practical.

Habitat degradation due to weed invasion

- Develop and implement a weed management plan.

Ongoing mortality

- Restrict vehicle access;
- Enforce maximum speed limits;
- Entrapment of fauna in exploration sumps and trenches should be minimised through design and inspection;
- Lighting should be used and directed so as to minimise mortality of invertebrates;
- Erect signage in areas of high wildlife activity, if required;
- Educate personnel with respect to fauna through the induction process; and
- Record and report all fauna incidents to the site supervisor and environment department.

Species interactions

- Rehabilitate access tracks as soon as possible to discourage access by feral fauna;
- Develop a predator management programme aimed at suppressing the abundance of the Fox and Cat and maintaining the Dingo population level at a natural density; this to be discussed and developed in consultation with the DBCA;
- Ensure appropriate waste disposal during construction activities to avoid attracting feral and native species to the area; and
- Educate personnel not to feed (deliberately or inadvertently) feral species.

Hydrological changes

- Ensure local hydrology is not affected, including alterations to runoff through the landscape and changes due to groundwater abstraction;
- Avoid runoff to ensure sediment or any chemicals do not contaminate soil, groundwater and Lake Miranda, and install appropriate erosion control, if required; and

- Implement management actions if hydrological changes are likely to affect significant fauna habitats, if required.

Altered fire regimes

- Develop and implement a regional fire management plan during construction and operational activities to ensure wildfires do not occur as a result of activities and appropriate responses are in place should a wildfire occur; and
- Investigate the possibility of a cooperative fire management strategy with other key stakeholders. Such a regional fire management plan would aim at developing a mosaic of fire ages through the frequent occurrence of small fires, including areas of long-unburnt patches and the prevention of extensive fires.

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1 Introduction

Bamford Consulting Ecologists (BCE) was commissioned by Bellevue Gold Limited to conduct a Level 2 fauna assessment (desktop review and field investigation) for the Bellevue/Tribune Gold project. The project is located approximately 40 kilometres (km) north of Leinster, 120km south of Wiluna and 400km north-west of Kalgoorlie in the Shire of Leonora Western Australia (Figure 1). Preliminary geological investigations have identified a high-grade gold and nickel district on the prolific Wiluna-Norseman gold belt. It is proposed to develop the underground deposit to a depth of 500 metres (m).

The project development area covers ca. 544 hectares (ha) and is situated in Mining Tenement M36/25 and Exploration Licence E36/535, and these leases were investigated in October 2018. In October 2019, work was carried out in conjunction with the possible development of a water supply at Kathleen Valley, with this later work being conducted in Mining Tenement M36/25 and Exploration Licence E36/535, and also in Tenements M36/24, 299,660,162 and 176 (Figure 1).

The purpose of this report is to provide information on the fauna values of the project area (also referred to as the survey area), particularly for significant species, an overview of the ecological function of the site within the local and regional context, and to provide discussion comments on the interaction of development on the site with these fauna values and functions. The report is based on the results of a desktop review and field investigations carried out in August 2018 (site reconnaissance) and comprehensive (level 2) sampling surveys in October 2018 and October 2019.

1.1 General Approach to Fauna Impact Assessment

The purpose of impact assessment is to provide government agencies with the information they need to decide upon the significance of impacts of a proposed development, and to provide information to proponents to help them to develop appropriate strategies for avoiding and minimising impacts of their activities. BCE uses an impact assessment process with the following components:

- The identification of fauna values:
    - Assemblage characteristics: uniqueness, completeness and richness;
    - Species of conservation significance;
    - Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
    - Patterns of biodiversity across the landscape; and
    - Ecological processes upon which the fauna depend.
- The review of impacting processes such as:
    - Habitat loss leading to population decline;
    - Habitat loss leading to population fragmentation;
    - Degradation of habitat due to weed invasion leading to population decline;
    - Ongoing mortality from operations;
    - Species interactions including feral and overabundant native species;
    - Hydrological change;
    - Altered fire regimes; and

    - Disturbance (dust, light, noise).
- The recommendation of actions to mitigate impacts.

Descriptions and background information on these values and processes can be found in Appendices 1 to 4. In particular, Appendix 1 explains and defines the fauna values, including the recognition of three classes of species of conservation significance (CS): those listed under legislation (CS1), those listed as priority by the Department of Biodiversity, Conservation and Attractions (CS2), and those that can be considered of local or other significance, but which have no formal listing (CS3). Appendix 2 describes threatening processes, while Appendix 3 outlines the legal definitions and classes of conservation significance, and Appendix 4 presents the threatening processes recognised under legislation.

Based on this impact assessment process, the objectives of investigations are to: identify fauna values; review impacting processes with respect to these values and the proposed activity; and provide recommendations to mitigate these impacts.

1.2 Study objectives

Study objectives
Based on the impact assessment process above, the key objectives of the study are to:
1. Conduct a literature review and searches of Commonwealth and State fauna databases;
2. Undertake an intensive field investigation to provide information on the presence of fauna in the project area with a focus on significant species known from the broader region; e.g Great Desert Skink, Brush-tailed Mulgara, Black-flanked Rock-Wallaby, Malleefowl and Night Parrot;
3. Review the list of fauna expected to occur on the site in the light of fauna habitats present;
4. Identify significant environments within the survey area;
5. Identify any ecological processes in the survey area upon which fauna may depend;
6. Identify general patterns of biodiversity within or adjacent to the survey area; and
7. Identify potential impacts upon fauna and propose recommendations to minimise impacts.

The information gathered from the level 2 field investigation, undertaken in October 2018 and 2019, enabled a thorough understanding of the fauna assemblage on site and the habitats that support them.

1.3 Description of the survey area

The project is situated in an area of extensive historical disturbance from past mining operations. The western and northern areas of the site extend into undisturbed native vegetation. The site consists primarily of mulga over grasses with some rocky hills. Lake Miranda forms part of the southern section and is a large, shallow, salt lake system which floods periodically. Approximately 45.7% (248.5 ha) of the survey area is intact native vegetation. Areas that don't qualify as intact native vegetation are Lake Miranda (112.7 ha) and degraded areas (182.8 ha).

It is our understanding that development will aim to take place in areas that utilise, where possible, all historical disturbance footprints. This can only be confirmed once sterilisation drilling is completed.

The project consists of 10 main impact areas within a larger development envelope including:

1. Underground mine workings (2.05 ha);
2. Tailing storage facility (47.64 ha);
3. Associated infrastructure (20.13 ha);
4. Processing plant (10.01 ha);
5. Waste dumps (20.56 ha);
6. Historical workings (14.62 ha);
7. Old mining pits (21.11 ha);
8. Prosper box cut (2.05 ha);
9. Lay down (1.86 ha); and
10. Pond (0.86 ha)

In addition to these areas, there are proposed locations for groundwater abstraction to the north (multiple mining leases) and west (E 36/535) of the main impact areas (see Figure 1).

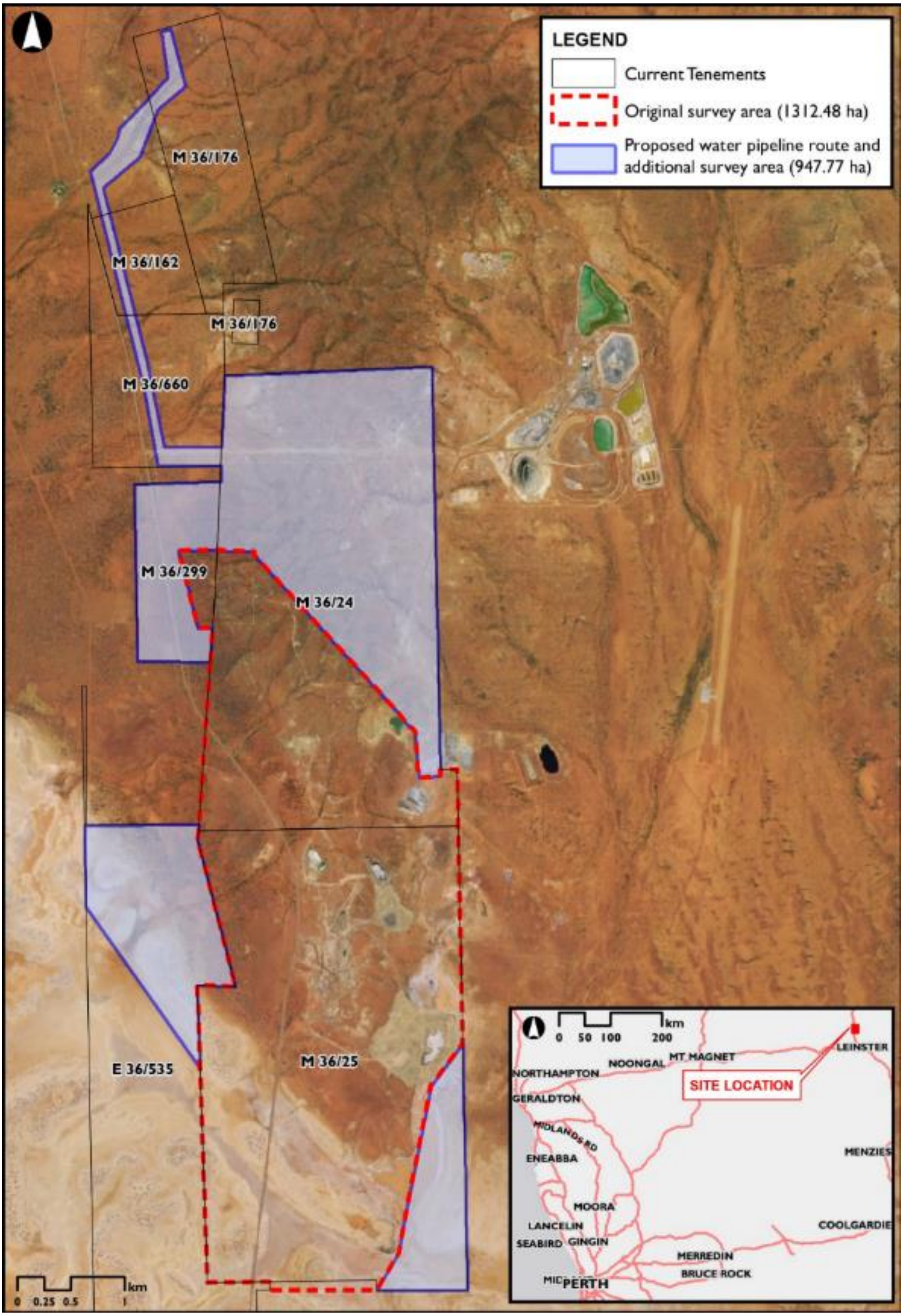

Figure 1. Location of the Bellevue project area. Studies undertaken in 2018 were confined to M36/25 (original survey area); studies in 2019 took place in parts of the areas shaded in blue-grey.

1.4 Regional Description

The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia which are further divided into subregions (Environment Australia 2000). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA 2004). The survey area lies in the East Murchison (MUR1) subregion of the Murchison bioregion (Figure 2).

The Murchison Bioregion falls within the Bioregion Group 2 classification (EPA 2004). Bioregions within Group 2 have "native vegetation that is largely contiguous but is used for commercial grazing."

The general features of the Eastern Murchison subregion are summarised by Cowan (2001). The subregion comprises a rich interzone between the arid and mesic biotas of south-western Australia, corresponding roughly to the "line" between the Mulga/Spinifex country and the Eucalypt environments (Dell *et al*. 1998, McKenzie and Hall 1992). The subregion is characterised by its internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. The climate is arid.

The dominant land use in this subregion is grazing, with smaller areas of crown reserves and mining. Only 1.4 per cent of the subregion is vested within conservation reserves (Cowan 2001). The southern boundary of the Wanjarri Nature Reserve is located approximately 15km north of the survey area and covers an area of 53,200 ha. More than 40 per cent of the Murchison's original mammal fauna is now regionally extinct (McKenzie *et al.* 2003).

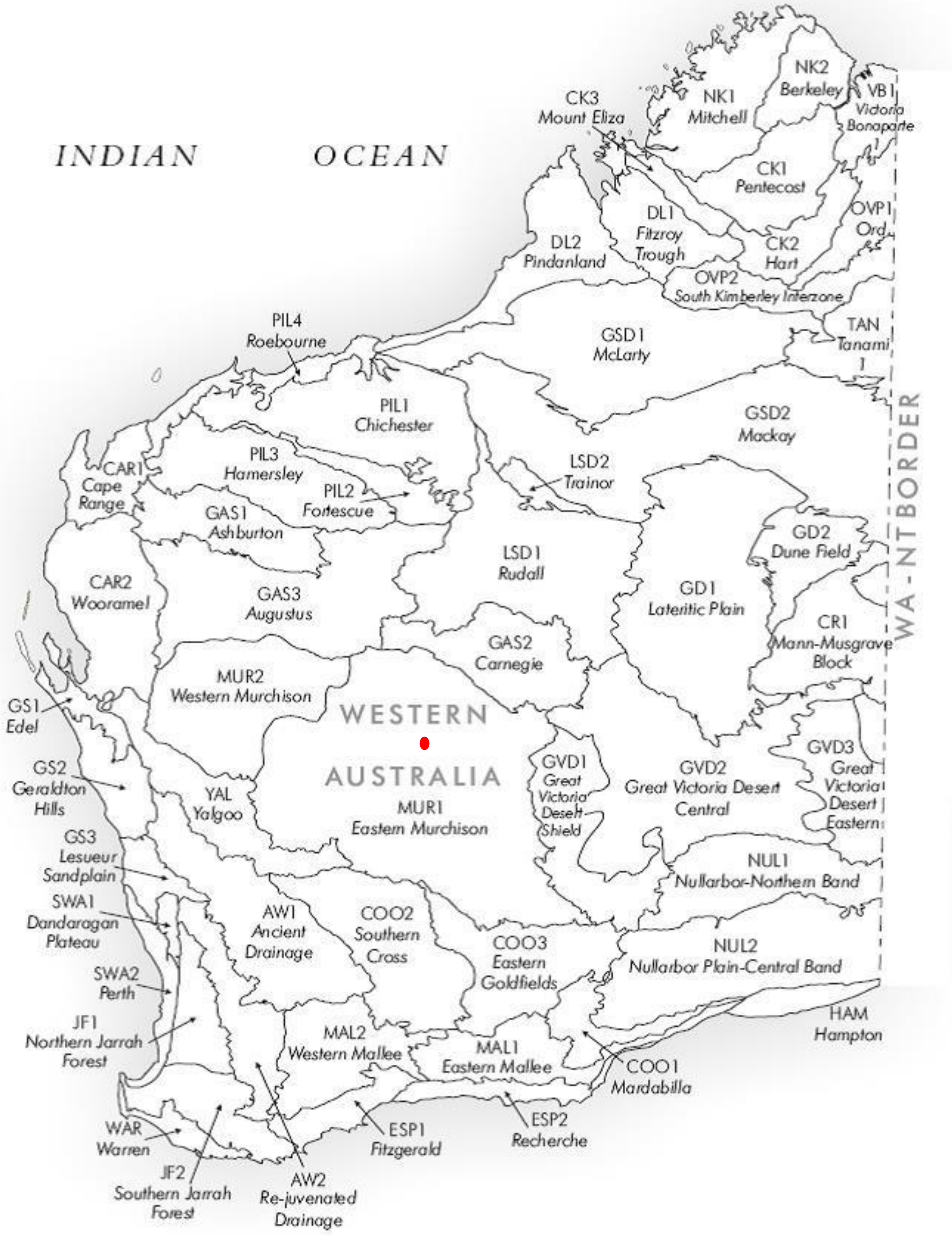

Figure 2. IBRA Subregions in Western Australia.

Note the survey area lies within the centre of MUR1 Eastern Murchison IBRA subregion (red dot).

2 Methods

2.1 Overview

The methods used for this assessment are based upon the general approach to fauna investigations for impact assessment as outlined in Section 1.1 and with reference to Appendices 1 to 4. Thus, the impact assessment process involves the identification of fauna values, review of impacting processes and, where possible, preparation of mitigation recommendations.

This approach to fauna impact assessment has been developed with reference to guidelines and recommendations set out by the Western Australian Environmental Protection Authority (EPA) on fauna surveys and environmental protection (EPA 2002, 2004), and Commonwealth biodiversity legislation (DSEWPaC (2010), DotE (2014). The EPA (2010) proposes two levels of investigation that differ in the approach to field investigations, Level 1 being a review of data and (usually) a site reconnaissance to place data into the perspective of the site, and Level 2 (this assessment) being a literature review and intensive field investigations (e.g. trapping and other intensive sampling). The level of assessment recommended by the EPA is determined by the size and location of the proposed disturbance, the sensitivity of the surrounding environment in which the disturbance is planned, and the availability of pre-existing data. Guidance for field investigations methods is provided by the EPA (2010) and by Bamford *et al.* (2013).

The following approach and methods is divided into three groupings that relate to the stages and the objectives of impact assessment:

Desktop assessment. The purpose of the desktop review is to produce a species list that can be considered to represent the vertebrate fauna assemblage of the project area based on unpublished and published data using a precautionary approach.

Field investigations. The purpose of the field investigations is to gather information on this assemblage: confirm the presence of as many species as possible (with an emphasis on species of conservation significance), place the list generated by the desktop review into the context of the environment of the project area, collect information on the distribution and abundance of this assemblage, and develop an understanding of the project area's ecological processes that maintain the fauna. Note that field investigations cannot confirm the presence of an entire assemblage, or confirm the absence of a species. This requires far more work than is possible in the EIA process. For example, in an intensive trapping survey, How and Dell (1990) recorded in any one year only about 70% of the vertebrate species found over three years. In a study spanning over two decades, Bamford *et al.* (2010) has found that the vertebrate assemblage varies over time and space, meaning that even complete sampling at a set of sites only defines the assemblage of those sites at the time of sampling.

Impact assessment. Determine how the fauna assemblage may be affected by the proposed development based on the interaction of the project with a suite of ecological and threatening processes.

2.2 Desktop Assessment

2.2.1 Sources of information

Information on the fauna assemblage of the survey area was drawn from a wide range of sources. The information used included state and federal government databases and results of regional studies. Databases accessed were the Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap (incorporating the Western Australian Museum's FaunaBase and the DBCA Threatened and Priority Fauna Database), BirdLife Australia's Atlas Database (BA) and the EPBC Protected Matters Search Tool of the Department of the Environment and Energy (DEE) (Table 1). Databases were accessed in2018 to inform the initial period of field investigations, and these records are considered adequate and current as the likelihood of new records being added since that time is very low. Information from the above sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns were:

Frogs: Tyler *et al.* (2009) and Anstis (2013);
Reptiles: Storr *et al.* (1983, 1990, 1999 and 2002) and Wilson and Swan (2017);
Birds: Johnstone and Storr (1998, 2004) and Barrett *et al.* (2003); and
Mammals: Menkhorst and Knight (2010); Churchill (2008); and Van Dyck and Strahan (2008).

Table 1. Sources of information used for the desktop assessment.

Database	Type of records held on database	Area searched
NatureMap (DBCA 2018)	Records in the WAM and DBCA databases. Includes historical data and records on Threatened and Priority species in WA.	Point search: -27.594977°, 120.581479° plus 20 km buffer. Searched: August 2018.
BirdLife Australia Atlas Database (BirdLife Australia, 2018)	Records of bird observations in Australia, 1998-2018.	Point search: -27.594977°, 120.581479° plus 20 km buffer. Searched: August 2018.
EPBC Protected Matters (DEE 2018a)	Records on matters of national environmental significance protected under the EPBC Act.	Point search: -27.594977°, 120.581479° plus 40 km buffer. Searched: August 2018.

2.2.2 Previous fauna surveys

Multiple fauna surveys and studies have been conducted in the general area, both by BCE and other consultants. Including recent site visits and surveys by BCE in 2018.
References include:

- Dell. J., How, R.A., Milewski, A.V. and Keighery, G.J. (1998). The biological survey of the eastern Goldfields of Western Australia. Part 7. Edjudina-Menzies Study Area. Records of the Western Australian Museum, Supplement No. 31:1-137. Perth, WA.

- Cowan, M. (2001). Murchison 1 (MUR1 – East Murchison subregion) in A biodiversity audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management, Western Australia.
- ATA (2005). Fauna Assessment, Western Mining Corporation, Yakabindie - Version 2 Report 2004/209. Unpublished report for Sinclair Knight Merz, ATA Environmental.
- Biota Environmental Sciences (2006a). Wanjarri Nature Reserve Land Swap Proposal. Unpublished report for Sinclair Knight Merz, Western Australia.
- Biota Environmental Sciences (2006b). Fauna Habitats and Fauna Assemblage Survey of the Mt Keith Mine Project Area. Unpublished report prepared for Nickel West Mt Keith Operations, November 2006, Western Australia.
- Thompson, S.A. and Thompson, G.G. (2006). Reptiles of the Western Australian Goldfields. Kalgoorlie, WA: Goldfields Environmental Management Group.
- Bamford, M., Huang, N., and Turpin, J. (2011). Vertebrate Fauna Assessment Yeelirrie Project Baseline Report. Unpublished report prepared for URS Australia Pty Ltd. February 2011.
- Bamford, M., and Turpin, J. (2015). Yeelirrie Terrestrial Vertebrate Fauna Review. Unpublished report prepared for Cameco Australia. April 2015.
- Biota Environmental Sciences (2017a). Mt Keith Satellite Proposal Vertebrate Fauna Review. Report prepared for BHP Billiton. July 2017.
- Biota Environmental Sciences (2017b). Mt Keith Satellite Night Parrot Survey. Report for BHP Billiton Nickel West. July 2017.

2.2.2 Nomenclature and taxonomy

As per the recommendations of EPA (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's (WAM) Checklist of the Fauna of Western Australia 2017. The authorities used for each vertebrate group were: amphibians (Doughty *et al.* 2017a), reptiles (Doughty *et al*. 2017b), birds (Johnstone and Darnell 2017), and mammals (Travouillon 2016). In some cases, more widely-recognised names and naming conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds). English names of species where available are used throughout the text; Latin species names are presented with corresponding English names in tables in the appendices.

2.2.3 Interpretation of species lists

Species lists generated from the review of sources of information are generous as they include records drawn from a large region and possibly from environments not represented in the survey area. Therefore, some species that were returned by one or more of the data searches have been excluded because their ecology, or the environment within the survey area, meant that it is highly unlikely that these species will be present. Such species can include, for example, seabirds that might occur as extremely rare vagrants at a terrestrial, inland site, but for which the site is of no importance. Some waterbirds were included, because there are environments suitable for these species within the project site, such as rivers, creeks, dams and large flat inundated areas. A number of species may also nest on the site.

Species returned from the databases and not excluded on the basis of ecology or environment are therefore considered potentially present or expected to be present in the survey area at least occasionally, whether or not they were recorded during field surveys, and whether or not the survey area is likely to be important for them. This list of expected species is therefore subject to interpretation by assigning each a predicted status in the survey area.

The status categories used are:

- **Resident**: species with a population permanently present in the survey area;
- **Regular visitor or migrant**: species that occur within the survey area regularly in at least moderate numbers, such as part of annual cycle;
- **Irregular Visitor**: species that occur within the survey area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the survey area in at least moderate numbers and for some time;
- **Vagrant**: species that occur within the survey area unpredictably, in small numbers and/or for very brief periods. Therefore, the survey area is unlikely to be of importance for the species; and
- **Locally extinct**: species that would have been present but has not been recently recorded in the local area and therefore is almost certainly no longer present in the survey area.

These status categories make it possible to distinguish between vagrant species, which may be recorded at any time but for which the site is not important in a conservation sense, and species which use the site in other ways but for which the site is important at least occasionally. This is particularly useful for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive, and further recognises that even the most detailed field survey can fail to record species which will be present at times, or may have been previously confirmed as present. The status categories are assigned conservatively. For example, a lizard known from the general area is assumed to be a resident unless there is very good evidence that the site will not support it, and even then it may be classed as a vagrant rather than assumed to be absent if the site might support dispersing individuals.

2.3 Field Investigation

2.3.1 Survey overview

The field surveys incorporated a range of survey techniques so as to maximise sampling results. The following techniques were used:

- Identification of VSAs;
- Systematic sampling transects;
    - Pit trapping;
    - Funnel trapping (October 2018 only);
    - Bird census;
    - Targeted Malleefowl mounds
    - Targeted Slender-billed Thornbill
- Motion sensitive cameras
- Bat echolocation devices (October 2018 only)

- Audio recording devices (October 2018 only)
- Nocturnal searching
- Opportunistic invertebrate collection, and
- Opportunistic observations.

Methods used only in 2018 were either ineffective/inappropriate for conditions in 2019 (funnel traps) or were deemed adequate after the 2018 round of sampling.

2.3.2 Dates and Personnel

- The project area was initially visited on the 14th August 2018 by Dr Mike Bamford – BSc (Biol.), Hons (Biol.), PhD (Biol.) for the purpose of site familiarisation and to enable Lake Miranda to be visited while it still contained water. The site visit involved walking over the proposed project development area to enable environmental descriptions to be prepared and some opportunistic observations on fauna to be made. Following this, comprehensive field investigations were undertaken as outlined above from the 23rd November to 1st October 2018, and from 21st to 28th October 2019. Personnel on field surveys were:
  - Dr Mike Bamford (B.Sc. Hons. Ph.D.) (2018 and 2019);
  - Mr Peter Smith (As.Dip.Ag) (2018 and 2019);
  - Mr Andy McCreery (B.Sc.) (2018 and 2019);
  - Mr Tim Gamblin (B.Sc. Cert. Env. Man. (2018);
  - Dr Jamie Wadey (B.Sc. Hons. Ph.D.) (2019).

The field investigations were carried out under Regulation 17 permit No 08-002996-01 (2018) and BA27000167 (2019). This fauna assessment report was prepared initially by Cameron Everard (B.Sc. (Env Sci), M.Sc. (Env Sci) and Mike Bamford following the 2018 survey, and was revised and updated by Tim Gamblin and Mike Bamford after the 2019 survey.

2.3.3 Vegetation and Substrate Associations

Vegetation and Substrate Associations (VSAs) in the survey area were assessed during the desktop review and site inspection in 2018 and during both level 2 assessments in 2018 and 2019. Within the survey area, all major VSAs were visited to develop an understanding of major fauna habitat types present and to assess the likelihood of conservation significant species being present in the area. BCE were able to access and use the vegetation descriptions from Environmental Consultant, RPS, which contributed to providing more detailed VSAs.

2.3.4 Targeted searching for conservation significant fauna

Significant fauna species identified during the desktop assessment include several that can be found by searching for evidence of their activities (e.g. scats, tracks, diggings, burrows), including Great Desert Skink, Brush-tailed Mulgara, Black-flanked Rock-Wallaby, Malleefowl. Signs of these species were searched for while walking over the project area during the site visit in August 2018 and field investigation in October 2018 and 2019. Some of these species can also be detected by trapping, but searching for evidence can be more efficient and provide reasonable estimates of distribution and abundance.

Targeted searches for Malleefowl and the Slender-billed Thornbill were undertaken during the field investigation in October 2018 and 2019. These involved walking transects where personnel searched for mounds and the target species, and made other fauna observations (Figures 3 and 4). Malleefowl mound transects were located in areas of mulga over tussock grass on sandy loam and rocky hills within the project area. This was identified as prime habitat for mound construction (based on previous experience of the field team). Personnel searched for active and old mounds and footprints in sandy areas, and also recorded other fauna and evidence of fauna, including abandoned Boodie warrens and evidence of feral animals. Mounds are easily detectable due to the displacement of soil and debris into a large and distinctive feature. Mounds can be detected in the landscape many years since last use. The total distance covered for all personnel walking transects in 2019 was approximately 74.3km, encompassing 362 ha when combining areas in-between personnel and line of sight.

Slender-billed Thornbill transects included areas on the margins of chenopod shrublands associated with Lake Miranda and Trapping Site 10. The species is not easily detectable as they are quiet, inconspicuous and less inquisitive than other Thornbills (DEE 2010). In order to increase the likelihood of detectability, four personnel walked in unison 50 metres apart to create a higher likelihood of disturbing individuals if encountered (Figure 4). All members of the team held binoculars. The total distance covered for all personnel walking transects was approximately 100.3km, encompassing 498ha when combining areas in-between personnel and line of sight.

Kathleen Valley pipeline corridor.
Transects were walked by four personnel along the Kathleen Valley Pipeline Corridor including parallel to the Cosmos Haul Road (Figure 6). Way-pointed photos with vegetation associations as well as fauna observations were recorded on these transects.

2.3.5 Systematic Fauna Sampling

Nine systematic sampling sites were deployed in October 2018 and six in October 2019. Each sampling site consisted of a transect of 10 pitfall traps with the pitfalls at 20-30m intervals. Pitfall configuration consisted of one 20 litre bucket with three fences (approximately 1.2 metres in length) extending radially from the bucket to allow fauna to fall into the pit when following the fence line. Six systematic sampling transects covered most major VSAs except for Lake Miranda and highly disturbed areas. Descriptions of sampling transects, including VSA, dates sampled, sampling effort and locations are given in Table 2; positions of transects are indicated on Figure 5. Two Funnel trap configurations were established separately to pitfalls at site 1 in 2018. Each funnel configuration consisted of five funnels spread approximately 25 metres in length, connected by drift fences. Total trapping effort was 828 pitfall nights and 30 funnel trap nights.

Bird census surveys were recorded during each pitfall check for the length of the transect and 25m on either side of the transect line. Birds were identified visually and acoustically. The length of transects were approximately 225m but varied due to different spacing of pitfalls (related to the difficulty of installing pitfalls). This was considered when comparing bird census results; but numbers were so low that only very general comparisons could be made irrespective of sampling effort. Total bird census effort was 83 surveys along transects.

Table 2. Systematic sampling transect locations, description and trapping effort. Sites 1 to 9 were operated within the period 23 October to 1 November 2018, and Sites 10 to 15 in the period 21 to 28 October 2019. VSAs (Vegetation and Substrate Associations) are described in Section 3.1.

Site	Trap transect end coordinates		Description	Sampling effort
Site 1	Pit 1	51 J 257580 6943479	VSA2; Broad-leaf Mulga over shrubs and tussock grass on red, sandy loam soils.	60 pitfall trap nights, 30 funnel trap nights 6 bird surveys
	Pit 10	51 J 257824 6943593		
Site 2	Pit 1	51 J 258200 6943764	VSA1; Narrow-leaf Mulga over sparse shrubs and tussock grass on rocky hills.	60 pitfall trap nights 6 bird surveys
	Pit 10	51 J 258301 6943645		
Site 3	Pit 1	51 J 258575 6943123	VSA1; Narrow-leaf Mulga over open shrubs and tussock grass on rocky hills.	60 pitfall trap nights 6 bird surveys
	Pit 10	51 J 258666 6942921		
Site 4	Pit 1	51 J 259040 6938860	VSA2; Broad-leaf Mulga over shrubs and tussock grass on red, sandy loam soils.	60 pitfall trap nights 6 bird surveys
	Pit 10	51 J 258770 6939015		
Site 5	Pit 1	51 J 258224 6939708	VSA2; Broad-leaf Mulga and Allocasuarina over shrubs and tussock grass on red, sandy loam soils.	60 pitfall trap nights 6 bird surveys
	Pit 10	51 J 258205 6939912		
Site 6	Pit 1	51 J 259195 6940188	VSA1; Heavily degraded narrow-leaf Mulga over sparse shrubs and tussock grass on shallow soils.	60 pitfall trap nights 6 bird surveys
	Pit 10	51 J 259173 6940136		
Site 7	Pit 1	51 J 258002 6939567	VSA3; Isolated trees over open shrubland on gypsum soils	60 pitfall trap nights 6 bird surveys
	Pit 10	51 J 257850 6939737		
Site 8	Pit 1	51 J 257761 6939820	VSA3; Isolated trees over open shrubland on gypsum soils	60 pitfall trap nights 6 bird surveys
	Pit 10	51 J 257596 6940019		
Site 9	Pit 1	51 J 259881 6941243	VSA4; Samphire marsh in loam clay	50 pitfall trap nights 5 bird surveys
	Pit 10	51 J 259808 6940971		
Site 10	Pit 1	256632 6941678	Edge of chenopod shrublands in calcrete soils (VSA3) and into mulga over low shrubs and clumped grasses on red loam (VSA2). Badly degraded by cattle in parts.	50 pitfall trap nights 5 bird surveys
	Pit 10	256854 6941659		
Site 11	Pit 1	256831 6941425	VSA2. Shrubland on loam into mulga over shrubs and clumped grasses on slightly sandy loam.	50 pitfall trap nights 5 bird surveys
	Pit 10	257072 6941482		

Site	Trap transect end coordinates		Description	Sampling effort
Site 12	Pit 1	257473 6940589	VSA2. Red sand dune supporting mulga over shrubs and clumped grasses. Pitfall 8 to 10 on loam-clay flat with scattered shrubs and sparse low shrubs and herbs.	50 pitfall trap nights 5 bird surveys
	Pit 10	257728 6940605		
Site 13	Pit 1	259907 6944579	Drainage line of tall Mulga over shrubs and grasses. Soil a hard loam with areas of sand and rock where water flows. Within VSA1.	50 pitfall trap nights 5 bird surveys
	Pit 10	259485 6944588		
Site 14	Pit 1	257565 6945022	VSA2. Tall Mulga over shrubland and mostly dense, clumping grasses on red loamy-sand flats.	50 pitfall trap nights 5 bird surveys
	Pit 10	257573 6944594		
Site 15	Pit 1	258101 6945006	Minor creekline with rocky slopes supporting miniritchi over scattered shrubs; larger acacia and scattered shrubs on rocky/loam in poorly-defined drainage line. Within VSA1.	48 pitfall trap nights. 5 bird surveys.
	Pit 10	258366 694636		

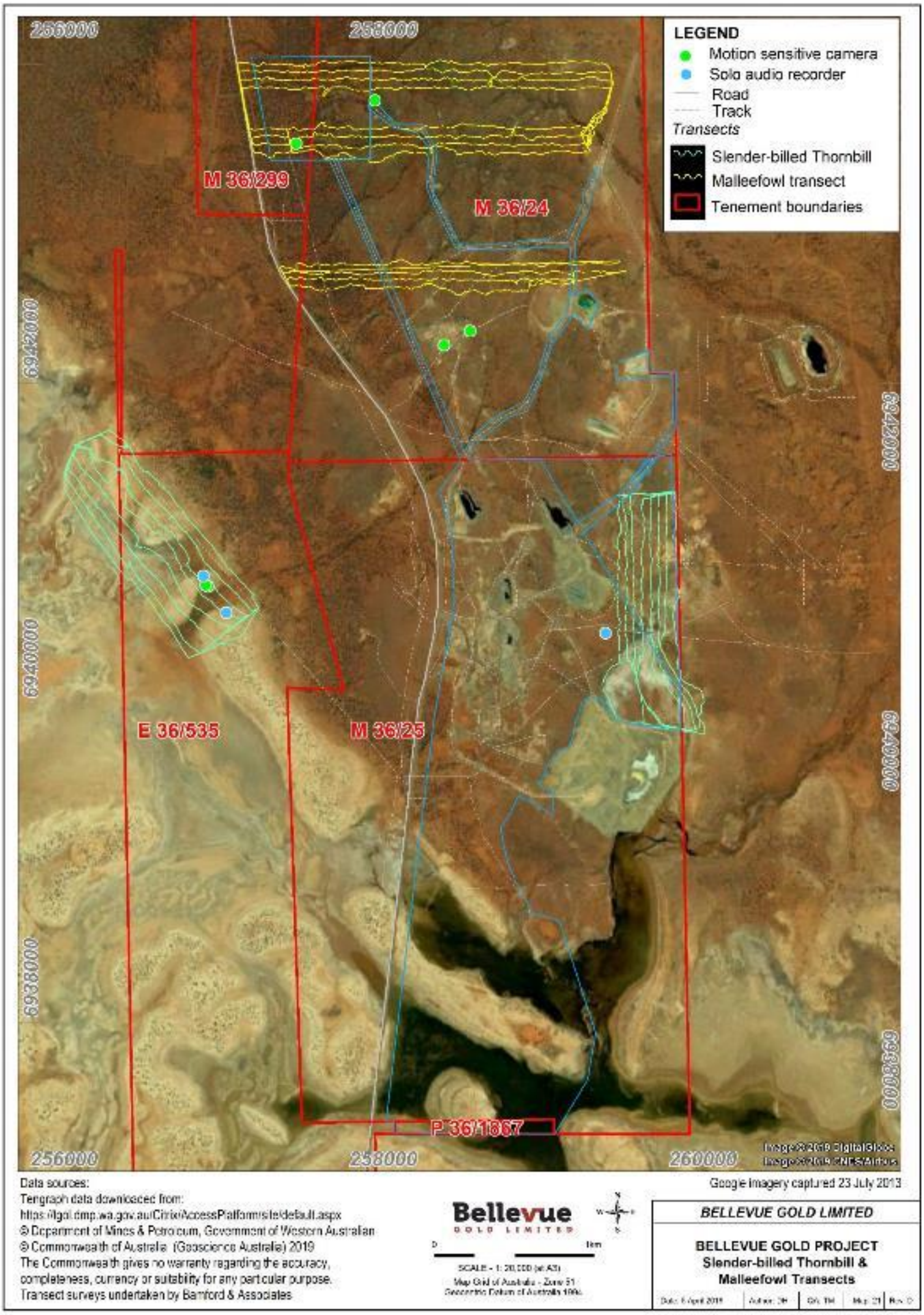

Figure 3. Locations of motion sensitive cameras, audio detectors and Malleefowl and Slender-billed Thornbill transects in October 2018.

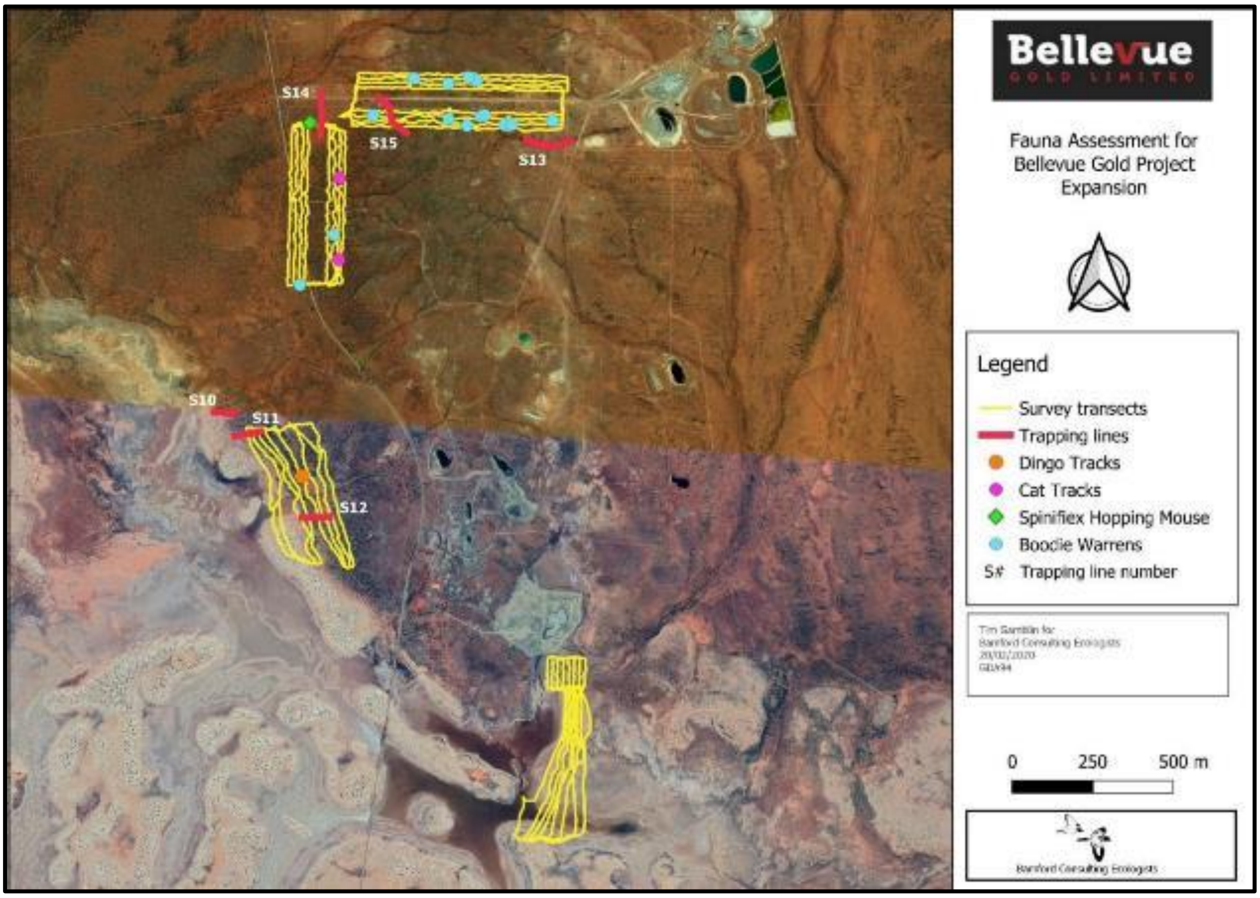

Figure 4. Locations of Malleefowl and Slender-billed Thornbill transects (yellow), and systematic sampling (trapping and census lines; red), in October 2019. Two motion-sensitive cameras were set on S15.

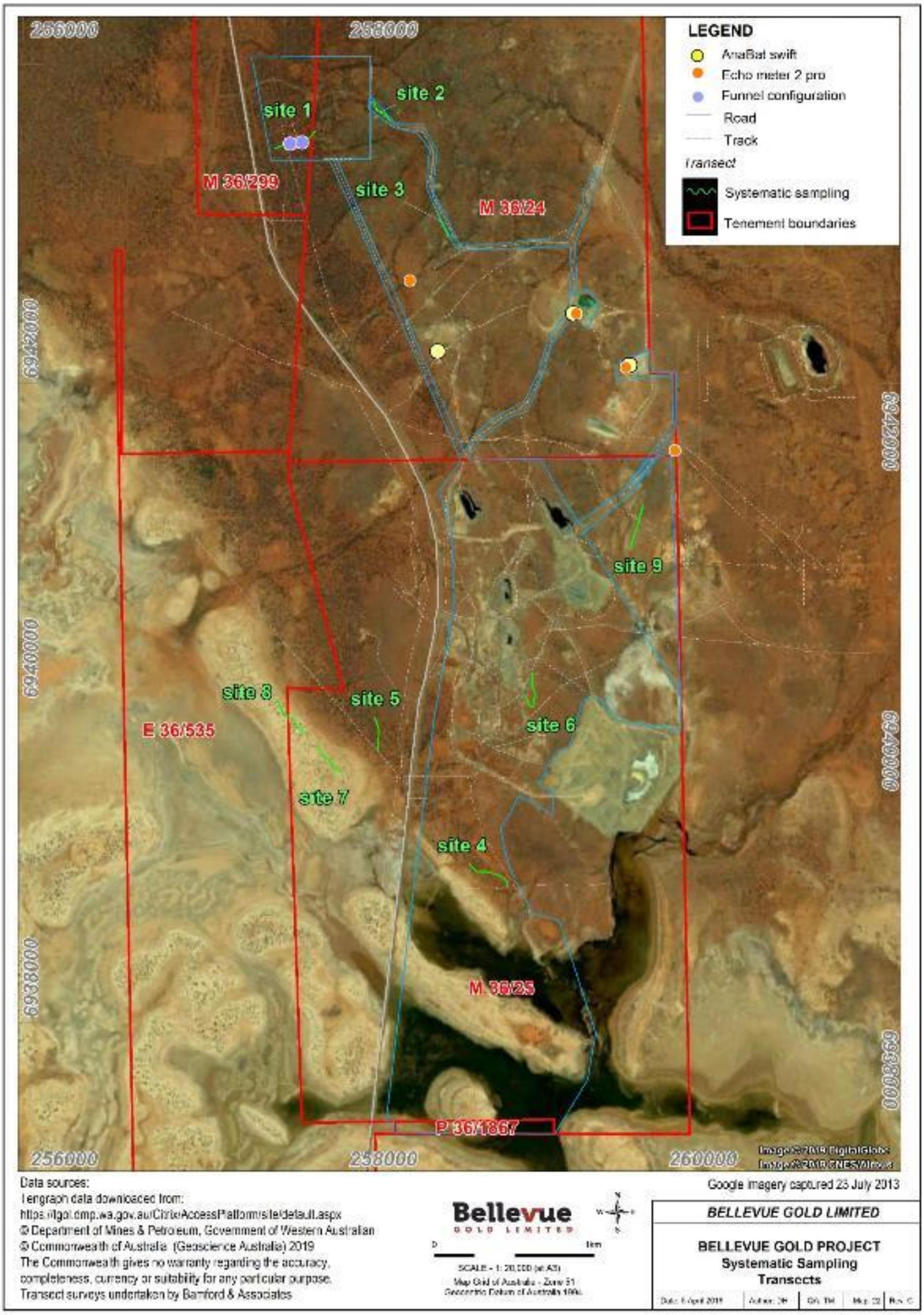

Figure 5. Locations of systematic sampling transects (trapping and census lines; green), funnel configurations and recording devices in October 2018.

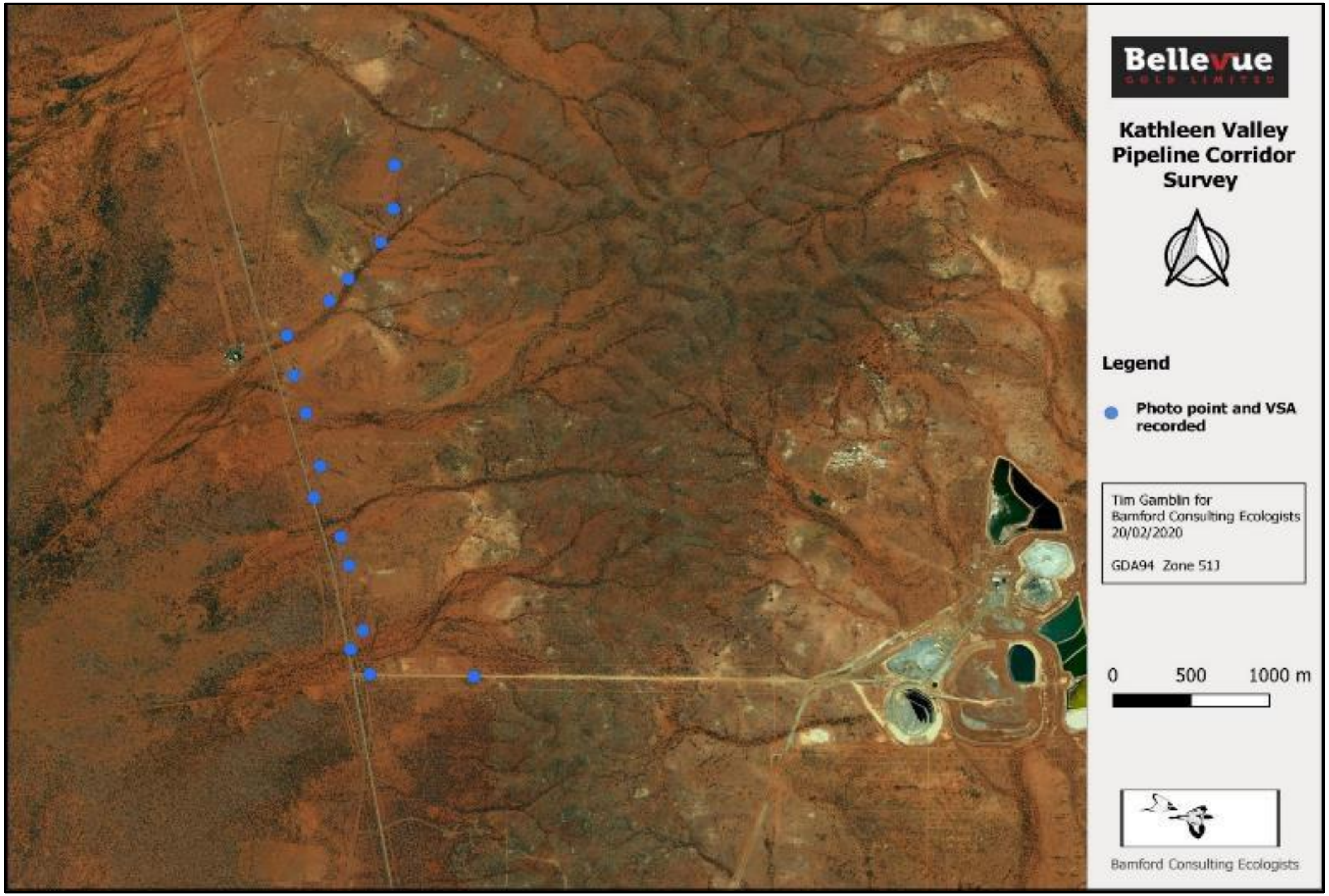

Figure 6. Kathleen Valley Pipeline Corridor, survey points in 2019. A photograph and vegetation association description were recorded at each point.

2.3.6 Nocturnal searching

Spotlighting for fauna involved four personnel searching over six nights in 2018, and four people over three nights in 2019. In October 2018, areas near Lake Miranda on the intact gypsum dunes around sites 7 and 8 were searched for two nights. The Boyd's Well area was searched on foot followed by a slow drive searching for nocturnal fauna via sites 1, 2 and 3. The perimeter of existing mining pit "Vanguard" was investigated for one night in areas of roadside vegetation and on the pit wall. The team spent one night in an area towards the northern section, where historical mining activities were undertaken. This area was heavily degraded with some vegetation clearing, and what remained was an old water tower, pieces of sheet metal, many historical artefacts and a few mine shafts. The final night involved driving along the Goldfields Highway using two vehicles, each team drove 10 kilometres from the entrance gate, one north, the other south, searching for reptiles utilising the warm road. In October 2019, the areas searched were site 15, the gypsum ridge in the south-west near Site 11 and the Vanguard pit (as in 2018). Spotlighting included observations made while driving at night to and from the locations described above.

2.3.7 Active hand searching

This method involved turning over ground debris including log, rocks and junk to detect fauna. This was done whenever the opportunity arose such as while doing transect walks and establishing the sampling transects. The high volume of foreign materials left over from previous mining activities provided many sheltered habitats for reptiles.

2.3.8 Opportunistic observations

At all times, observations of fauna were noted when they contributed to the accumulation of information on the fauna of the site. These included such casual observations as birds or reptiles seen while walking through the survey area.

2.3.9 Opportunistic invertebrate fauna collection

Collecting of invertebrate fauna was limited to those taxonomic groups that potentially include short range endemic (SRE) species such as Isopods, scorpions, pseudoscorpions, mygalomorph spiders and millipedes. Opportunistic searching for potential SREs included turning over logs and rocks. Potential SRE specimens caught as by-catch in the vertebrate fauna traps were also collected and sent to specialists for identification. Specimens were collected in both major surveys.

2.3.10 Bat Echolocation devices

An Anabat Swift (Titley) was deployed in various locations throughout the Bellevue study area for overnight recording during the October 2018 fauna assessment. Additional recordings were taken during evening fauna surveys on an Echo Meter 2 Pro allied to an iphone 7 running Echo Meter software. The Echo meter was used in shorter intervals in a range of locations, often for the period of nocturnal searches. On the evening of 31 October, the echo meter was activated over a distance of approximately 12 km starting from camp, through central areas of the survey area and then proceeding south along the Goldfields Highway. A summary of bat echolocation device locations is displayed in Table 3.

Table 3. Locations for the Swift and EMT 2 deployment.

Date	Easting	Northing	Description of deployment location
Anabat Swift			
26 Oct	259798	6942118	Camp
27th Oct	259445	6942441	Vanguard Pit
28th Oct	258597	6942204	Old mine workings, including old water tank
EMP 2			
23nd Oct	259776	6942106	Camp
25th Oct	258422	6942648	Bat walk around old mine workings
27th Oct	259463	6942440	Vanguard Pit
31st Oct	260083	6941583	Driving survey from camp to -27.71933, 120.5405

Calls were assessed using Anabat Insight software and compared against previously collected calls using the following characteristics.

Fmax (kHz): Average maximum frequency of call pulses within each call sequence;
Fpeak (kHz): Average frequency of peak energy within call pulses, within each call sequence;
Fmin (kHz): Average minimum frequency of call pulses within each call sequence;
Dur (ms): Average duration of call pulses.

2.3.11 Audio recorders

Solo Audio recording devices were utilised to detect the presence of Night Parrots in October 2018. Two devices were set out in five locations to capture 11 recording nights. To maximise detection of bird calls, devices were set up in elevated and open positions in the landscape. Details of audio recorders are outlined in Table 2 (Locations on Figure 5).

Table 4. Location of Solo audio recorders

Location	Recording device	Device ID	Description	Set	Removed	Easting	Northing
Site 9	Solo Audio recorder	Solo 1	Chenopod Shrubland	25/10/18	27/10/18	259881	6941243
Lake Miranda crossing	Solo Audio recorder	Solo1	Lake Miranda	27/10/18	29/10/18	259648.8	6940441
West of Site 8	Solo Audio recorder	Solo1	Chenopod Shrubland	29/10/18	31/10/18	257273.8	6940568
Between Sites 7 and 8	Solo Audio recorder	Solo 2	Gypsum ridge	26/10/18	29/10/18	257800	6939650
Gypsum dune	Solo Audio recorder	Solo2	NW of site 8	29/10/18	31/10/18	257130.7	6940798

2.3.12 Motion sensitive cameras

Motion sensitive cameras were set up to detect vertebrate fauna on site. A non-reward lure was used to attract fauna in the form of bait tubes filled with universal bait (peanut butter, oats and sardines). Bait tubes were placed into the camera frame and attached to a solid object. Cameras were positioned in areas selected to maximise fauna detection, mostly near artificial excavations of old mine shafts and Boyd's Well. The details of camera deployment are given in Table 5 (see also Figure 3).

Table 5. Description and location of motion sensitive cameras.

Location	Camera type	Camera ID	Description	Set	Removed	Easting	Northing
Site 1	Reconyx	CAM1	Broad-leaf Mulga on sandy-loams	26/10/18	28/10/18	E 257710	S 6943507
Site 2	Reconyx	CAM2	Narrow-leaf Mulga on Violet Range	26/10/18	28/10/18	E 258204	S 6943777
Boyds' Well	Reconyx	BCE10	Old water tank south of Well	28/10/18	29/10/18	E 258800	S 6942333
Boyds' Well	Reconyx	BCE11	Old water tank south of Well	28/10/18	29/10/28	E 258637	S 6942245
West of Site 8	Reconyx	BCE10	Set on old Boodie warren	29/10/18	31/10/18	257159.2	6940733
West of Site 8	Reconyx	BCE11	Set on old Boodie warren	29/10/18	31/10/18	257144.2	6940741

2.4 Survey Limitations

The EPA Guidance Statement 56 (EPA 2004) outlines a number of limitations that may arise during surveying. These survey limitations are discussed in the context of the BCE investigation of the survey area in Table 6.

Table 6. Survey limitations as outlined by EPA.

EPA Limitation	Comment
Level of survey.	Level 2 (desktop study and field investigation). Survey intensity was deemed adequate due to the condition of the project area, scale of the project and the amount of data records available in the region.
Competency/experience of the consultant(s) carrying out the survey.	The ecologist has had extensive experience in conducting fauna surveys and have conducted several fauna studies within the region, focussing on relevant conservation significant species including Great Desert Skink, Black-flanked Rock-Wallaby, Malleefowl and Night Parrot.
Scope. (What faunal groups were sampled and were some sampling methods not able to be employed because of constraints?)	The survey focussed on vertebrate fauna, and fauna values for of the significant species potentially occurring, although some potential short-range endemic species were collected when encountered.
Proportion of fauna identified, recorded and/or collected.	All species encountered were identified.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	Abundant information from databases e.g. DBCA, EPBC and previous studies, e.g. *Dell et al*. (1998), Cowan (2001), ATA (2005), Biota Environmental Sciences (2006a, b), Thompson and Thompson (2006), Bamford *et al*. (2011), Bamford and Turpin (2015), Biota Environmental Sciences (2017a, b) and Everard and Bamford (2019).
The proportion of the task achieved and further work which might be needed.	The survey was completed and the report provides fauna values for the survey area. Waterbird survey for Lake Miranda may be required after a period of heavy rain.
Timing/weather/season/cycle.	Surveys were conducted in October 2018 and October 2019. The ideal time for Level 2 surveys in the Murchison coincides in Spring. However, conditions had been very dry for several years and levels of abundance were low, particularly in 2019. This issue is discussed later in the report.
Disturbances (e.g. fire, flood, accidental human intervention etc.) that affected results of survey.	None
Intensity. (In retrospect, was the intensity adequate?)	All major VSAs were visited and significant species habitat and traces were identified. VSAs beyond the survey area

	limits were also visited to gain local context of the species habitat.
Completeness (e.g. was relevant area fully surveyed).	Sites were fully surveyed to the level appropriate for a Level 2 assessment. Fauna database searches covered a >10 km radius beyond the survey area boundary.
Resources (e.g. degree of expertise available in animal identification to taxon level).	Field personnel have extensive experience with fauna and habitat in the region.
Remoteness and/or access problems.	There were no remoteness/access problems encountered.
Availability of contextual (e.g. biogeographic) information on the region.	Extensive regional information was available and was consulted.

2.5 Presentation of results for Impact Assessment

While some impacts are unavoidable during a development, of concern are long-term, deleterious impacts upon biodiversity. This is reflected in documents such as the Significant Impact Guidelines provided by DotE (2013). Significant impacts may occur if:

- There is direct impact upon a VSA and the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna;
- There is direct impact upon conservation significant fauna; and
- Ecological processes are altered and this affects large numbers of species or large proportions of populations, including significant species.

The impact assessment process therefore involves reviewing the fauna values identified through the desktop assessment and field investigations with respect to the project and impacting processes. The severity of impacts on the fauna assemblage and conservation significant fauna can then be quantified on the basis of predicted population change.

The presentation of this assessment follows the general approach to impact assessment as given in Section 1.1, but modified to suit the characteristics of the site. Key components to the general approach to impact assessment are addressed as follows:

<u>Fauna values</u>
This section presents the results of the desktop and field investigations in terms of key fauna values (described in detail in Appendix 1):

- Assemblage characteristics (uniqueness, completeness and richness) - based upon desktop assessment and information from the site inspection;
- Species of conservation significance – based upon desktop assessment and site inspection;
- Recognition of ecotypes or vegetation/substrate associations (VSAs) - based upon desktop assessment and site inspection;

- Patterns of biodiversity across the landscape - based upon desktop assessment and site inspection;
- Ecological processes upon which the fauna depend - based upon desktop assessment and site inspection.

Impact assessment

This section reviews impacting processes (as described in detail in Appendix 2) with respect to the proposed project and examines the potential effect of these impacts upon biodiversity of the survey area. It thus expands upon Section 1.1 and discusses the contribution of the project to impacting processes, and the consequences of this with respect to biodiversity. A major component of impact assessment is consideration of threats to species of conservation significance as these are a major and sensitive element of biodiversity. Therefore, the impact assessment includes the following:

- Review of impacting processes; will the proposal result in:
  - Habitat loss leading to population decline, especially for significant species;
  - Habitat loss leading to population fragmentation, especially for significant species;
  - Weed invasion that leads to habitat degradation;
  - Ongoing mortality;
  - Species interactions that adversely affect native fauna, particularly significant species;
  - Hydrological change;
  - Altered fire regimes; and
  - Disturbance (dust, light, noise).
- Summary of impacts upon significant species, and other fauna values.

The impact assessment concludes with recommendations based upon predicted impacts and designed to mitigate these. Note that the terms direct and indirect impacts are not used in this report; for further explanation see Appendix 2.

2.5.1 Criteria for impact assessment

Impact assessment criteria are based on the severity of impacts on the fauna assemblage and conservation significant fauna, and were quantified on the basis of predicted population change (Appendix 2). Population change can be the result of direct habitat loss and/or impacts upon ecological processes.

The significance of population change is contextual. The EPA (2004) suggests that the availability of fauna habitats within a radius of 15km can be used as a basis to predict low, moderate or high impacts. In this case, a high impact is where the impacted environment and its component fauna is rare (<5% of the landscape within a 15km radius or within the Bioregion), whereas a low impact is where the environment is widespread (10% of the local landscape). Under the Ramsar Convention, a wetland that regularly supports 1% of a population of a waterbird species is considered to be significant. These provide some guidance for impact assessment criteria, but are really only appropriate when considering very large proposed developments in broad landscapes.

This is the case for the Bellevue Gold survey area. In the following criteria (Table 7), the significance of impacts is based upon percentage population decline within an estimated 15km radius and upon the effect of the decline upon the conservation status of a recognised taxon (recognisably discrete genetic population, sub-species or species). Note that percentage declines can usually only be estimated on the basis of distribution of a species derived from the extent of available habitat, while for a few species, such as the black-cockatoos (although not relevant to the current project), there is guidance for the assessment of impact significance. The impact assessment concludes with recommendations based upon predicted impacts and designed to mitigate these.

Table 7. Assessment criteria of impacts upon fauna.

Impact Category	Observed Impact
Negligible	Effectively no population decline; at most few individuals impacted and any decline in population size within the normal range of annual variability.
Minor	Population decline temporary (recovery after end of project such as through rehabilitation) or permanent, but <1% within the immediate area. No change in viability or conservation status of taxon.
Moderate	Permanent population decline 1-10% within the immediate area. No change in viability or conservation status of taxon.
Major	Permanent population decline >10% within the immediate area. No change in viability or conservation status of taxon.
Critical	Taxon extinction within the immediate area and/or change in viability or conservation status of taxon.

3 Results and discussion

3.1 Vegetation and Substrate Associations (VSAs)

Six key Vegetation and Substrate Associations (VSAs) were recorded during the site visit. Photographs of VSAs are shown in Plates 1 to 6 and described below. VASs are mapped on Figure 7.

7. **Long-leaf Mulga over shrubs and tussock grass on rocks and loam of undulating hills**. Miniritchie *Acacia grasbyi, Acacia sp. and A. xanthocarpa* grow where soil is very shallow and is present on slopes of the Violet Range. Below the canopy, dominant shrubs of this VSA include *Eremophila forrestii forrestii, E. exilifolia, Ptilotus obovatus* and *Grevillia inconspicua* (Priority 4). The ground cover of this rocky substrate is open with sparse tufts of tussock grasses *Aristida contorta, Enneapogon caerulescens* and *E. polyphyllus*. Minor drainage lines occur at the bottom of stony valleys and these often have dense thickets and Minirithie. This VSA is well represented and in good condition in the north of the site, including the Karthleen Valley area, but degraded around the old Bellevue mine. In the southern part of this VSA, the Acacia are stunted and vegetation characterises a low, open shrubland. A small hill in the Tribune area is an aboriginal sacred site and access is not permitted. Development will not impact the heritage site. Plates 1 and 2.
8. **Broad-leaf Mulga over shrubs and tussock grass on sandy-loam plains.** *Acacia sp.* and *A. ramulosa var. linophylla* dominate the canopy within this VSA. At the shrub layer, similar to VSA 1, *Eremophila forrestii forrestii* and *Ptilotus obovatus* is present as well as *Solanum lasiophyllum.* Comparative to other VSAs on site, this habitat contained the highest density of ground cover due to tussock grasses *Aristida holathera* var. *holathera, Eragrostis eriopoda, Monachather paradoxus and Eriachne sp.* and a light covering of leaf litter. This VSA is extensive and in good condition to the west of the Violet Range. However, within the Tribune area it is degraded due to past and current exploration and mining activities. Areas west of the Goldfields highway are in good condition. Plate 3.
9. **Isolated trees over open shrubland on gypsum soils close to Lake Miranda.** This VSA is limited to small patches surrounding salt lakes in the region and contains flora associated with hard crusted soil (Hall *et al.* 1994). The open canopy consists of *Eucalyptus striaticalyx* and *Casuarina pauper* over a shrub layer of *Lycium australe, Lawrencia helmsii, Maireana* spp. and flowering *Grevillia sarissa.* The sparse ground cover is dominated by *Aristida contorta, Aristidea chaetopoda and Frankenia* spp. The crusted surface was shallow and underneath, the substrate gave way to a very fine, powder-like consistency. Good examples of this VSA are located west of the highway. The open shrubland also occurs to the south of the project area on Long Island. Plate 4.
10. **Samphire marsh in loam clay on margins and across parts of Lake Miranda.** Samphire species *Tecticornia spp*. dominated this VSA with other shrubs *Maireana spp*., *Sclerolaena spp*. and *Atriplex sp*.. Occasional grasses, *Eragrostis* spp*. and Aristida contorta were* also present. The clay loam substrate was very dry and compact at the time of the field investigation. Plate 5.

11. **Lake Miranda**. A very shallow and hypersaline lake with soft sediments. Lake Miranda was mostly dry during the site visit (14th August 2018) and completely dry during the major field investigations (October 2018 and October 2019), but mine personnel report that the lake had been full for many months following summer rains of 2016/2017 and 2017/2018. Charophyta green algae were present in the lake. Lake Miranda is a large playa salt lake located in the southern part of the survey area (Figure 1). The lake is shallow, approximately 15km by 10km and seasonally inundated following heavy rains (often after major summer events as occurred in summer 2017/2018. Water quality is generally hypersaline due to low annual rainfall coupled with high summer temperatures and high evapo-concentration rates, with the exception, after heavy summer rains when a lens of fresh water is likely to stratify at the lake surface. Over 50 bird species have been recorded from Lake Miranda (BirdLife Australia 2018). Numerous other salt lake systems with similar physical and geochemical properties as Lake Miranda occur throughout the region. It should be highlighted that Lake Miranda has previously been used as a discharge lake for saline mine dewatering (Outback Ecology 2009). Historical mining operations, and in particular the storage of mine waste adjacent to the lake, have been reported to have leached contaminants into the lake such that concentrations of some metals were elevated above baseline conditions (Finucane 2001, Finucane *et al.* 2003).

12. Degraded areas. Isolated trees over sparse shrubland, tussock grass and scattered herbs on flats. The areas identified as degraded are a mixture of two VSAs. The northern degraded areas are the rocky ridgeline communities of VSA 1, while the sandy loam flats of VSA 2 is represented in the southern degraded areas. Soil is either original (rocky loam and loam) or is overburden (thus a mixture of rock, loam and clay). Some of these areas have historical disturbance that date back to 1897. Plate 6.

Plate 1. Long-leaf Mulga over shrubs and tussock grass on rocks and loam of undulating hills (VSA 1)

Plate 2. Miniritchie over scattered shrubs on rocky loam slopes in drainage lines (VSA1).

Plate 3. Broad-leaf Mulga over shrubs and tussock grass on sandy-loam plains (VSA 2)

Plate 4. Open Chenopod shrublands on gypsum/calcrete soils close to Lake Miranda (VSA 3). VSA2 in background.

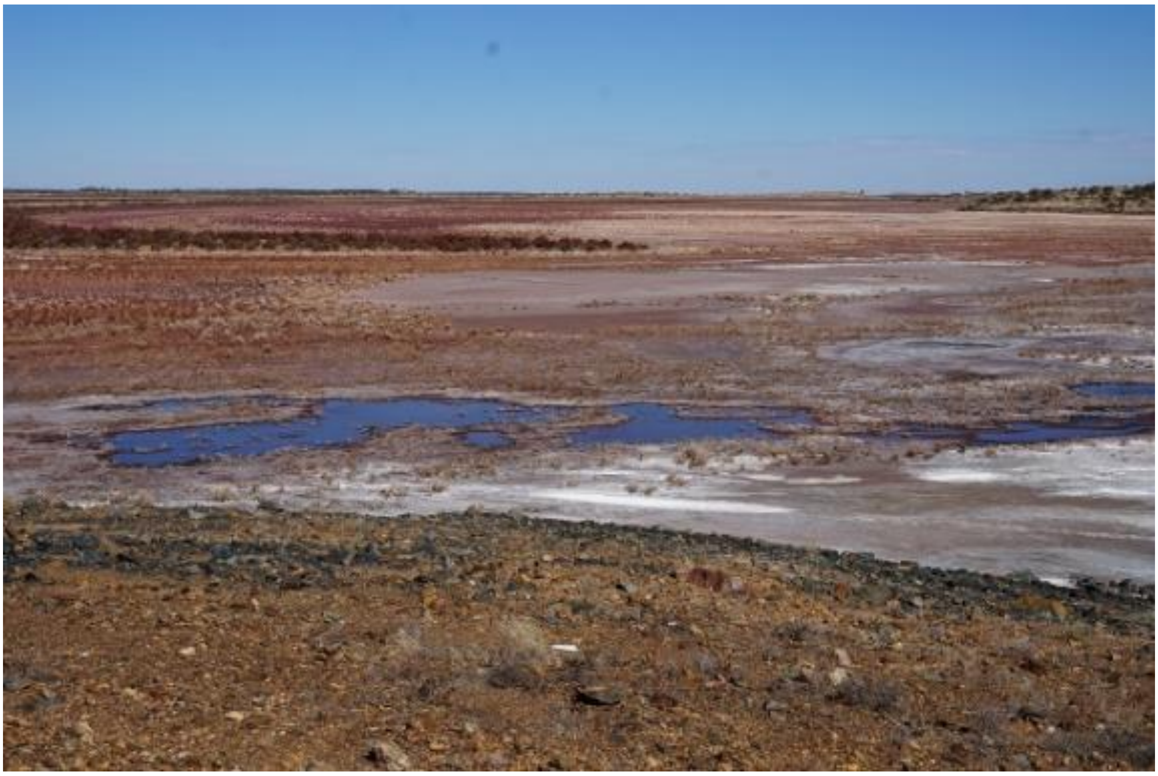

Plate 5. Samphire marsh in loam clay (VSA4) and Lake Miranda (VSA 5)

Plate 6. Degraded areas. Sparse shrubland with some tussock grass, scattered herbs on rocky loam, loam or overburden (VSA 6)

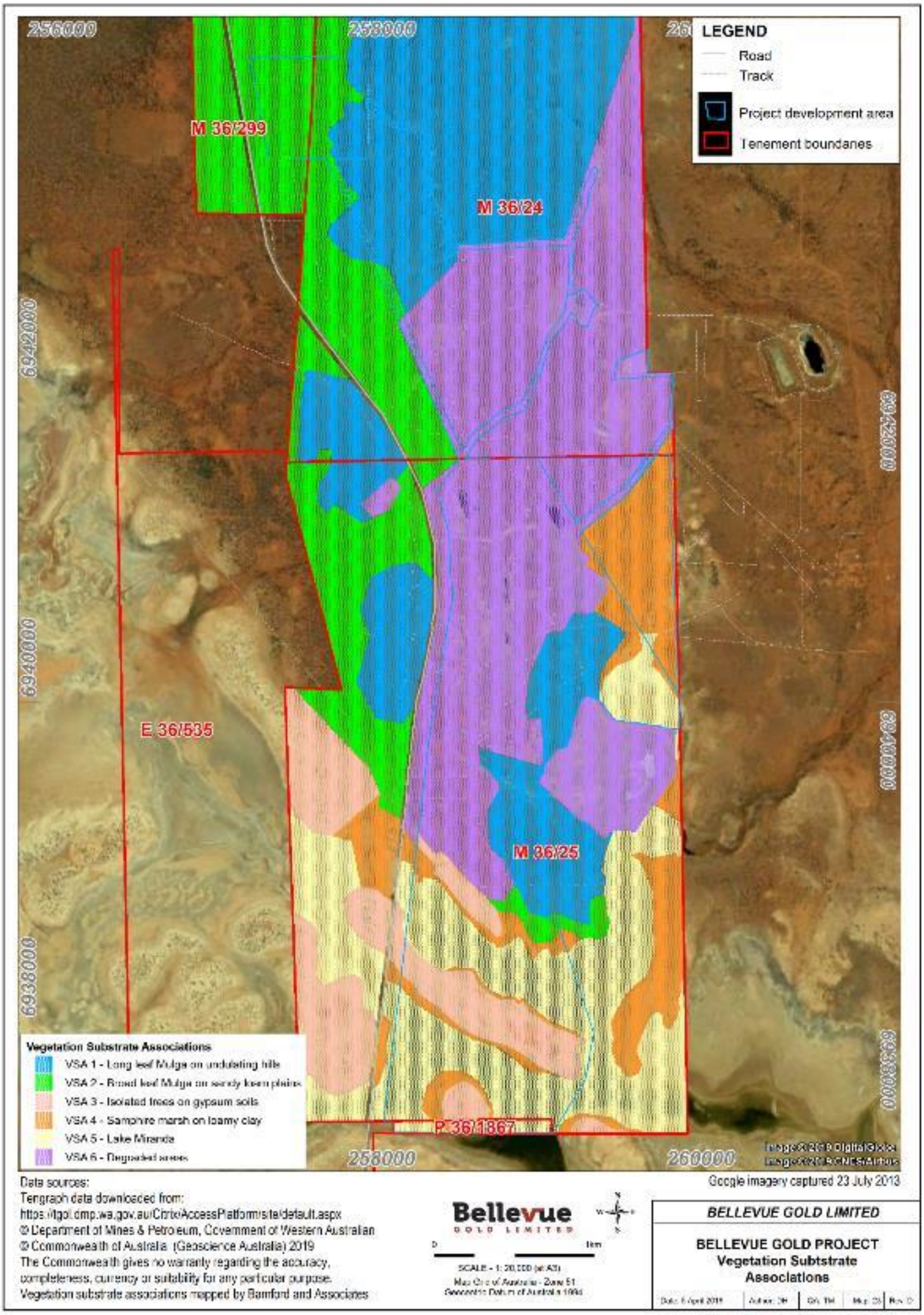

Figure 7. Vegetation and Substrate Associations within the development zone of the project area. Note that VSA1 is extensive in unmapped areas in the north, and VSA2 is extensive in unmapped areas west of the highway.

Kathleen Valley

Kathleen Valley is a proposed pipeline corridor that passes largely through VSA2. In the north, it lies in a broad valley between low, rocky hills (VSA1) and alongside a drainage line. It passes through VSA2 alongside the Goldfields Highway and along much of the Cosmos Haul road before entering VSA1 in the east. Details of the vegetation and corresponding images (photo points were taken every 300 to 400m on both sides of the corridor-see Figure 6) are described below with representative photographs in Plates 7 to 13.

Plate 7. Ironstone plain with dense mulga along drainage line (VSA 1 -257345E, 6948506N).

Plate 8. Sparse shrubs on gravelly slope (VSA 1 - 257345E, 6948836N).

Plate 9. Dense mulga in creekline with mixed shrubs on ironstone lower slope (VSA 1 - 257065E, 6947970N).

Plate 10. Mulga shrubland with tussock grasses on sandy loam
(VSA 2 - 256681E, 6947536N).

Plate 11. Sparse mulga with eremophila over dense tussock grasses on sandy loam (VSA 2 - 256880E, 6946314N).

Plate 12. Mulga shrubland with tussock grasses on loam (VSA 2 -257113E, 6945805N).

Plate 13. Dense tall mulga over mixed shrubs on rocky/gravelly rise (VSA 2 - 257137E, 6945171N).

3.2 Fauna

3.2.1 Overview of fauna assemblage

The desktop study identified 269 vertebrate fauna species as potentially occurring in the survey area (Table 8 and Appendix 5): 10 frogs, 70 reptiles, 153 birds, and 28 native and eight introduced mammals. The assemblage includes 35 species of conservation significance (Section 3.3.2). Note that this assemblage originates from databases and includes species that may occur occasionally in the survey area, but for which it is not important (such as birds that rarely fly overhead). Many species may also occur as vagrants at the site. Some species occur in the region but have specific habitat requirements that are not present in the project area. In particular, spinifex grassland (*Triodia sp.*) is not present within the project area and therefore spinifex specialist fauna would be unlikely to occur regularly on site. Species returned from databases that are unlikely to occur due to habitat requirements, and species considered to be extinct in the survey area, have been removed from the expected species list and are displayed in Appendix 5. Appendix 7 presents an annotated species list with notes on observations of each species in the project area.

The field investigation in 2018 confirmed the presence of 100 vertebrate fauna species including: one frog, 29 reptiles, 58 birds and 12 mammals (eight native and four introduced). The 2019 investigations confirmed the presence of just nine additional species (2 reptiles, 6 birds and one mammal). The confirmed assemblage therefore consists of 110 species: one frog, 32 reptiles, 64 birds and 13 mammals (nine native and four introduced). Two species of conservation significance were confirmed present: the schedule 1 listed migratory wetland shorebird, the Sharp-tailed Sandpiper and the locally significant (schedule 3) Australian Bustard. All fauna records have been compiled in the fauna list in Appendix 5; this includes observations made during the field investigation in 2018.

Frogs. Up to 10 species (1 confirmed) may be present in the area and are considered resident, although adults may leave the survey area to breed in other areas. *Litoria rubella* was recorded in 2018 (but only around the Bellevue Camp) however no frogs were recorded in 2019. All the frog species rely on seasonal freshwater for breeding and are therefore sensitive to changes in hydrology and water quality. Detection of frog presence was unlikely during the field investigation due to the dry conditions. No frogs of conservation significance are expected to occur.

Reptiles. Up to 70 species are known from the general area, but distributions can be patchy and therefore not all 70 species may be present in the project area. The virtual absence of spinifex (*Triodia* spp.) is likely to mean that a whole suite of spinifex-dependent lizards is scarce or absent. Of the 32 species confirmed, 14 were found only by searching (including head-torching) and just 11 were found only by trapping. The large contribution of results from searching means that a species accumulation curve cannot be used to predict the actual number of species present, but no additional species were added by trapping after the fifth night in October 2018, and only one species was added to the overall list by the trapping carried out in October 2019. The other species added to the overall list in 2019 was observed only. The overall total of 32 species was reached on the fourth field day in October 2019. This does suggest a total assemblage of <40 species, but conditions were dry and therefore levels of abundance may have been low. The Great Desert Skink *Liopholis kintorei* (CS1: Vulnerable) and the Black-headed Worm-lizard *Aprasia picturata* (CS3) are the only reptiles of conservation significance returned from databases that may occur in the project area, but neither was recorded and neither seems likely to be present. They are discussed further below (Section 3.3.2).

Birds. Up to 153 species may be present, of which 72 are classed as residents, 34 regular visitors, 32 irregular visitors and 15 Vagrants. The majority of the 64 species confirmed are residents and all but six were recorded in October 2018. The salt-lake system of Lake Miranda provides a foraging resource for some waterbirds and shorebirds during times of inundation; some species may also breed there. Waterbirds were reported by staff to be abundant at Lake Miranda following summer rains (2017/2018) and were likely to include several duck species (e.g. Grey Teal, Australian Shelduck and Australian Wood Duck), stilts, avocets, terns and herons. During the August site visit, Common Greenshank, Black Swan and Red-capped Plover were recorded using the salt-lake.

Mammals. The mammal assemblage is depauperate with several locally extinct species including the Chuditch, Boodie (Burrowing Bettong) and several bandicoot species (Appendix 5). Abandoned Boodie warrens were found to be abundant, indicating that the species had formerly been common in the area. Twenty-eight native mammals and eight introduced mammal species may occur in the survey area, but only eight native species were confirmed during field investigations. The terrestrial mammal fauna, and in particular small species, was virtually absent. This is likely to be the result of annual and seasonal conditions being extremely dry, as the populations of many terrestrial mammals decline in poor periods. Six mammals of conservation significance occur in the region (Table 6).

The key features of the fauna assemblage expected in the project area are:

- Uniqueness: The assemblage is likely to be typical of the region, and due to the project's location the assemblage is expected to include elements of the Murchison and arid interior, and with some fauna species expected occur near the extreme edge of their range. Previous assessments by BCE and other consultants in the region have confirmed a rich regional assemblage but the virtual absence of spinifex (*Triodia*) may reduce the numbers of reptile species present in particular.
- Completeness: The assemblage is likely to be incomplete due largely to the loss of some mammal species (e.g. critical weight range species). Many of the species expected may only utilise the area occasionally, when conditions are suitable (e.g. nomadic or migratory birds at Lake Miranda), and therefore it would take multiple surveys over several years to confirm the majority of the assemblage.
- Richness: The assemblage is likely to vary annually and seasonally according to climatic conditions. The assemblage is considered to be moderately rich, due to the range of substrates within the study area, but would be richer still if spinifex (*Triodia*) was present.

Table 8. Composition of the vertebrate fauna assemblage in the survey area; number of species confirmed in brackets.

Taxon	Number of species	Number of species in each status category				
		Resident	Migrant or regular visitor	Irregular visitor	Vagrant	Locally extinct
Frogs	10 (1)	10 (1)	-	-	-	-
Reptiles	70 (32)	69 (32)	1	-	-	-
Birds	153 (64)	72 (46)	34 (13)	32 (5)	15	-
Native Mammals	28 (excluding locally extinct) (9, including 5 bats)	24 (6)	2 (2)	2	1	9
Introduced Mammals	8 (4)	6 (4)	1	-	-	-
Total	269 (110)	181 (90)	38 (16)	34 (5)	16	-

3.2.2 Fauna of conservation significance

Thirty-five vertebrate species of conservation significance may occur in the survey area, with the majority of these being wetland birds classed as CS1 (Table 9 and Appendix 5). Note that the expected species assemblage is based largely on database records and on a greater than 20 km radial buffer zone, which can include environments not represented within the survey area. Species for which there is no habitat in the survey area have not been included, but could be very rare vagrants (and could include birds that overfly the site).

Species classed as CS1 are those listed under legislation (EPBC Act and WA Biodiversity Conservation Act), while those classed as CS2 are listed as Priority by the Department of Biodiversity Conservation and Attractions (DBCA), but not listed under legislation. The CS3 class is more subjective, but includes locally significant species that have declined extensively in an area due to natural or human-induced impacts, and species that occur at the edge of their range. This makes their presence in the survey area significant as populations on the edge of a species' range are often less abundant and more vulnerable to extinction than populations at the centre of the range (Curnutt *et al.* 1996).

A summary of the conservation significant species and their predicted occurrence in the survey area is provided in Table 10. Species or groups of species which are at least irregular visitors are discussed below. The only conservation significant species actually recorded during field investigations were the Common Greenshank (CS1), Sharp-tailed Sandpiper (CS1), and three species of local significance (CS3): Sandplain worm-Lizard, Australian Bustard and Bush Stone-curlew.

Table 9. Composition of extant conservation significance of the vertebrate fauna assemblage expected and recorded in the project area; number of species confirmed are in brackets.

Taxon	Conservation Significant fauna			
	CS1	CS2	CS3	Total
Frogs	-	-	-	0
Reptiles	1(0)	-	2(0)	3 (0)
Birds	18(2)	1(0)	8 (2)	27 (4)
Native Mammals	1(0)	2(0)	2(0)	5
Introduced Mammals	-	-	-	-
Total	20	3	12	35

Table 10. Conservation significant species expected to occur in the survey area.

Species	Common Name	Conservation significance	Recorded	Predicted status
Reptiles				
Liopholis kintorei	Great Desert Skink	CS1 (V,S3[v])		Vagrant
Aprasia picturata	Black-headed Worm-Lizard	CS3		Vagrant
Aprasia repens	Sandplain Worm-Lizard	CS3	X	Resident
Birds				
Leipoa ocellata	Malleefowl	CS1 (V,S3[v])		Irregular, non-breeding Visitor
Lophoictinia isura	Square-tailed Kite	CS3		Irregular visitor
Falco hypoleucos	Grey Falcon	CS1 (S3[v])		Vagrant
Falco peregrinus	Peregrine Falcon	CS1 (S7)		Irregular Visitor
Ardeotis australis	Australian Bustard	CS3	X	Regular visitor
Up to 10 waterbird species	See Appendix 5.	CS1 (M)	X*	Regular/Irregular Visitors, Vagrants
Burhinus grallarius	Bush Stone-curlew	CS3		Regular Visitor
Cacatua leadbeateri	Major Mitchell's Cockatoo	CS3		Vagrant
Neophema splendida	Scarlet-chested Parrot	CS3		Irregular Visitor
Polytelis anthopeplus	Regent Parrot	CS3		Irregular Visitor
Polytelis alexandrae	Princess Parrot	CS1 (V,P4)		Irregular Visitor
Pezoporus occidentalis	Night Parrot	CS1 E,S1 [ce]		Vagrant
Apus pacificus	Fork-tailed Swift	CS1 (M)		Regular Visitor
Amytornis striatus striatus	Striated Grasswren	CS2 (P4)		Vagrant

Acanthiza iredalei iredalei	Slender-billed Thornbill (Western)	CS3		Regular Visitor
Stipiturus ruficeps	Rufous-crowned Emu wren	CS3		Vagrant
Conopophila whitei	Grey Honeyeater	CS3		Irregular Visitor
Mammals				
Dasycercus blythi	Brush-tailed Mulgara	CS2 (P4)		Irregular Visitor
Antechinomys laniger	Kultarr	CS3		Resident
Sminthopsis longicaudata	Long-tailed Dunnart	CS2 (P4)		Resident
Petrogale lateralis	Black-flanked Rock-Wallaby	CS1 (E,S2[e])		Vagrant
Nyctophilus major tor	Central Long-eared Bat	CS2 (P3)		Resident
Pseudomys desertor	Desert Mouse	CS3		Irregular visitor
Invertebrates				
Kwonkan moriartii	Moriarty's Trapdoor Spider	CS3 (P2)		Resident

*Common Greenshank (August 2018) and Sharp-tailed Sandpiper (October 2019).
Conservation Significance codes:

- CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.
- EPBC Act listings (CS1 species): E = Endangered, V = Vulnerable, M = Migratory, Mar = Marine (Appendix 3).
- Wildlife Conservation Act listings (CS1 species): for all CS1 species S1 to 7 = Schedules 1 to 7 respectively, (Appendix 3) with IUCN listing in square parentheses: [e] = endangered, [v] = vulnerable, [ce] = critically endangered.
- DBCA Priority species (CS2 species): P1 to P5 = Priority 1 to 5 (Appendix 3).
- Species considered to be of local significance (CS3).

Conservation Significance Level 1

One reptile, 18 birds and one mammal are listed as conservation significance level 1.

Great Desert Skink

The Great Desert Skink is a large burrowing lizard, with a scattered distribution and is restricted to sandplain and gravelly habitats in the western desert's region of central Australia (DEE 2018b). It is known to have disappeared from former habitats, particularly in the Gibson Desert and Great Sandy Desert regions.

The Great Desert Skink occupies a variety of habitat types within the Western Desert region. They generally occur on hummock grass sandplains characterised by a dominant cover of Spinifex grasses e.g. *Triodia basedowii*. In the Tanami Desert and parts of the Great Sandy Desert, the Great Desert Skink also inhabits paleodrainage lines characterised by giant termite mounds and *Melaleuca* shrubs. The decline of the Great Desert Skink has been attributed to altered fire regimes and predation by introduced predators (DEE 2018b). The species has a clumped distribution which is influenced by fire regimes (McAlpin 1997) and is near the south-western extreme of its distribution (DBCA 2018).

The Great Desert Skink is probably absent from the project area as no evidence of the species was recorded during field investigations and no spinifex grassland is present. However, an old historical record exists approximately 30km north-east of the survey area at Wanjarri Nature Reserve (DBCA 2018).

Malleefowl

In Western Australia, Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca pauperiflora M. sheathiana*), Bowgada (*Acacia ramulosa var. linophylla*) and also in other dense litter-forming shrublands including Mulga shrublands (*Acacia aneura*) (Johnstone and Storr 2004). The species is threatened by the widespread clearing of habitat, habitat degradation (by fire and livestock) and fox predation (Benshemesh 2007).

Malleefowl have been recorded both north and south of the project area, including at Wanjarri Nature Reserve, Mt Keith, Wiluna and at Yeelirrie by BCE. At Yeelirrie Station, 10 to 20 breeding pairs are estimated to occur on the property (Benshemesh *et al.* 2008) and it is considered to be of high importance because it is one of the few examples known of a Malleefowl population in a low rainfall area.

Malleefowl habitat is present in the project area, but searching did not find any recent or even old mounds, and previous experience indicates that more than enough habitat was searched for mounds to be detected had they been present. It therefore seems likely that the species is not and has not been (at least in recent decades) a breeding resident, but it could still be at least an irregular visitor.

Grey Falcon

The species is infrequently recorded over much of arid and semi-arid Australia and occurs at low densities (BirdLife International 2018). The distribution of the Grey Falcon is centred on inland drainage systems and nests are usually in the tallest trees along watercourses (Garnett and Crowley 2000). Regional records occur at Wiluna, Lorna Glen and Wanjarri Nature Reserve (DBCA 2018). It is likely to occur as a vagrant to the project area but there is none of its favoured habitat present.

Peregrine Falcon

The Peregrine Falcon is classified as Specially Protected Fauna under Schedule 7 (Other Specially Protected Fauna) of the Wildlife Conservation Act. Blakers *et al*. (1984) consider that Australia is one of the strongholds of the species, since it has declined in many other parts of the world. The species is found in a wide variety of habitats, with its distribution often linked to the abundance of prey. The Peregrine Falcon lays its eggs in recesses of cliff faces, tree hollows or in large abandoned nests of other birds and pairs maintain a home range of about 20 to 30 km^2 throughout the year (BirdLife Australia 2018).

The Peregrine Falcon has been recorded at Wanjarri Nature Reserve (DBCA 2018) and along a cliff ledge in the Barr Smith Range (Bamford *et al.* 2011). The study area is likely to lie within the foraging territory of a pair but breeding is very unlikely due to the lack of substantial cliffs or large trees.

Migratory Wetland Birds – up to 10 species

This group includes several shorebird species such as plovers, sandpipers, Common Greenshank, and others known to occur locally and regionally over a wide variety of wetland habitats. All the shorebird species listed in Appendix 5 potentially occur within the survey area and/or Lake Miranda as a regular visitor, irregular visitor or vagrant. The Common Greenshank (one bird) was present in August 2018 and the Sharp-tailed Sandpiper was seen in dry chenopod shrubland in October 2019. Under ideal conditions, numbers of migratory waterbirds could be very high, although at such times many lakes in the greater region would be flooded and thus the birds could be widely dispersed. Species include:

Black-tailed Godwit	*Limosa limosa*	Vagrant
Common Greenshank	*Tringa nebularia*	Regular Visitor
Marsh Sandpiper	*Tringa stagnatalis*	Regular Visitor
Common Sandpiper	*Tringa hypoleucos*	Regular Visitor
Wood Sandpiper	*Tringa glareola*	Regular Visitor
Red-necked Stint	*Calidris ruficollis*	Regular Visitor
Pectoral Sandpiper	*Calidris melanotos*	Irregular Visitor
Sharp-tailed Sandpiper	*Calidris acuminata*	Irregular Visitor
Curlew Sandpiper	*Calidris ferruginea*	Vagrant
Oriental Plover	*Charadrius veredus*	Vagrant

Princess Parrot

The Princess Parrot occurs on red desert sandplains, dunes, along tree-lined watercourses and arid woodlands (DEE 2018b). The Princess Parrot is highly nomadic, with its occurrence sporadic through the arid interior. A specimen was collected in 1964 from Wanjarri Nature Reserve (DBCA 2018), and Biota (2017a) report an unconfirmed sighting in 2005 from environmental personnel at Mount Keith. The species is likely to be an irregular visitor to the survey area. It is an irregular visitor (sometimes at intervals of more than 20 years) to most sites in its range (Garnett and Crowley 2000), and movements are largely unknown (Higgins 1999).

Night Parrot

The Night Parrot is listed as Endangered under the EPBC Act and Critically Endangered under the WA Biodiversity Conservation Act. Habitat requirements for the species include areas of old-growth spinifex (*Triodia spp.*) for roosting and nesting, together with foraging habitats that are likely to include various native grasses and herbs, including around salt lakes, and that may or may not contain shrubs or low trees (DPaW 2017).

A targeted Night Parrot survey was conducted for BHP Billiton's Mount Keith Satellite Proposal (approximately 20 km north of the survey area) and adjacent Wanjarri Nature Reserve but did not record the species (Biota 2017b). The detection of Night Parrot calls was the main objective for establishing Solo audio recorders in the project area in October 2018. These were set up for 11 nights and no calls were recorded. The virtual lack of spinifex around Lake Miranda makes it unlikely the species is present, but the Night Parrot may potentially occur as a vagrant in the survey area.

Fork-tailed Swift
The Fork-tailed Swift is a non-breeding summer visitor to Australia. It is a largely aerial species of unpredictable occurrence and mostly independent of terrestrial environments.

Black-flanked Rock-Wallaby
The Black-flanked Rock-Wallaby has declined over much of its range and now occurs in only a few scattered populations across Western Australia, with very few known from the arid zone. The main factors threatening Rock-Wallaby populations are competition/habitat degradation due to introduced herbivores and over-abundant native herbivores, predation from introduced predators and habitat degradation (Pearson 2013).

Scats collected from a cave within the Barr Smith Range by Bamford and Turpin (2015) were confirmed as the Black-flanked Rock-Wallaby (*Petrogale lateralis*), and most likely the sub-species *P. l. lateralis*. Scats were also collected and camera trapping conducted at the Mt Keith Satellite Proposal situated north of the survey area but did not identify the species (Biota 2017a).

The Black-flanked Rock-Wallaby relies on behavioural (occupying caves and exhibiting nocturnal foraging activity) rather than physiological responses for survival during adverse conditions (Bradshaw *et al*. 2001; King and Bradshaw 2008). As a result, sites containing permanent water (such as along the Barr Smith Range) can be important for the species in the arid zone, allowing animals to occupy sub-optimal habitat with inferior thermal refuge (Pearson 2013). While much of the rocky habitat along the Barr Smith Range appears marginal, the presence of scattered waterholes in association with caves and rock crevices may allow the species to persist.

While not expected to be resident in the survey area (due to the lack of rocky and breakaway environments), the species may persist in the rocky habitats of the southern Barr Smith Range (south of Mount Keith) and south of Wanjarri Nature Reserve, so could be a vagrant in the project area.

Conservation Significance Level 2

Striated Grasswren
The sandplain sub-species of the Striated Grass- has disappeared from the southern fringes of its historical range (Western Central and Southern Inland Australia (BirdLife International 2018) and has declined in density over the remainder of its range (Garnett and Crowley 2000). Striated Grasswrens occur on sandplains dominated by mature *Triodia* hummock grassland with an overstorey of shrubs, usually mallee Eucalypts. Fire is recognised as a major threat throughout this sub-species' range (Garnett and Crowley 2000). The Striated Grasswren has been recorded from the Wanjarri Nature Reserve and while the project area lacks suitable spinifex, the species could still occur as a vagrant.

Brush-tailed Mulgara
The Brush-tailed Mulgara has recently been separated from the similar Crest-tailed Mulgara which is known from the desert regions along the border between the Northern Territory and South Australia. The species is widely distributed in arid regions of the central and western parts of the

country (Woolley 2008). It occurs in scattered populations at fairly low density, but may be locally abundant. The density of Brush-tailed Mulgara populations fluctuates depending on long-term climatic conditions and is also sensitive to fire (Woolley 2008). The species occupies spinifex (*Triodia spp.)* grasslands, and burrows in flats between sand dunes.
The Brush-tailed Mulgara was recorded extensively at Yeelirrie in spinifex sandplains (Bamford *et al.* 2011; Bamford and Turpin 2015). The species has also been recorded at Mount Keith and Wanjarri Nature Reserve. Spinifex grassland is not present in the survey area and therefore the species may only be an irregular visitor.

Long-tailed Dunnart
The Long-tailed Dunnart appears to be a specialist of rocky habitats and has a probably fragmented distribution from the Pilbara and northern Murchison into the southern Northern Territory and northern South Australia (van Dyck and Strahan 2008). Possible threats include habitat alteration due to introduced herbivores e.g. cattle and rabbits, inappropriate fire regimes, invasion by Buffel Grass, and predation by cats and foxes (Pavey 2006). Although associated with rocky environments, it has been recorded near Wiluna by BCE in an area of small rocky hills similar to those of the Violet Range, and thus can be considered a potential resident in the project area.

Central Long-eared Bat
The distribution, the Central Long-eared Bat is poorly-known but populations occur in the Dundas, Jilbadji and Mt Manning Nature Reserves in Western Australia (DBCA 2018). The Central Long-eared Bat was recorded during field surveys at Yeelirrie (c.a. 60 km north-west) (Bamford *et al.* 2011). The Central Long-eared Bat is likely to be resident in the survey area, probably favouring Mulga areas where suitable tree hollows provide shelter.

Moriarty’s Trapdoor Spider
Documenting the invertebrate assemblage is beyond the scope of a level 2 investigation, but one invertebrate species of conservation significance (CS2, Priority 2 by DBCA) has been documented in the general area, Moriarty's Trapdoor Spider *Kwonkan moriartii*. The species was recorded approximately 15 km north of the survey area and Wanjarri Nature Reserve (DBCA 2018), it was not recorded during the field investigation and site inspection but is assumed to be resident in the absence of other information.

<u>Conservation Significance Level 3</u>

One reptile, nine birds and two mammals are listed as conservation significance level 3.

Black-headed Worm-Lizard *Aprasia picturata*
This pygopod species has been collected and described by Smith and Henry (1999) and is known from the vicinity of Leonora and Wiluna. *Aprasia picturata* has been recorded 35 km east of Leonora, and three and a half kilometres south of Minara homestead (Smith and Henry 1999). At these locations, Smith and Henry (1999) recorded the species from a low greenstone ridge with pockets of sandy loam supporting a mixed *Acacia* shrubland and a low rocky ridge with sparse *Acacia* and *Eremophila* shrubs. It is considered to be locally conservation significant due to its limited distribution and specialised habitat requirements (Wells 2007). Although the environments

where it has been recorded do not completely fit those of the project area, it is considered that it may occur nearby and individuals may occasionally be present.

Sandplain Worm-Lizard ***Aprasia repens***

Several specimens of this small legless-lizard were caught in pitfalls set near bushes in VSA3 (open shrubland on calcrete/gypsum soils on the margin of Lake Miranda). This is a range extension of several hundred kilometres and an atypical habitat for the species, which is usually on near-coastal sands of the South-West, so the population can be considered locally significant. One specimen was sent to the WA Museum for further analysis and initial feedback returned a positive identification for *A. repens,* with a note that genetic analysis may be required in future as several other inland specimens have been recorded and may represent an undescribed taxon.

Square-tailed Kite

The Square-tailed Kite is sparsely distributed over much of Australian mainland, with a few scattered records from Wanjarri Nature Reserve and Lake Mason (BirdLife Australia 2018) and Yeelirrie Station (Bamford and Turpin 2015). The species is a specialised predator of small birds taken from the canopy, foraging primarily over forest, woodland, mallee and heath (Garnett and Crowley 2000). It is likely to be an irregular visitor to the project area.

Australian Bustard

The Australian Bustard is associated with a variety of grassland, grassy woodland and shrubland habitats across Australia, but has declined in the south. It was formally listed as a priority species by the DBCA. The main threats to its survival are a combination of habitat loss/degradation and predation by introduced fauna (e.g. feral Cats and Foxes). The Australian Bustard has been previously recorded from Yeelirrie Station, Wanjarri Nature Reserve and Cosmos (BirdLife Australia 2018) and one sighting in the project area was made in October 2019.

Bush Stone-curlew

The ground-dwelling Bush Stone-curlew inhabits lightly timbered open woodlands and dense *Acacia* shrublands including along drainage lines (J. Turpin, pers. obs.). It is also known to occur in dense *Acacia* shrublands on Banded Ironstone ridges such as at Weld Range (J. Turpin and M. Bamford, pers. obs.). This species has suffered significant declines and is now sparsely distributed in the southern parts of Western Australia; it was formerly listed as a priority species by the DBCA and records in the south of its range are still very unusual. It has been recorded at Wanjarri Nature Reserve (BirdLife Australia 2018) and is likely to be a regular visitor in the survey area.

Bellevue staff members reported the wailing nocturnal calls of Bush Stone-curlew a few weeks prior to the field investigation in 2018. The observations were made at the accommodation quarters on site.

Major Mitchell's Cockatoo

The Major Mitchell’s Cockatoo was formerly more widespread and is patchily distributed across its range. It may occur in woodland, sparsely timbered grasslands and shrublands, and rocky outcrops (BirdLife Australia 2018). It has previously been recorded at Yeelirrie Station, with a small flock seen in Mulga shrubland (anon. 1978). The species is likely to be a vagrant to the project area.

Scarlet-chested Parrot

The Major Mitchell's Cockatoo was formerly more widespread and is patchily distributed across its range. It may occur in woodland, sparsely timbered grasslands and shrublands, and rocky outcrops (BirdLife Australia 2018). It has previously been recorded at Yeelirrie Station, with a small flock seen in Mulga shrubland (anon. 1978). The species is likely to be a vagrant to the project area.

Scarlet-chested Parrot

The Scarlet-chested Parrot has declined over much of its range, formerly occurring across the Murchison and into the south-west of Western Australia. This species has also declined in the Goldfields (Garnet and Crowley 2000). Most recent records for the Scarlet-chested Parrot come from arid inland Australia including the Great Victoria Desert. This species has been recorded from the Wanjarri Nature Reserve and is likely to be an irregular visitor to the survey area.

Regent Parrot

The Regent Parrot has been identified by Saunders and Ingram (1995) as one of a number of south-west Australian woodland bird species recognized as declining. It is at the extreme north of its range in the region and is a rare visitor to Wanjarri Nature Reserve. The species is likely to be an irregular visitor to the survey area.

Slender-billed Thornbill

The western sub-species of the Slender-billed Thornbill was formerly listed as Vulnerable under the EPBC Act, however, in 2013 it was removed from the list of threatened taxa. A South Australian sub-species remains listed. The Slender-billed Thornbill occurs in shrubland, typically in areas of saltmarsh dominated by samphire, bluebush (*Maireana spp*.) or saltbush (*Atriplex spp*.) around salt lakes, or in low heath on sandplain. The species occurs in a number of disjunct populations in Western Australia, from Shark Bay to the Nullarbor (Johnstone and Storr 2004). The species is declining in much of its range owing to the degradation of chenopod vegetation by livestock and rabbits (Johnstone and Storr 2004).

The Slender-billed Thornbill has been recorded to the west of the survey area near Cue and Mount Magnet (BirdLife Australia 2018). The species was recorded in 1978 at a salt lake near Sir Samuel, in low, dense samphire shrubland with occasional taller patches. The fringes of Lake Miranda contain Chenopod shrubland and provide ideal habitat for Slender-billed Thornbill, with low, dense samphire and occasional taller patches. Targeted transects undertaken during the field investigation in 2018 and 2019 (Figures 3 and 4) did not confirm their presence in saltmarsh fringes of Lake Miranda. The species may still be a regular visitor at the site.

Rufous-crowned Emu wren

The Rufous-crowned Emu-wren has a fragmented population in northern and central Australia and is generally uncommon. It is patchily distributed, with Wanjarri, where it has been recorded (DBCA 2018), near the limit of its range. The Rufous-crowned Emu-wren is associated with tall, dense spinifex and long-unburnt mature hummock grasslands, which are not present in the survey area. The species is considered to be a vagrant in the area.

Grey Honeyeater

The Grey Honeyeater is uncommon throughout the Murchison and Pilbara, being recorded from a few, scattered localities (BirdLife Australia 2018). This species inhabits *Acacia* woodlands and shrublands, particularly those dominated by Mulga (*Acacia aneura*), across arid central Australia. The Grey Honeyeater has been recorded at Wanjarri Nature Reserve and north of the survey area (ATA 2005). It is likely to be at least an irregular visitor to the survey area as there is extensive suitable habitat.

Kultarr

The Kultarr occurs across central Australia extending into the Murchison. It prefers stony, granitic plains dominated by *Acacia*, *Eremophila* and *Senna* shrublands (Strahan 1995). The Kultarr is uncommon over most of its range, and populations appear to fluctuate seasonally (Strahan 1995). Some eastern populations are now considered extinct. The Kultarr appears to occur sporadically across the Murchison and has been recorded at Mount Keith and Wanjarri Nature Reserve (DBCA 2018). The Kultarr is considered resident in the project area as habitats appear suitable.

Desert Mouse

The Desert Mouse is a medium sized rodent (15–30 gram) that has a widespread distribution throughout the arid zone of Australia (Menkhorst and Knight 2010). It is considered locally abundant in habitats containing samphire, sedge, nitrebush or mature Spinifex grasslands (Alpers *et al.* 2003). The distribution of the species once extended from the Murray-Darling through the Flinders Ranges to the Gibson and Great Sandy Deserts, to the west coast and onto Bernier Island (Read *et al*. 1999, Menkhorst and Knight 2010). Since European colonisation there has been a contraction of the species' range to the central deserts (Kerle 1995, Read *et al*. 1999). In Western Australia, the Desert Mouse occurs in the Pilbara and the Central Deserts. The Desert Mouse is at the south-western extreme of its distribution, records come from near Wanjarri Nature Reserve and Mount Keith (DBCA 2018). The Desert Mouse is considered locally significant and may be resident.

SRE Invertebrates

The majority of invertebrates that were considered potentially SREs were collected in pitfall traps as bycatch. Several specimens were collected and sent to specialists (S. Judd for slaters, E. Volschenk for scorpions and Framenau for trapdoor spiders) for identification, and the results are presented in table 11. A different slater species was collected in each of the major VSAs, corresponding to rocky substrate (Site 2), sandy loam (Site 4) and gypsum (Site 8). One of these species, *Buddelundia labiata,* may be an SRE as it has only previously been collected in the Lake Miranda area and very recently (spring 2019; Bamford Consulting) Lake Way. In contrast, *Buddelundia* 45 and *Buddelundia* 96 have been collected 20-30km further north, and in the case of *Buddelundia* 96, also at a series of sites 50-105km further north.

The five scorpion species collected in 2018 are also mostly widespread, and also showed patterns related to VSA type. *Urodacus* sp. was noted as a possible SRE but in the absence of identification to species level additional specimens would be needed. This came from site 1 (VSA1) which is widespread in the region.

The single trapdoor spider (*Aname* sp.) was of a widespread genus which is undergoing taxonomic review and could not be identified to species.

No collection of subterranean fauna was undertaken, but two Priority Ecological Communities containing unique assemblages of invertebrates are documented in the area: the Lake Miranda east and Lake Miranda west calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station (DBCA 2019).

Table 11. Invertebrates collected.

Family	**Species**	**Site**	**Easting**	**Northing**	**Comments**
Isopods (slaters)					
Armadillidae	*Buddelundia labiate*	Site 2	258575	6943123	3 Males possible SRE
Armadillidae	*Buddelundia 45*	Site 4	258226	6939706	1 Male, 1 Female
Armadillidae	*Buddelundia 96*	Site 8	258001	6939566	7 Males, 1 Female
Scorpions					
Buthidae	*Isometroides* 'goldfields 1'	Site 1	257579	6943478	1 Male, not SRE
Buthidae	*Isometroides* 'goldfields 1'	Site 9	259910	6941265	1 Male, Considered widespread
Buthidae	*Lychas 'adonis'*	Site 1	257579	6943478	1 Male, Considered widespread
Buthidae	*Lychas jonesae*	Site 1	257579	6943478	1 Female, 1 Male, Considered widespread
Buthidae	*Lychas 'splendens'*	Site 7	258000	6939566	1 Male, Considered widespread
Buthidae	*Lychas 'splendens'*	Site 8	257760	6939820	2 Males, Considered widespread
Urodacidae	*Urodacus sp.*	Site 1	257579	6943478	1 Male, Possible SRE
Nemesiidae	*Aname sp.*	Site 3	258575	6943123	Adult male. Unlikely to be an SRE

3.2.3 Introduced Species

The desktop study identified eight introduced fauna species as potentially occurring in the project area (Table 12). The field investigations confirmed four of these species, with Rabbits particularly abundant on the margins of Lake Miranda.

Table 12. Introduced fauna species expected to occur in survey area.

Common Name	Latin Name	Expected Status	Recorded
MAMMALS			
House Mouse	*Mus musculus*	Resident	
Rabbit	*Oryctolagus cuniculus*	Resident	Y
Dog	*Canis lupus*	Resident	Y
European Red Fox	*Vulpes vulpes*	Resident	
Feral Cat	*Felis catus*	Resident	Y
Goat	*Capra hircus*	Resident	
Cow	*Bos taurus*	Resident	Y
Camel	*Camelus dromedarius*	Regular Visitor	

3.2.4 Patterns of biodiversity

Reptiles and birds

Investigating patterns of biodiversity can be complex and are often beyond the scope even of level 2 investigations, but it is possible to draw some general conclusions based upon the size of the study area, the trapping and censussing results, and the patterns of soils and vegetation across the landscape. Important patterns of biodiversity indicated by sampling data (discussed further below) are:

- High reptile species richness and abundance in the Broad-leaf Mulga over shrubs and tussock grass on sandy-loam plains (VSA 2);
- High bird species richness and abundance in VSAs including Mulga (VSAs 1 and 2);
- High bird species richness and abundance, when conditions suitable, in and around the margins of Lake Miranda; and
- High reptile species richness and abundance in low shrubland over gypsum dunes (VSA 3).

Remnant native vegetation across the site is patchy and fragmented in structure and composition. The fauna assemblage is likely to reflect this and vary across the VSA types. There are some areas of native vegetation in good condition, mostly west of the Goldfields Highway and in the north, along the Cosmos Haul Road and towards Kathleen Valley (although some degradation due to cattle in this area). Large parts of the project area where mining has taken place in the past are degraded with scattered vegetation over mine overburden. Clearly, degraded areas will be lower in biodiversity. Lake Miranda will attract a large number of waterbird species following major rains.

Some patterns of biodiversity between sites and VSAs can be interpreted from capture data for reptile and mammal trapping, bird censussing and opportunistic observations. Tables 13 and 14 provides a summary of capture data for each systematic sampling transect, while Tables 15 and 16 presents bird data. The fauna assemblage and associated VSA are discussed below.

Table 13. Trapping data from systematic sampling sites, October 2018.

VSA	2	1	1	2	2	6	3	3	4	**Total captures**
Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	
Diplodactylus granariensis rex			1				1			**2**
Diplodactylus pulcher			1			2				**3**
Gehyra variegata		1					1	1		**3**
Heteronotia binoei							3	7		**10**
Nephrurus vertebralis	1				2					**3**
Strophurus strophurus			1	2			3			**6**
Underwoodisaurus milii							5	2		**7**
Aprasia repens							1	1		**2**
Pygopus nigriceps	1									**1**
Ctenophorus nuchalis				1						**1**
Ctenotus leonhardi	1			4		1				**6**
Eremiascincus richardsonii								3		**3**
Lerista desertorum	3			1			1	1		**6**
Lerista timida	2	2	1		8		3	1		**17**
Menetia greyii		1			2		10	2		**15**
Anilios hamatus					1					**1**
Anilios waitii								1		**1**
Total species	**5**	**3**	**4**	**4**	**4**	**2**	**9**	**9**	**0**	
Total captures	**8**	**4**	**4**	**8**	**17**	**3**	**37**	**28**	**0**	**109**

Table 14. Trapping data from systematic sampling sites, October 2019.

VSA	2	2	2	1	2	1	**Total captures**
Species	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	
Gehyra variegata		1	1				2
Heteronotia binoei						2	2
Nephrurus vertebralis		1			8		9
Strophurus strophurus	1	1					2
Rhynchoedura ornata		2	2			1	5
Ctenotus leonhardi		1	1				2
Lerista desertorum			1				1
Lerista timida	4	6		1	1		12
Menetia greyii				1			1
Total species	**2**	**6**	**4**	**2**	**2**	**2**	
Total captures	**5**	**12**	**5**	**2**	**9**	**3**	**36**

The trapping data (Table 13) provide a measure of species richness and abundance of small reptiles across the sites. No mammals were captured; in our experience of many decades of conducting this sort of sampling, such an outcome is unique. As a group the small mammal ground fauna is clearly depauperate. This is presumably due to current dry conditions, but the lack of spinifex may reduce richness and abundance. There was a single record of a small mammal, the Spinifex Hopping Mouse *Notomys* alexis, but only from an active burrow (Figure 4).

Numbers of species and captures in 2018 were generally higher than in 2019, suggesting an ongoing decline in abundance, but some VSAs consistently had richer and more abundant reptile assemblages than others. The richest reptile assemblage with the highest levels of abundance was the Gypsum dunes (Sites 7 and 8; VSA 3). In combination, these two sites recorded 11 reptile species, of which five were not recorded elsewhere. In addition, nocturnal searching at this site recorded one gecko species, *Diplodactylus conspicillatus,* and Rosen's Snake *Suta fasciata*, that were not found elsewhere. The Salt Lake Dragon *Ctenophorus salinarium* was captured in samphire on the edge of the gypsum dunes west of site 8. This dragon species exclusively inhabits samphire habitats adjacent to salt lakes and clay pans in arid and semi-arid environments (Wilson and Swan 2013. Among the species recorded only in this VSA was the Sandplain Worm-Lizard which may represent an undescribed taxon.

Heavy red sandy soils with an overstorey of broad-leaf mulga (VSA2; Sites 1, 4 and 5 in 2018; Sites 10. 11, 12 and 14 in 2019) were also rich in species except where there was degradation by cattle (particularly site 10). Among reptiles confined or largely confined to this VSA were fossorial species adapted to move through soil and leaf litter. Short limbed skinks *Lerista desertorum, L. timida* and the legless lizard *Pygopus nigriceps* are adapted to loams and sands with a Mulga overstory (Wilson and Swan 2013) and were confirmed present in this VSA. It was also the only VSA where the gecko *Nephrurus vertebralis,* also a sand specialist, was recorded. *Ctenophorus isolepis* and *Varanus gouldii* are also associated with sandy substrates and were opportunistic observations in this VSA at site 1.

Rocky hills with narrow-leaf mulga and sparse tussock grass (VSA1; Sites 2, 3 and 6 in 2018; Sites 13 and 15 in 2019) generally had low numbers of captures and species. Several geckoes appeared to be restricted to this VSA. Sampling in creeklines within this VSA (parts of sites 13 and 15) did not result in unusual captures, but this may reflect the poor conditions. The larger vegetation along minor creek lines within this VSA may provide habitat for small vertebrates and invertebrates, and small hollows and cracks in mature Mulga provide refuge for several species. Moreover, water will pool and persist in these creek lines after rainfall, creating important localised water points.

Samphire adjacent to Lake Miranda (VSA 4) was represented by one trapping location at site 9 in 2018. The samphire habitat was very exposed with a shrubland height of approximately 30cm. This trap site yielded no vertebrate captures which in our experience of many decades of conducting this sort of sampling, is extremely unusual. It suggests a very depauperate ground fauna.

Degraded areas (VSA 6) covered large expanses through the central part of the project area. Site 6 in 2018 was a typical representation of the degraded rocky hill environment with trapping resulting in small numbers of captures of just two species: *Ctenotus leonhardi* and *Diplodactylus pulcher.* Nocturnal searches were undertaken in several degraded locations and found a few additional species. For example, the geckoes *Lucasium squarossum*, *Underwoodisaurus milii*, *Heteronotia binoei* and *Gehyra variegata* were recorded around Vanguard pit. This nocturnal searching was more successful in 2018 than 2019, further suggesting a decline in overall abundance.

Table 15. Bird census results from systematic sampling transects, October 2018.

VSA	2	1	1	2	2	6	3	3	4	**Total N records**
Species	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	
Crested Pigeon								1		1
Red-backed Kingfisher				3						3
Splendid Fairy-wren			3							3
White-winged Fairy-wren				3			1	5		9
Inland Thornbill					2					2
Chestnut-rumped Thornbill	4	4	11		7					26
Yellow-rumped Thornbill					3					3
Spiny-cheeked Honeyeater					1					1
Yellow-throated Miner	4			12	4	12	29	23	4	88
Singing Honeyeater	2			9	7	6	11	3		38
Crimson Chat								3		3
Crested Bellbird				1						1
Grey Shrike-thrush			1							1
Black-faced Woodswallow						4				4
Pied Butcherbird				2						2
Little Crow				2						2
Torresian Crow				7						7
Australasian Pipit								1		1
Red-capped Robin	1									1
Zebra Finch				5	4			27		36
Welcome Swallow						1			1	2
Total species	4	1	3	9	7	4	3	7	2	
Total birds/abundance	11	4	15	44	28	23	41	63	5	**234**

Table 16. Bird census results from systematic sampling transects, October 2019.

VSA	2	2	2	1	2	1	Total N Records
Species	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	
Crested Pigeon	1						1
Red-backed Kingfisher			1				1
Australian Ringneck	2						2
White-winged Fairy-wren	2	5					7
Chestnut-rumped Thornbill			4		2	5	11
Spiny-cheeked Honeyeater	2		1				3

VSA	2	2	2	1	2	1	Total N Records
Species	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	
Yellow-throated Miner	1	2	6	1			10
Singing Honeyeater	5	2	4				11
Willy Wagtail	1						1
Torresian Crow		2					2
Red-capped Robin						2	2
Zebra Finch			6				6
Total species	**7**	**4**	**5**	**1**	**1**	**2**	**12**
Total birds/abundance	14	11	22	1	2	7	**57**

Bird censussing on the systematic sampling transects recorded 21 species with a total number of records of 234 in 2018 (Table 15), with just 12 species and 57 records in total in 2019 (Table 16). This is a marked difference even with fewer sites in 2019 (five compared with nine sites in 2018), with much of the difference due to no sampling in VSA3 where a few species were very abundant. However, some species were less abundant in 2019 than in 2018 in the same VSA. For example, the Chestnut-rumped Thornbill was more abundant in VSAs 1 and 2 in 2018 than in 2019.

The abundance of Yellow-throated Miner and Singing Honeyeater was notable in sites 7 and 8 (VSA3) in 2018; they were observed feeding on nectar, with one Miner observed feeding on seed pods from flowering *Grevillia sarissa*. The low, open vegetation of VSA3 also provided suitable habitat for Crimson Chat and Australasian Pipit. Site 9 (VSA 4) recorded very low numbers of birds, but in areas of larger clumped samphire further to the south and west, several groups of White-winged Fairy-wrens were observed. In 2019, Site 10 was the only transect that included a small amount of VSA3 and it was the richest in bird species in that year.

Mulga woodlands (VSA 1 and 2) recorded several arid interior species expected to be seen in the region during censusing and opportunistic observations, including Chestnut-rumped Thornbill, Western Bowerbird, Mulga Parrot, Western Quail-thrush, White-plumed Honeyeater, Redthroat and Southern Whiteface. The Violet Range in the northern areas of the site recorded Hooded Robin, and both Grey-crowned and White-browed Babblers. Despite this, there was a lot of variation in species richness and abundance between sites in the same VSA. Some sites in either VSA1 or VSA2 were very poor in species and abundance, but the site with the highest bird richness and second highest abundance overall was Site 4 (VSA 2). This may be partly explained by the fact site 4 is surrounded by a range of different environments within close proximity: gypsum dunes (VSA 3) to the west; samphire shrubland (VSA 4) directly south, the aboriginal sacred site near Tribune (VSA 1) and degraded areas (VSA 6) to the north. This combination may have offered a variety of resources for bird species and transitions between environment are often important for birds.

Vanguard Pit consistently displayed large numbers of birds in areas above and in bushland directly to the north. White-backed Swallow, Fairy Martin, Black-faced Woodswallow and Little Woodswallow were regularly observed over the pit, while Zebra Finch, Crimson Chat, Variegated Fairy-wren and Mulga Parrot amongst others, were seen in dense vegetation north of Vanguard. The pit is saline so the attraction was not freshwater; at least some of the species utilise the rocky structures and it is possible that the earthworks around the pit have dammed subsoil water movement as some of the acacias in the area were unusual in that they were flowering and seeding, whereas elsewhere these species were not.

Bats

In 2018, bat species were detected by call frequency using two echolocation devices: Anabat Swift and Echo Meter 2 Pro. A total of 82 audio files was obtained containing at least one call sequence each of bats. Five species of bat were recorded from the Bellevue study area (see Tables 15 to 17). All are common and widespread in the region.

The Bellevue project area provides a range of natural and artificial environments for bats to roost. Old and disused mine shafts provide a suitable microclimate (humidity) for some bats (Moro 2018). Of the bats recorded, *Vespadelus finlaysoni* are known to roost in twilight areas of caves and rock crevices, and have been recorded in disused mines in mulga shrubland (Churchill 2008, Moro 2018). *Chalinolobus gouldii, Nyctophilus geoffroyi* and *Ozimops planiceps* are widespread and will roost in a variety of locations such as tree hollows, as well as human environments such as buildings (Churchill, 2008). *C. gouldii* was heard feeding several times in the late evening. The large *Austronomus australis* is also widespread and roosts in trees in a wide variety of environments. None of the species recorded is of conservation significance. Figures of Sonograms for species of bats recorded on site are presented in Appendix 6.

Table 17. Bat species recorded and call characteristics.

Parameters	Species				
	Chalinolobus gouldii	*Vespadelus finlaysoni*	*Nyctophilus geoffroyi*	*Ozimops planiceps*	*Austronomus australis*
Fmax (kHz)	41.8	78.9	68	26	14.0
Fpeak (kHz)	28.2	58.2	56.5	24.7	11
Fmin (kHz)	25.6	55.1	43.9	23	10
Dur (ms)	7.03	4.3	3.1	7.1	7.6

Table 18. Species recorded on the Anabat Swift and record dates

Night of	Location	Species				
		C. gouldii	*V. finlaysoni*	*N. geoffroyi*	*O. planiceps*	*A. australis*
26th Oct	Camp	✓	-	-	-	-
27th Oct	Vanguard Pit	No Calls				
28th Oct	Old mine workings	✓	-	-	✓	-

Table 19. Bat species recorded on the Echo Meter Pro and record dates

Night of	Location	Species				
		C.gouldii	*V.finlaysoni*	*N.geoffroyi*	*O.planiceps*	*A.australis*
23rd Oct	Camp	✓	✓	✓	✓	✓
25th Oct	Old mine workings	No Calls				
27th Oct	Vanguard Pit	✓	✓		✓	
31st Oct	Throughout site & along Goldfields Hwy	✓				

3.2.4 Ecological processes

The nature of the landscape and the fauna assemblage indicate some of the ecological processes that may be important for ecosystem function (see Appendix 4 for descriptions and other ecological processes). These include:

Fire. Fire is an integral part of regional ecosystems and is recognised as a factor in the dynamics of fauna populations in Western Australia (Bamford and Roberts 2003). In terms of conservation management, it is not fire per se but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity and leave pockets of unburnt vegetation can enhance biodiversity. Note that fire regime can interact with feral species in providing greater access to habitats and native fauna hence impacting on native fauna populations.

In the survey area, tussock grasslands are highly flammable and Mulga communities are fire sensitive. Grasses are highly flammable and are able to withstand high intensity fires by regenerating quickly from seed and rootstock following a fire event (Latz 1995). Mulga, however, is highly sensitive to fire and can be permanently removed by high intensity fires (mature Mulga trees and seedlings readily succumb to moderately intense fire and generally do not resprout). High intensity fires, repeat fire events or the lack of rainfall following a fire can deplete Mulga seed supply and cause long-term change (Bradstock *et al*. 2012). In the absence of traditional burning regimes adopted by indigenous Australians, large areas of fire-sensitive Mulga (including the associated animals and plants) can be replaced by grassland dominated communities (Bradstock *et al*. 2012).

The project area currently supports large areas of intact Mulga, suggesting fire have not been too-frequent in recent decades. It is important to maintain this. Some animal species are particularly sensitive to wildfires and altered fire regimes as they rely on long-unburnt environments to survive. Fauna in small and isolated reserves can be vulnerable to local extinction due to an inappropriate fire regime, and this may be a concern for the study area. Fire regimes post European settlement may have affected the abundance of the Greater Bilby, Brush-tailed Mulgara and Great Desert Skink, as they are known to be sensitive to changed fire regimes. The Striated Grasswren and Rufous-crowned Emu-wren are also sensitive to altered fire regimes and fire may also have an effect on reptile species richness and abundance in the area.

Feral species and interactions with over-abundant native species. The fauna assemblage of the survey area includes a range of feral species and the mammal fauna in particular has suffered as a result. Predation by feral species is a major factor in the decline of Australian mammals, including Bilby, Boodie and rock-wallabies (Burbidge and McKenzie 1989). There was clear evidence that the Boodie had formerly been abundant in the project area. The Fox is of greatest concern; Bilbies coexist with feral Cats in the Great Sandy Desert (M. Bamford pers. obs) and rock-wallabies persist with Cats in the Pilbara, but feral Cats have been implicated in the failure of attempts to reintroduce the Bilby (Miller *et al*. 2010). The Fox is likely to be present in the survey area and cats were recorded. Any management programme to improve the condition of the environment in the region for rare mammals would need to include a feral predator control strategy. Management of Dingoes (also recorded) would need to be included in this plan, as the presence of Dingoes in the survey area can suppress the numbers of Foxes and feral Cats, but the Dingo is also an efficient predator. Rabbits and cattle were recorded however Goats and Camels may occur in the survey area and also cause widespread damage to vegetation and habitat.

Local hydrology. Surface and sub-surface hydrology may be complex at the site, particularly the interaction with Lake Miranda. There are also two subterranean fauna assemblages (Lake Miranda east and west calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station) that are likely to be supported by current hydrological patterns. Drainage patterns in the rocky hills (Violet Range) and Kathleen Valley support dense vegetation in valleys and where drainage moves out onto sandier soils, and these patterns are likely to support local concentrations of fauna.

Connectivity and landscape permeability. The project area lies in a largely intact landscape despite a long history of mining and degradation in some areas. For fauna, connectivity may be important where there are linear VSAs such as the gypsum dunes around Lake Miranda. Drainage lines in the rocky hills such as around Kathleen Valley may also facilitate fauna movement across the landscape.

3.2.5 Summary of fauna values

The desktop study identified 269 vertebrate fauna species as potentially occurring in the survey area (see Table 10 and Appendix 5): 10 frogs, 70 reptiles, 153 birds and 36 mammals (28 native and eight introduced species). The assemblage includes up to 35 species of conservation significance. The field investigations in 2018 and 2019 confirmed the presence of 110 species: one frog, 32 reptiles, 64 birds and 12 mammals (eight native and four introduced). Fauna values within the survey area can be summarised as follows:

Fauna assemblage.
Rich and substantially intact except for the loss of some, mostly medium-sized, mammal species and some birds, but the reptile assemblage may be almost intact. Overall, the fauna assemblage is likely to be well-represented in the region but is incomplete due to local species loss, and it is only moderately rich due to this extinction. The survey area is likely to contain only a subset of the fauna assemblage predicted for the entire region, particularly due to the absence of spinifex that

provides habitat for a number of species. The number of species confirmed is low due to dry conditions in the preceding two years.

Species of conservation significance.
This list includes up to 35 species (three reptile, 27 bird and five mammal species). Some of the significant species expected to be present are widespread and occur in very extensive regional landscapes. The majority of significant species recorded from the desktop review are probably not present, or at least occur only irregularly or as vagrants. This includes the Great Desert Skink, Malleefowl, Night Parrot and Black-footed Rock-Wallaby. Not even old Malleefowl mounds were found, suggesting the species has not recently (within half a century or more) been a breeding resident. Similarly, the Brush-tailed Mulgara, Peregrine Falcon and several CS3 parrot species are likely to be only irregular visitors to the survey area.

Up to 10 species of migratory waterbirds are likely to occur on an occasional basis on Lake Miranda, potentially in large numbers. Several CS3 bird species are certainly present in the survey area. These species are very mobile and populations can fluctuate, so even if not recorded at one time, these species may be present later. Up to nine mammal species are known to be extinct in the area, such as the Greater Bilby, Chuditch and Burrowing Bettong.

Patterns of biodiversity.
The gypsum soils surveyed in 2018 around Lake Miranda are rich in reptiles, while Mulga over clumped grasses and on sandy loams was moderately rich in reptiles and birds. The rocky hills are poorer in biodiversity by comparison, but dense vegetation along drainage lines in this area may support more species at that landscape scale. Lake Miranda will attract large numbers of waterbird and shorebird species following substantial rains.

Key ecological processes.
The main processes which may affect the fauna assemblage are likely to be the fire regime, the presence and abundance of feral species and to a lesser degree landscape connectivity and local hydrology. The current assemblage has been strongly influenced by feral predators and possibly also altered fire regimes, resulting in the local loss of a substantial proportion of the mammal fauna. The effect of feral predators (Dingo, Cat and Fox) is complicated as it interacts with the fire regime, and the feral species interact with each other. For example, the abundance of Cats and Foxes is suppressed by Dingoes and in some cases this has been found to be of benefit to native species (Southgate *et al*. 2007). Goats and camels may occur in the survey area and also cause widespread damage to vegetation and habitat. Rabbits cause damage and were recorded.

Overall, the survey area has a fauna species assemblage that has suffered some species loss and in a regional context it is only moderately rich due to the absence of spinifex that supports a rich assemblage of reptiles in particular. The assemblage does include some species of conservation significance, dominated by migratory waterbirds that will make intermittent use of Lake Miranda. There are some internal patterns of distribution that may be important for planning and the assemblage is sensitive to fire, feral species and landscape connectivity.

4 Impact Assessment

Impacting processes have to be considered in the context of fauna values and the nature of the proposed development, which in this case is assumed to involve some clearing of native vegetation. Predicted impacts are examined below; impacting processes are outlined in Appendix 2 and definitions of levels of impact significance are given in Table 4. Based on the impact assessment below, mitigation measures are presented in Section 5.

4.1 Impacting processes

Habitat loss leading to population decline.

The proposed development will result in some localised loss of native vegetation but it is intended to concentrate development in previously disturbed areas. The surface footprint is smaller than it might otherwise be due to operations being underground. The actual proportion of loss of native vegetation within the local area is small as there is extensive native vegetation outside of the survey area. Impacts largely avoid Mulga on sandy-loam, which is locally important for biodiversity. There will be little or no direct impact on Lake Miranda.

Some loss of habitat and population decline is inevitable in areas to be cleared but can be minimised through controls during clearing. Rehabilitation of disturbed areas may also be implemented as soon as possible after clearing. The small area of impact in relation to the surrounding landscape means that loss of habitat is unlikely to have long-term adverse impacts upon fauna populations in the region. Impact Minor.

Habitat loss leading to population fragmentation.

The proposed development is concentrated in previously disturbed areas. Linear environments around Lake Miranda and drainage lines elsewhere will be largely unaffected. Exploration has occurred close to Lake Miranda which could reduce connectivity along this side of the lake and therefore rehabilitation of Mulga on sand would minimise any fragmentation effect. Pipelines can cause population fragmentation for small species where pipes lie on the ground and create a barrier, but this can be avoided by burying a pipe or creating occasional earthen ramps over the pipe (see recommendations below). Impact Negligible to Minor.

Degradation of habitat due to weed invasion.

There is some weed invasion of the project area where it is already disturbed. Further impacts from weeds can be minimised by maintaining reasonable hygiene measures. This will be important as the current levels of weed invasion in disturbed locations provides a source of weed-seeds that can compromise rehabilitation. Impact Minor.

Ongoing mortality from operations.

Increased mortality is inevitable during clearing operations and from ongoing activities, such as roadkill due to animals being struck by vehicles, or birds striking infrastructure and fauna attracted into production areas (e.g. In search of food or water, insects attracted to lights). It is not known if waterbirds will be at risk from tailings storage facilities (either toxic or through entrapment in mud). In general, areas to be cleared are small within the context of the regional landscape so mortality during clearing is likely to represent only a small proportion of regional populations. For common species, levels of mortality are unlikely to be significant in a conservation sense, but there are welfare issues. Risk of roadkill will be greatest if there is night movement of vehicles on roads that pass through native vegetation. Lighting may pose a risk to insects and this can affect the abundance of other species, with an increase in scavenging birds around buildings leading to a decline in some other bird species at remote mine sites (Read *et al.* 2015). Impact Minor with management.

Species interactions.

There are already concerns with impacts of feral species, including Cats and Foxes, but sensitive species have largely been exterminated. The abundance of feral species can increase around remote mining operations, often due to an increase in food supply. Tracks can improve access by these species into otherwise undisturbed areas. With several significant species in the area vulnerable to predation by these feral species, such impacts are a concern. There is also potential for increased abundance of some native species due to the provision of water or additional food supplies, and this can adversely impact other native species. Impact Minor to Moderate.

Hydrological change

Interruptions of hydroecological processes are a concern where habitat may be impacted, resulting in impacts to fauna species. Some habitats are likely to be reliant on surface and sub-surface flows that may be altered by clearing, earthworks and drainage management. As a result, habitat degradation may occur beyond the clearing footprint. Some increased runoff from development can be expected, and there may be mine de-watering. The sensitivity of subterranean assemblages is unknown. Similarly, the effect of groundwater abstraction in the Kathleen Valley area is unknown but can presumably be monitored and managed. Maintaining local hydrological flows is considered the key to managing impacts upon fauna in the survey area. It is likely that with standard operating procedures the impacts can be managed. Impact Minor.

Altered fire regimes

While the biota of the region is probably adapted to a particular fire regime, it is likely this regime has already been altered since European settlement. There is currently little evidence of recent fire and it is important for protecting fauna habitat that widespread or regular fires are avoided. Mulga in particular is sensitive to fire, while biodiversity in grassland environments can be altered by changes in the fire regime. Although not part of the mining process, mining activities can lead to a change in the fire regime and there may be a slight increase in the potential for fires as a result of the project. Impact Negligible assuming management.

Disturbance (dust, noise, light).

The level of dust, noise and light from the proposed development is uncertain but at a remote location, lighting can introduce a great change and lead to large numbers of insect deaths and to predatory species being attracted that then displace other species. Disturbance of waterbirds may be a concern in seasons when they are abundant, especially as some may bred on small islands in Lake Miranda. Impact could therefore be considered potentially Minor to Moderate.

Overall, impacts of greatest concern are related to:

- Vegetation clearing leading to direct mortality;
- Interference with population movement due to barriers such as pipelines on the surface;

- Species interactions due to changes in abundance of feral predators (Cat and Fox) and potentially increase in abundance of predatory native birds around the project;
- Hydrological change from groundwater abstraction, dewatering and altered surface flows,, as some vegetation types and fauna assemblages may be sensitive to such changes;
- Altered fire regimes (but could be beneficial as part of management); and
- Possibly light causing local mortality of invertebrates and increases in abundance of predatory species.

Note that some impacts are uncertain because of lack of data on the fauna assemblage. In particular, there is little information on the subterranean fauna assemblage.

5 Recommendations

The development footprint is small in the context of a very broad and continuous landscape, and development occurs largely on previously disturbed areas. Furthermore, the fauna assemblage is generally widespread and has lost most significant species, with key features being occasional use of Lake Miranda by waterbirds, , a rich and unusual reptile assemblage on gypsum soils close to the lake, a rich assemblage of fauna generally in Mulga on sandy-loam, and the presence of unusual subterranean fauna assemblages nearby. The composition of the fauna assemblage and the nature of the proposed development therefore ameliorate the significance of impacts, but there remains concern with risk to some parts of the environment, risks to significant species and concern with landscape-scale ecological processes that may be affected by the proposal. Mining projects can affect the abundance of fauna species but also provide opportunities for active conservation management, which may be assessed as offsets to development. Key management actions can be related to impacting processes as outlined below. Many of these strategies are now considered best practice at most mine sites. Although impacts are mostly expected to be minor, any reduction in impacts is desirable.

Habitat loss leading to population decline and fragmentation

- Minimise the disturbance footprint and maintain large trees where possible. Large eucalypt trees and even Mulga are important for fauna, including providing hollows for species.
- Ensure that pipelines lying on the ground do not obstruct the movement of small species, such as by burying or creating ramps.
- Clearly delineate areas to be cleared to minimise unnecessary vegetation loss.
- Maintain linkages to adjacent vegetation where possible.
- Rehabilitate (where possible) as soon as practical.

Habitat degradation due to weed invasion

- Develop and implement a weed management plan.

Ongoing mortality

- Restrict vehicle access to where this is necessary for project operation.
- Enforce maximum speed limits.
- Minimise night driving.
- Erect signage in areas of high wildlife activity, if required.
- Lighting should be directed to where it is needed and not into surrounding native vegetation. Unnecessary lighting should be avoided.
- Educate personnel with respect to fauna through the induction process, including avoiding disturbance of waterbirds should Lake Miranda flood.
- Check infrastructure where there may be a risk of fauna entrapment.
- Record and report all fauna incidents to the site supervisor and environment department.

Species interactions

- Rehabilitate access tracks as soon as possible to discourage access by feral fauna.
- Develop a predator management programme aimed at suppressing the abundance of the Fox and Cat and maintaining the Dingo population level at a natural density; this to be discussed and developed in consultation with the DBCA.
- Ensure appropriate waste disposal during construction activities to avoid attracting feral species to the area.
- Educate personnel not to feed (deliberately or inadvertently) feral species.

Hydrological changes

- Ensure local hydrology is not affected, including alterations to runoff through the landscape.
- Monitor groundwater levels where groundwater abstraction takes place.
- Avoid runoff to ensure sediment or any chemicals do not contaminate soil, groundwater and Lake Miranda and install appropriate erosion control, if required.
- Implement management actions if hydrological changes are likely to affect significant fauna habitats, if required.

Altered fire regimes

- Develop and implement a regional fire management plan during construction and operational activities to ensure wildfires do not occur as a result of activities and to ensure appropriate responses are in place should a wildfire occur. This could be developed as part of a cooperative fire management strategy with other key stakeholders.

Monitoring

- Waterbird abundance on Lake Miranda should be monitored to ensure that if birds are present and breeding, actions required to ensure that disturbance does not occur can be implemented. This does not require detailed counting; only observation of presence/ absence.
- Monitor local groundwater levels.

6 References

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7 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but rather contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e., has all the species that would have been present at the time of European settlement) or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species-rich site is more valuable than a species-poor site, but value is also determined by other factors, for example, by the sorts of species present.

Vegetation and Substrate Associations

Vegetation and Substrate Associations (VSAs) combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment, which VSAs will recognise. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity, such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (Biodiversity Conservation Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report and are outlined below. A full description of the conservation significance levels, schedules and priority levels mentioned below is provided in Appendix 3.

Conservation Significance (CS) level 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The Biodiversity Conservation Act uses a series of Schedules to classify status, but also recognizes the IUCN categories and ranks species within the Schedules using the categories of Mace and Stuart (1994).

Conservation Significance (CS) level 2: Species listed as Priority by the DBCA but not listed under State or Commonwealth Acts.

In Western Australia, the DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Biodiversity Conservation Act but for which the DBCA believes there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

Conservation Significance (CS) level 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information and expert judgment, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (DEP 2000).

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in an area may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes as outlined below are effectively the ecological processes that can be altered to result in impacts upon fauna.

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Appendix 2. Explanation of threatening processes.

Potential impacts of proposed developments upon fauna values can be related to threatening processes. This is recognised in the literature (e.g. Gleeson and Gleeson 2012) and under the EPBC Act, in which threatening processes are listed. Processes that may impact fauna values are discussed below. Rather than being independent of one another, processes are complex and often interrelated. They are the mechanisms by which fauna can be affected by development. Impacts may be significant if large numbers of species or large proportions of populations are affected.

Note that the terms direct and indirect impacts are used by the DotE (2013), SEWPaC (2013) and EPA (2016), but there is some inconsistency in how these are defined. The federal guidance does not define direct impact but has a very broad definition of indirect, and makes the statement (DotE 2013) '*Consideration should be given to all adverse impacts that could reasonably be predicted to follow from the action, whether these impacts are within the control of the person proposing to take the action or not. Indirect impacts will be relevant where they are sufficiently close to the proposed action to be said to be a consequence of the action, and they can reasonably be imputed to be within the contemplation of the person proposing to take the action*.' Indirect impacts therefore can even include what the DotE (2013) calls facilitated impacts, which are the result of third party actions triggered by the primary action. In contrast, the EPA (2016) defines direct impacts to '*include the removal, fragmentation or modification of habitat, and mortality or displacement of individuals or populations.*' This document then lists as indirect impacts what in many cases are the consequences of the removal, fragmentation or modification of habitat. For example, '*disruption of the dispersal of individuals required to colonise new areas inhibiting maintenance of genetic diversity between populations'* is a consequence of habitat fragmentation. Impacts of light, noise and even roadkill are defined as indirect but they are clearly the result of the action and in control of the person taking the action. Roadkill is as direct a form of mortality as can be observed, but it is considered as an indirect impact in the context of a development presumably because it is not directly linked to land clearing. The EPA (2016) makes a strong distinction between removal of vegetation (direct impact) and the consequences of such clearing and other aspects of a development (indirect impacts). It is not obvious how this distinction between direct and indirect impacts is helpful in the EIA process, as the key aim is to ensure that all impacts that result from a project are addressed in this assessment process. Interestingly, Gleeson and Gleeson (2012), in a major review of impacts of development on wildlife, do not use the terms direct or indirect. In the following outlines of threatening processes that can cause impacts, the emphasis is upon interpreting how a threatening process will cause an impact. for example, loss of habitat (threatening process) can lead to population decline and to population fragmentation, which are two distinct impacts.

Loss of habitat affecting population survival

Clearing for a development can lead to habitat loss for a species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to habitat loss affecting population survival.

Loss of habitat leading to population fragmentation

Loss of habitat can affect population movements by limiting movement of individuals throughout the landscape as a result of fragmentation (Gleeson and Gleeson 2012, Soule *et al.* 2004). Obstructions associated with the development, such as roads, pipes and drainage channels, may also affect movement of small, terrestrial species. Fragmented populations may not be sustainable and may be sensitive to effects such as reduced gene flow.

Degradation of habitat due to weed invasion leading to population decline

Weed invasion, such as through introduction by human boots or vehicle tyres, can occur as a result of development and if this alters habitat quality, can lead to effects similar to habitat loss.

Increased mortality

Increased mortality can occur during project operations; for example, roadkill, animals striking infrastructure, and entrapment in trenches. Roadkill as a cause of population decline has been documented for several medium-sized mammals in eastern Australia (Dufty 1989, Jones 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Scheick and Jones 1999, Clevenger and Waltho 2000, Jackson and Griffin 2000). Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population.

Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the feral Cat, Red Fox and Rabbit, may have adverse impacts upon native species and development can alter their abundance. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent, the feral Cat (Burbidge and McKenzie 1989). Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for other species.

Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands to influence the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Over-abundant native herbivores, such as kangaroos, can also adversely affect less abundant native species through competition and displacement.

Hydroecology

Interruptions of hydroecological processes can have major effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. Fauna may be impacted by potential changes to groundwater level and chemistry and altered flow regime. These changes may alter vegetation across large areas and may lead to habitat degradation or loss. Impacts upon fauna can be widespread and major. Changes to flow regime across the landscape may alter vegetation and may lead to habitat degradation or loss, affecting fauna. For example, Mulga has a shallow root system and relies on surface sheet flow during flood events. If surface sheet flow is impeded, Mulga can die (Kofoed 1998), which may impact on a range of fauna associated with this vegetation type.

Fire

The role of fire in the Australian environment and its importance to vertebrate fauna has been widely acknowledged (Gill *et al.* 1981, Fox 1982, Bamford and Roberts 2003). It is also one of the factors that has contributed to the decline and local extinction of some mammal and bird species (Burbidge and McKenzie 1989). Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Changes in fire regime, whether to more frequent or less frequent fires, may be significant to some fauna. Impacts of severe fire may be devastating to species already occurring at low densities or to species requiring long unburnt habitats to survive. In terms of conservation management, it is not fire *per se* but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity can enhance biodiversity. Fire management may be considered the responsibility of managers of large tracts of land, including managers of mining tenements.

Dust, light, noise and vibration

Impacts of dust, light, noise and vibration upon fauna are difficult to predict. Some studies have demonstrated the impact of artificial night lighting on fauna, with lighting affecting fauna behaviour more than noise (Rich and Longcore 2006). Effects can include impacts on predator-prey interactions, changes to mating and nesting behaviour, and increased competition and predation within and between invertebrates, frogs, birds and mammals.

The death of very large numbers of insects has been observed around some remote mine sites and attracts other fauna, notably native and introduced predators (M. Bamford, pers. obs). The abundance of some insects can decline due to mortality around lights, although this has previously been recorded in fragmented landscapes where populations are already under stress (Rich and Longcore 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes may be vulnerable to light spill.

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Appendix 3. Categories used in the assessment of conservation status.

IUCN categories (based on review by Mace and Stuart 1994) as used for *the Environment Protection and Biodiversity Conservation Act 1999* and the *Western Australian Biodiversity Conservation Act 2016.*

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the *WA Biodiversity Conservation Act 2016*

Schedule 1 (S1)	Critically Endangered fauna.
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties.
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependant fauna
Schedule 7 (S7)	Other specially protected fauna

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4. (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 4. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

Ecological processes relevant to the conservation of biodiversity in Australia (Soule *et al*. 2004):

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

Threatening processes (EPBC Act)

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 20 key threatening processes listed by the federal Department of the Environment (DEE 2018c):

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Dieback caused by the root-rot fungus (Phytophthora cinnamomi).
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European red fox.
- Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha).

- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (Bufo marinus).
- The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, Solenopsis invicta (fire ant).

General processes that threaten biodiversity across Australia (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, DotE (2013) has produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

Will the proposed action lead to a long-term decrease in the size of a population?
Will the proposed action reduce the area of occupancy of the species?
Will the proposed action fragment an existing population?
Will the proposed action adversely affect habitat critical to the survival of a species?
Will the proposed action disrupt the breeding cycle of a population?
Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
Will the proposed action introduce disease that may cause the species to decline?
Will the proposed action interfere with the recovery of the species?

References for the above text:

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Appendix 4. Vertebrate fauna expected to occur in the survey area.

These lists are derived from the results of database and literature searches conducted in the general area.

Cons Sig = Conservation significance codes: CS1, CS2, CS3. See Appendix 1 for full explanation.

- EPBC Act listings: E = Endangered, V = Vulnerable, Mig = Migratory, Mar = Marine (see Appendix 3).
- Wildlife Conservation Act listings: for all CS1 species S1 to 7 = Schedules 1 to 7 respectively, (see Appendix 3) with rankings shown in square parentheses: [e] = endangered, [v] = vulnerable.
- DBCA Priority species: P1 to P5 = Priority 1 to 5 (see Appendix 3).
- CS3 species: are considered to be of local significance by Bamford Consulting Ecologists
- Int. Introduced species.

DB = Database Searches:

- NatureMap database (DBCA), searched August 2018;
- BirdLife Australia Atlas database, searched August 2018; and
- EPBC Protected Matters Search Tool, searched August 2018.

Regional Studies = Other studies conducted in the region:

- BCE = Past surveys at Yeelirrie (Bamford *et al.* 2011, Bamford and Turpin 2015);
- B = Biota 2017 Mt Keith Satellite survey (includes several studies; ATA 2005, Biota 2006a, 2006b); and
- WJ = Species recorded from Wanjarri Nature Reserve (DBCA).

Status = Status in survey area is based on the categories described in Section 2.2.4.

R = Resident; M = Migrant; RV = Regular Visitor; IV = Irregular Visitor; Va = Vagrant.

8 = Field investigation conducted by BCE in August and October 2018.

9 = Field investigation conducted by BCE in October 2019.

FROGS

Species		Cons Sig	DB	Regional studies	Status
HYLIDAE (Tree frogs)					
Cyclorana maini	Main's Frog			WJ,BCE,B	R
Cyclorana platycephala	Water-holding Frog			BCE,B	R
Litoria rubella	Desert Tree Frog			BCE	R8
LIMNODYNASTIDAE (Burrowing Frogs)					
Platyplectrum spenceri	Spencer's Frog			B	R
Neobatrachus aquilonius	Northern Burrowing Frog			WJ	R
Neobatrachus kunapalari	Kunapalari Frog				R
Neobatrachus sudellae	Desert Trilling Frog			WJ	R
Neobatrachus sutor	Shoemaker Frog				R
Neobatrachus wilsmorei	Wilsmore's Frog		x		R
MYOBATRACHIDAE (Ground frogs)					
Pseudophryne occidentalis	Western Toadlet			BCE	R
Total Species Expected: 10					

REPTILES

Species		Con Sig	DB	Regional studies	Status (BCE8,9)
Cheluidae (freshwater tortoises)					
Chelodina steindachneri	Flat-shelled Tortoise				RV
Gekkonidae (geckoes)					
Diplodactylus conspicillatus	Fat-tailed Gecko			BCE,B	R8,9
Diplodactylus granariensis rex	Goldfields Stone Gecko		x	BCE	R8,9
Diplodactylus pulcher	Western Saddled Ground Gecko		x	BCE,B	R8
Gehyra crpta	Western Cryptic Gehyra				R8,9
Gehyra purpurascens	Purple Arid Dtella				R
Gehyra variegata	Variegated Dtella		x	BCE,B	R8,9
Heteronotia binoei	Bynoe's Gecko		x	BCE,B	R8,9
Lucasium squarrosum	Mottled Ground Gecko		x	B	R8
Lucasium stenodactylus	Pale-snouted Ground Gecko				R
Nephrurus vertebralis	Midline Knob-tail		x	BCE	R8,9
Rhynchoedura ornata	Beaked Gecko			BCE,B	R8,9
Strophurus assimilis	Thorn-tailed Gecko				R
Strophurus strophurus	Western Ring-tailed Gecko			BCE,B	R8,9
Strophurus wellingtonae	Western Shield Spiny-tailed Gecko		x	BCE,B	R
Underwoodisaurus milii	Barking Gecko		x		R8,9
Pygopodidae (legless lizards)					
Aprasia picturata	Black-headed worm-lizard	CS3			R
Aprasia repens	Sand-plain Worm-lizard				R8
Lialis burtonis	Burton's Legless Lizard			BCE,B	R8
Pygopus nigriceps	Western Hooded Scaly-foot			BCE,B	R8
Agamidae (dragon lizards)					
Ctenophorus caudicinctus	Ring-tailed Dragon		x	BCE	R
Ctenophorus isolepis	Military Dragon			BCE,B	R8,9
Ctenophorus nuchalis	Central Netted Dragon		x	BCE	R8
Ctenophorus reticulatus	Western Netted Dragon			BCE	R
Ctenophorus salinarum	Claypan Dragon		x		R8
Ctenophorus scutulatus	Lozenge-marked Dragon			BCE	R9
Gowidon longirostris	Long-nosed Dragon				R
Moloch horridus	Thorny Devil			BCE	R
Pogona minor	Western Bearded Dragon			BCE	R9
Tympanocryptis cephala	Earless Pebble Dragon		x	B	R
Varanidae (monitors or goannas)					
Varanus caudolineatus	Stripe-tailed Monitor			BCE,B	R
Varanus eremius	Desert Pygmy Monitor			BCE	R
Varanus giganteus	Perentie			BCE,B	R
Varanus gouldii	Sand Goanna			BCE	R8
Varanus panoptes	Yellow-spotted Monitor			B	R8,9
Varanus tristis	Black-headed Monitor			BCE	R

Species		Con Sig	DB	Regional studies	Status (BCE8,9)
Scincidae (skink lizards)					
Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink			BCE	R
Cryptoblepharus plagiocephalus	Peron's Fence Skink			BCE	R
Ctenotus helenae	Clay Soil Ctenotus			BCE,B	R
Ctenotus leonhardii	Leonhardi's Ctenotus			BCE,B	R8,9
Ctenotus pantherinus	Leopard Skink			BCE,B	R
Ctenotus quattuordecimlineatus			x	B	R
Ctenotus schomburgkii	Barred Wedge-snout Ctenotus			BCE	R
Ctenotus severus	Stern Rock Ctenotus				R
Ctenotus uber	Spotted Ctenotus			B	R
Egernia depressa	Pygmy Spiny-tailed Skink			BCE,B	R
Egernia formosa	Goldfields Crevice Skink			B	R
Liopholis inornata	Desert Skink			BCE,B	R
Liopholis kintorei	Great Desert Skink	CS1		WJ,B	IV
Eremiascincus richardsonii	Broad-banded Sand-swimmer			BCE,B	R8
Lerista bipes				B	R
Lerista desertorum			x	BCE,B	R8,9
Lerista rhodenoides				BCE	R
Lerista timida			x	B	R8,9
Menetia greyii	Common Dwarf Skink		x	BCE,B	R8,9
Morethia butleri	Woodland Dark-flecked Morethia		x	B	R
Tiliqua occipitalis	Western Blue-tongue			BCE	R
Typhlopidae (blind snakes)					
Anilios bicolor	Dark-spined blind snake			BCE	R
Anilios hamatus	Northern Hook-snouted Blind Snake			BCE	R8
Anilios waitii	Beaked Blind Snake				R8
Pythonidae (pythons)					
Antaresia stimsoni	Stimson's Python				R8
Elapidae (front-fanged snakes)					
Brachyurophis semifasciata	Southern Shovel-nosed Snake				R
Brachyurophis fasciolatus	Narrow-banded Shovel-nosed Snake				R
Demansia psammophis	Yellow-faced Whipsnake				R
Parasuta monachus	Monk Snake			B	R
Pseudechis australis	Mulga				R
Pseudechis butleri	Spotted Mulga Snake		x		R
Pseudonaja modesta	Ringed Brown Snake			BCE,B	R8,9
Pseudonaja mengdeni	Gwardar			BCE,B	R8
Simoselaps bertholdi	Jan's Banded Snake			BCE	R
Furina ornata	Moon Snake				R
Suta fasciata	Rosen's Snake		x	BCE	R8
Total Species Expected: 70					

BIRDS

Species		Cons Sig	DB	Regional studies	Status (BCE8,9)
CASUARIIDAE (Cassowaries and emus)					
Dromaius novaehollandiae	Emu		x	BCE, B	RV8,9
MEGAPODIIDAE (Megapodes)					
Leipoa ocellata	Malleefowl	CS1	x	BCE	RV?
PHASIANIDAE (Pheasants and allies)					
Coturnix pectoralis	Stubble Quail				IV
ANATIDAE (swans and ducks)					
Cygnus atratus	Black Swan		x		IV8,9
Tadorna tadornoides	Australian Shelduck		x	BCE, B	IV8
Anas superciliosa	Pacific Black Duck		x		IV
*Anas gracilis*l	Grey Teal		x	BCE	IV8
Chenonetta jubata	Australian Wood Duck			BCE	IV
Malacorhynchus membranaceus	Pink-eared Duck				IV
Aythya australis	Hardhead				IV
Podicipedidae (grebes)					
Tachybaptus novaehollandiae	Australasian Grebe				IV
Poliocephalus poliocephalus	Hoary-headed Grebe		x	BCE	IV
Phalacrocoracidae (cormorants)					
Phalacrocorax melanoleucos	Little Pied Cormorant				Va
Phalacrocorax sulcirostris	Little Black Cormorant			B	Va
Ardeidae (herons and egrets)					
Egretta novaehollandiae	White-faced Heron		x		IV
Ardea pacifica	White-necked Heron		x		IV
Ardea modesta	Eastern Great Egret	CS1	x		Va
Threskiornithidae (ibis and spoonbills)					
Threskiornis molucca	Australian White Ibis				IV
Threskiornis spinicollis	Straw-necked Ibis				IV
ACCIPITRIDAE (Osprey, hawks and eagles)					
Elanus axillaris	Black-shouldered Kite				Va
Lophoictinia isura	Square-tailed Kite	CS3	x	BCE	Va
Hamirostra melanosternon	Black-breasted Buzzard				IV8
Milvus migrans	Black Kite		x		IV
Haliastur sphenurus	Whistling Kite		x	BCE,B	R8,9
Circus assimilis	Spotted Harrier		x	BCE	RV
Accipiter fasciatus	Brown Goshawk		x	B	R
Accipiter cirrhocephalus	Collared Sparrowhawk		x	BCE,B	R
Aquila audax	Wedge-tailed Eagle		x	BCE,B	R8,9
Hieraaetus morphnoides	Little Eagle		x	BCE,B	R
FALCONIDAE (Falcons)					
Falco berigora	Brown Falcon		x	BCE,B	R8,9
Falco longipennis	Australian Hobby		x	BCE	R8,9
Falco hypoleucos	Grey Falcon	CS1		WJ	Va
Falco subniger	Black Falcon				Va

Species		Cons Sig	DB	Regional studies	Status (BCE8,9)
Falco peregrinus	Peregrine Falcon	CS1		BCE	IV
Falco cenchroides	Nankeen Kestrel		x	BCE,B	R8,9
RALLIDAE (Rails, gallinules and coots)					
Gallinula ventralis	Black-tailed Native-hen				IV
Fulica atra	Eurasian Coot				IV
OTIDIDAE (Bustards)					
Ardeotis australis	Australian Bustard	CS3	x	BCE	R9
TURNICIDAE (Button-quails)					
Turnix velox	Little Button-quail		x		R
SCOLOPACIDAE (sandpipers)					
Limosa limosa	Black-tailed Godwit	CS1			Va
Tringa nebularia	Common Greenshank	CS1			RV8
Tringa stagnatalis	Marsh Sandpiper	CS1			IV
Tringa hypoleucos	Common Sandpiper	CS1	x		RV
Tringa glareola	Wood Sandpiper	CS1			RV
Calidris ruficollis	Red-necked Stint	CS1			RV
Calidris melanotos	Pectoral Sandpiper	CS1	x		IV
Calidris acuminata	Sharp-tailed Sandpiper	CS1	x		IV9
Calidris ferruginea	Curlew Sandpiper	CS1			Va
BURHINIDAE (Stone-curlews)					
Burhinus grallarius	Bush Stone-curlew	CS3	x	BCE	RV8
RECURVIROSTRIDAE (stilts and avocets)					
Himantopus himantopus	Black-winged Stilt		x		RV
CHARADRIIDAE (Lapwings, plovers and dotterels)					
Erythrogonys cinctus	Red-kneed Dotterel			B	RV
Charadrius ruficapillus	Red-capped Plover		x	BCE	RV8
Charadrius veredus	Oriental Plover	CS1	x		Va
Charadrius melanops	Black-fronted Dotterel			B	RV
Charadrius australis	Inland Dotterel				IV
Vanellus tricolor	Banded Lapwing		x	BCE	IV
COLUMBIDAE (Pigeons and doves)					
Phaps chalcoptera	Common Bronzewing		x	BCE,B	R9
Ocyphaps lophotes	Crested Pigeon		x	BCE,B	R8,9
Geopelia cuneata	Diamond Dove		x	BCE	R8
CACATUIDAE (Cockatoos)					
Eolophus roseicapilla	Galah		x	BCE,B	R
Cacatua sanguinea	Little Corella				R
Cacatua leadbeateri	Major Mitchell's Cockatoo	CS3			Va
Nymphicus hollandicus	Cockatiel		x	BCE,B	R
PSITTACIDAE (Parrots)					
Barnardius zonarius	Australian Ringneck		x	BCE,B	R8,9
Psephotus varius	Mulga Parrot		x	BCE,B	R8,9
Melopsittacus undulatus	Budgerigar		x	BCE,B	RV
Neosephotus bourkii	Bourke's Parrot		x		RV

Species		Cons Sig	DB	Regional studies	Status (BCE8,9)
Neophema elegans	Elegant Parrot			BCE	IV
Neophema splendida	Scarlet-chested Parrot	CS3		WJ	IV
Polytelis alexandrae	Princess Parrot	CS1	x	WJ	IV
Polytelis anthopeplus	Regent Parrot	CS3	x	WJ	IV
Pezoporus occidentalis	Night Parrot	CS1	x		Va?
CUCULIDAE (Old world cuckoos)					
Cuculus pallidus	Pallid Cuckoo		x	BCE,B	RV
Chrysococcyx osculans	Black-eared Cuckoo		x	BCE	RV
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo		x	BCE,B	RV
STRIGIDAE (Hawk owls)					
Ninox novaeseelandiae	Southern Boobook		x	BCE	R
TYTONIDAE (Barn owls)					
Tyto alba	Barn Owl		x		RV
PODARGIDAE (Australian frogmouths)					
Podargus strigoides	Tawny Frogmouth		x	BCE	R9
CAPRIMULGIDAE (Nightjars and allies)					
Eurostopodus argus	Spotted Nightjar		x	BCE	RV
AEGOTHELIDAE (Owlet-nightjars)					
Aegotheles cristatus	Australian Owlet-nightjar		x	BCE,B	R
APODIDAE (Typical swifts)					
Apus pacificus	Fork-tailed Swift	CS1		BCE	RV
HALCYONIDAE (Kingfishers)					
Todiramphus pyrrhopygia	Red-backed Kingfisher		x	BCE,B	R8,9
Todiramphus sanctus	Sacred Kingfisher				RV
MEROPIDAE (Bee-eaters)					
Merops ornatus	Rainbow Bee-eater		x	BCE,B	RV8,9
CLIMACTERIDAE (Australo-Papuan treecreepers)					
Climacteris affinis	White-browed Treecreeper		x	B	IV
MALURIDAE (Fairy-wrens, emu-wrens and grasswrens)					
Malurus splendens	Splendid Fairy-wren		x	BCE,B	R8,9
Malurus lamberti	Variegated Fairy-wren		x	BCE,B	R8,9
Malurus leucopterus	White-winged Fairy-wren		x	BCE,B	R8,9
Amytornis striatus striatus	Striated Grasswren	CS2	x	WJ	Va
Stipiturus ruficeps	Rufous-crowned Emu wren	CS3		WJ	Va
PARDALOTIDAE (Pardalotes, scrubwrens, thornbills and allies)					
Pardalotus rubricatus	Red-browed Pardalote		x		R
Pardalotus striatus	Striated Pardalote		x	BCE,B	R
Calamanthus campestris	Rufous Fieldwren		x	BCE	R
Pyrrholaemus brunneus	Redthroat		x	BCE	R8,9
Smicrornis brevirostris	Weebill		x	BCE,B	R
Gerygone fusca	Western Gerygone		x	BCE	R
Acanthiza apicalis	Inland Thornbill		x	BCE,B	R8
Acanthiza uropygialis	Chestnut-rumped Thornbill		x	BCE,B	R8,9
Acanthiza robustirostris	Slaty-backed Thornbill		x	BCE,B	R9

Species		Cons Sig	DB	Regional studies	Status (BCE8,9)
Acanthiza iredalei	Slender-billed Thornbill	CS1			R
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		x	BCE,B	R8,9
Aphelocephala leucopsis	Southern Whiteface		x	BCE,B	R8
MELIPHAGIDAE (Honeyeaters)					
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		x	BCE,B	R8,9
Anthochaera carunculata	Red Wattlebird		x		Va
Manorina flavigula	Yellow-throated Miner		x	BCE,B	R8,9
Lichenostomus virescens	Singing Honeyeater		x	BCE,B	R8,9
Lichenostomus penicillatus	White-plumed Honeyeater		x	BCE,B	R8
Lichenostomus plumulus	Grey-fronted Honeyeater		x	B	R
Lichmera indistincta	Brown Honeyeater		x	BCE	R8
Phylidonyris albifrons	White-fronted Honeyeater		x	BCE,B	R
Conopophila whitei	Grey Honeyeater	CS3		WJ,B	IV
Certhionyx niger	Black Honeyeater		x	B	R
Certhionyx variegatus	Pied Honeyeater		x	BCE,B	R
Epthianura tricolor	Crimson Chat		x	BCE	RV8,9
Epthianura aurifrons	Orange Chat		x		RV
Epthianura albifrons	White-fronted Chat		x		RV
PETROICIDAE (Robins)					
Microeca leucophaea	Jacky Winter		x	BCE	RV
Petroica goodenovii	Red-capped Robin		x	BCE,B	R8,9
Melanodryas cucullata	Hooded Robin		x	BCE,B	R8,9
POMATOSTOMIDAE (Babblers)				BCE	
Pomatostomus temporalis	Grey-crowned Babbler		x	BCE,B	R8,9
Pomatostomus superciliosus	White-browed Babbler		x	BCE,B	R8,9
CINCLOSOMATIDAE (Quail-thrushes and allies)					
Psophodes occidentalis	Chiming Wedgebill		x	B	R
Cinclosoma castanotum	Chestnut Quail-thrush		x	B	R
Cinclosoma casteneothorax	Western Quail-thrush		x	BCE	RV8
NEOSITTIDAE (Sitellas)					
Daphoenositta chrysoptera	Varied Sittella		x	BCE	R9
PACHYCEPHALIDAE (Whistlers, shrike-thrushes and allies)					
Oreoica gutturalis	Crested Bellbird		x	BCE,B	R8,9
Pachycephala rufiventris	Rufous Whistler		x	BCE,B	R8,9
Colluricincla harmonica	Grey Shrike-thrush		x	BCE,B	R8
DICRURIDAE (Monarchs, fantails and drongos)					
Grallina cyanoleuca	Magpie-lark		x	BCE,B	R8,9
Rhipidura f. albicauda	Grey (White-tailed) Fantail				R
Rhipidura leucophrys	Willie Wagtail		x	BCE,B	R8,9
CAMPEPHAGIDAE (Cuckoo-shrikes and trillers)					
Coracina novaehollandiae	Black-faced Cuckoo-shrike		x	BCE,B	R8,9
Coracina maxima	Ground Cuckoo-shrike		x	BCE,B	RV8
Lalage sueurii	White-winged Triller		x	BCE,B	R

Species		Cons Sig	DB	Regional studies	Status (BCE8,9)
ARTAMIDAE (Woodswallows, butcherbirds and currawongs)					
Artamus personatus	Masked Woodswallow		X	BCE,B	RV
Artamus cinereus	Black-faced Woodswallow		x	BCE,B	R8,9
Artamus minor	Little Woodswallow		x	BCE,B	IV8,9
Cracticus torquatus	Grey Butcherbird		x	BCE,B	R8,9
Cracticus nigrogularis	Pied Butcherbird		x	BCE,B	R8
Gymnorhina tibicen	Australian Magpie		x	BCE,B	R8
Strepera versicolor	Grey Currawong			WJ, BCE,B	IV
CORVIDAE (Crows and allies)					
Corvus bennetti	Little Crow		x	BCE	RV8
Corvus orru	Torresian Crow		x	BCE	RV8,9
Ptilonorhynchidae (Bowerbirds)					
Ptilonorhynchus guttatus	Western Bowerbird		x	BCE,B	R8,9
MOTACILIDAE (Old world wagtails and pipits)					
Anthus novaeseelandiae	Australasian Pipit		x	BCE,B	R8,9
PASSERIDAE (Sparrows, weaverbirds, waxbills and allies)					
Taeniopygia guttata	Zebra Finch		x	B	R8,9
DICAEIDAE (Flowerpeckers)					
Dicaeum hirundinaceum	Mistletoebird		x	B	R
HIRUNDINIDAE (Swallows and martins)					
Cheramoeca leucosternum	White-backed Swallow		x	BCE	R8
Hirundo neoxena	Welcome Swallow		x	BCE,B	RV8,9
Hirundo nigricans	Tree Martin		x	B	R
Hirundo ariel	Fairy Martin		x	BCE,B	R8
SYLVIIDAE (Old world warblers)					
Cinclorhamphus mathewsi	Rufous Songlark		x	B	RV
Cinclorhamphus cruralis	Brown Songlark		x		RV
Total Species Expected: 153					

Bird species recorded by trap line census and walking transects.

Date	Species	Survey type	Location; Site or Lease #	Count
22/10/2019	Singing Honeyeater	Census	11	1
22/10/2019	Yellow-throated Miner	Census	11	1
22/10/2019	Yellow-throated Miner	Census	10	1
22/10/2019	Singing Honeyeater	Census	10	1
22/10/2019	Crested Pigeon	Census	10	1
23/10/2019	Willie Wagtail	Census	10	1
23/10/2019	Singing Honeyeater	Census	10	1
23/10/2019	Spiny-cheeked Honeyeater	Census	10	1
23/10/2019	Grey-crowned Babbler	Census	10	out

23/10/2019	Australian Ringneck	Census	10	2
23/10/2019	White-winged Fairy-wren	Census	11	2
23/10/2019	Torresian Crow	Census	11	2
24/10/2019	Singing Honeyeater	Census	12	3
24/10/2019	Yellow-throated Miner	Census	12	6
24/10/2019	Zebra Finch	Census	12	6
24/10/2019	Chestnut-rumped Thornbill	Census	12	2
24/10/2019	Singing Honeyeater	Census	10	1
24/10/2019	White-winged Fairy-wren	Census	10	2
24/10/2019	Singing Honeyeater	Census	11	1
24/10/2019	Red-capped Robin	Census	15	2
24/10/2019	Chestnut-rumped Thornbill	Census	15	2
25/10/2019	Red-backed Kingfisher	Census	12	1
25/10/2019	Singing Honeyeater	Census	12	1
25/10/2019	Chestnut-rumped Thornbill	Census	12	2
25/10/2019	Spiny-cheeked Honeyeater	Census	12	1
25/10/2019	Chestnut-rumped Thornbill	Census	14	1
25/10/2019	Chestnut-rumped Thornbill	Census	15	3
25/10/2019	Singing Honeyeater	Census	10	2
25/10/2019	White-winged Fairy-wren	Census	11	3
25/10/2019	Yellow-throated Miner	Census	11	1
26/10/2019	Yellow-throated Miner	Census	13	1
26/10/2019	Spiny-cheeked Honeyeater	Census	10	1
27/10/2019	Singing Honeyeater	Census	14	1
25/10/2019	Crested Pigeon	Transect	M36-535 (Mulga woodland)	2
25/10/2019	White-browed Babbler	Transect	M36-535 (Mulga woodland)	2
25/10/2019	Variegated fairy-wren	Transect	M36-535 (Mulga woodland)	4
25/10/2019	Willy Wagtail	Transect	M36-535 (Mulga woodland)	1
25/10/2019	Red-capped Robin	Transect	M36-535 (Mulga woodland)	1
25/10/2019	Black-faced Cuckoo-shrike	Transect	M36-535 (Mulga woodland)	1
25/10/2019	Singing Honeyeater	Transect	M36-535 (Mulga woodland)	4
25/10/2019	Yellow-throated Miner	Transect	M36-535 (Mulga woodland)	9
25/10/2019	Chestnut-rumped Thornbill	Transect	M36-535 (Mulga woodland)	2
25/10/2019	Red-capped Robin	Transect	M36-535 (Mulga woodland)	3
25/10/2019	Slender-billed Thornbill	Transect	M36-535 (Mulga woodland)	1
25/10/2019	Welcome Swallow	Transect	M36-535 (Mulga woodland)	2
25/10/2019	Spiny-cheeked Honeyeater	Transect	M36-535 (Mulga woodland)	1
25/10/2019	White-winged fairy -wren	Transect	M36-535 (Mulga woodland)	2
25/10/2019	Chestnut-rumped Thornbill	Transect	M36-535 (Mulga woodland)	5
26/10/2019	Crimson Chat	Transect	M36-535 (Mulga woodland)	1
26/10/2019	Singing Honeyeater	Transect	M36-535 9 (Gypsum island)	4
26/10/2019	Spiney-cheeked Honeyeater	Transect	M36-535 9 (Gypsum island)	2
26/10/2019	Yellow-throated Miner	Transect	M36-535 9 (Gypsum island)	7

26/10/2019	Australian Ringneck	Transect	M36-535 9 (Gypsum island)	5
26/10/2019	Australian Ringneck	Transect	M36-24	4
26/10/2019	Chestnut-rumped Thornbill	Transect	M36-24	11
26/10/2019	White-browed Babbler	Transect	M36-24	2
26/10/2019	Mulga Parrot	Transect	M36-24	6
26/10/2019	Red-capped Robin	Transect	M36-24	4
26/10/2019	Singing Honeyeater	Transect	M36-24	3
26/10/2019	Willy Wagtail	Transect	M36-24	2
26/10/2019	Rainbow Bee-eater	Transect	M36-24	1
26/10/2019	Black-faced Woodswallow	Transect	M36-24	1
26/10/2019	Yellow-throated Miner	Transect	M36-24	1
26/10/2019	Australian Hobby	Transect	M36-24	1
27/10/2019	Sharp-tailed Sandpiper	Transect	M36-25 (SE Lake Miranda)	1

MAMMALS

Species		Cons Sig	DB	Regional studies	Status (BCE8,9)
TACHYGLOSSIDAE (Echidnas)					
Tachyglossus aculeatus	Echidna			BCE,B	R8,9
DASYURIDAE (Dasyurids)					
Dasycercus blythi	Brush-tailed Mulgara	CS2	x	MK, BCE,B	IV
Antechinomys laniger	Kultarr	CS3		MK,WJ	R
Ningaui ridei	Wongai Ningaui		x	MK, BCE,B	R
Pseudantechinus woolleyae	Woolley's Pseudantechinus			WJ,scats	R
Sminthopsis crassicaudata	Fat-tailed Dunnart			WJ,B	R
Sminthopsis dolichura	Little Long-tailed Dunnart			WJ,B	R
Sminthopsis hirtipes	Hairy-footed Dunnart			WJ, BCE	IV
Sminthopsis longicaudata	Long-tailed Dunnart	CS2			R
Sminthopsis macruora	Stripe-faced Dunnart		x	WJ, BCE,B	R
Sminthopsis ooldea	Ooldea Dunnart			WJ, BCE	R
MACROPODIDAE (Kangaroos, wallabies)					
Macropus robustus	Euro, Biggada			WJ, BCE,B	R8,9
Macropus rufus	Red Kangaroo, Marlu			WJ, BCE	R8,9
Petrogale lateralis	Black-flanked Rock-Wallaby	CS1		Scats BCE	Va?
EMBALLONURIDAE (Sheathtail bats)					
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat			BCE	R
Taphozous hillli	Hill`s Sheathtail-bat				R
VESPERTILIONIDAE (Vespertillionid bats)					
Chalinolobus gouldii	Gould's Wattled Bat		x	WJ, BCE	R8
Nyctophilus geoffroyi	Lesser Long-eared Bat		x	WJ, BCE	R8
Nyctophilus major tor	Central Long-eared Bat	CS2		BCE	R
Scotorepens balstoni	Inland Broad-nosed Bat		x	WJ, BCE,B	R
Vespadelus baverstocki	Inland Forest Bat			WJ, BCE	R
Vespadelus finlaysoni	Finlayson's Cave Bat			BCE	R8
Vespadelus regulus	Southern Forest Bat		x	WJ	R
MOLOSSIDAE (Freetail bats)					
Austronomus australis	White-striped Freetail-Bat			WJ, BCE	RV8
Mormopterus (*Ozimops) petersi*	Inland Freetail-Bat			BCE	RV8
MURIDAE (Rats and mice)					
Mus musculus	House Mouse	INT	x	MK,B	R
Notomys alexis	*Spinifex Hopping-Mouse*		X	MK,BCE	R9
Pseudomys bolami	Bolam's Mouse		x	B	R
Pseudomys desertor	Desert Mouse	CS3		MK,B	R
Pseudomys hermannsburgensis	Sandy Inland Mouse		x	MK,B	R

Species		Cons Sig	DB	Regional studies	Status (BCE8,9)
LEPORIDAE (Rabbits and hares)					
Oryctolagus cuniculus	Rabbit	INT	x	BCE	R8,9
CANIDAE (Dogs and foxes)					
Canis lupus dingo	Dingo	INT	x	BCE	R8,9
Vulpes vulpes	Red Fox	INT	x	BCE	R
FELIDAE (Cats)					
Felis catus	Cat	INT	x	BCE	R8,9
BOVIDAE (Horned ruminants)					
Capra hircus	Goat	INT	x		R
Bos Taurus	Cow	INT			R8,9
CAMELIDAE (camels)					
Camelus dromedarius	Camel	INT	x	BCE	RV
Native Species Expected: 28 **Introduced Species Expected: 8**					

Species present in database searches but considered unlikely due to habitat presence or clearly out of range. Some could be rare vagrants.

Species		Cons Sig	DB	Regional studies
Strophurus elderi	Jewelled Gecko			BCE,B
Delma butleri	Unbanded Delma			BCE
Delma nasuta	Long-nosed Delma			BCE
Delma petersoni				
Ctenotus ariadnae				BCE,B
Ctenotus calurus				B
Ctenotus grandis				BCE
Ctenotus hanloni				BCE
Liopholis striata	Night Skink			BCE,B
Tiliqua multifasciata	Centralian Blue-tongue			BCE,B
Acanthophis pyrrhus	Desert Death Adder			
Phalacrocorax varius	Pied Cormorant			
Nycticorax caledonicus	Nankeen Night Heron			
Elanus scriptus	Letter-winged Kite			

Species considered extinct in the survey area

Species Name	Common Name
Amytornis textilis	Thick-billed Grasswren
Dasyurus geoffroii	Chuditch
**Bettongia lesueur*	Boodie, *Burrowing Bettong- many old warrens recorded in 2018 and 2019 surveys.
Lagorchestes hirsutus	Rufous Hare-Wallaby
Macroderma gigas	Ghost Bat
Macrotis lagotis	Greater Bilby
Isoodon auratus	Golden Bandicoot
Chaeropus ecaudatus	Pig-footed Bandicoot
Leporillus apicalis	Lesser Stick-nest Rat

Note that this list is probably incomplete and the past status of some of these species in the area is uncertain.

Appendix 6. Sonograms of bat species recorded on site.

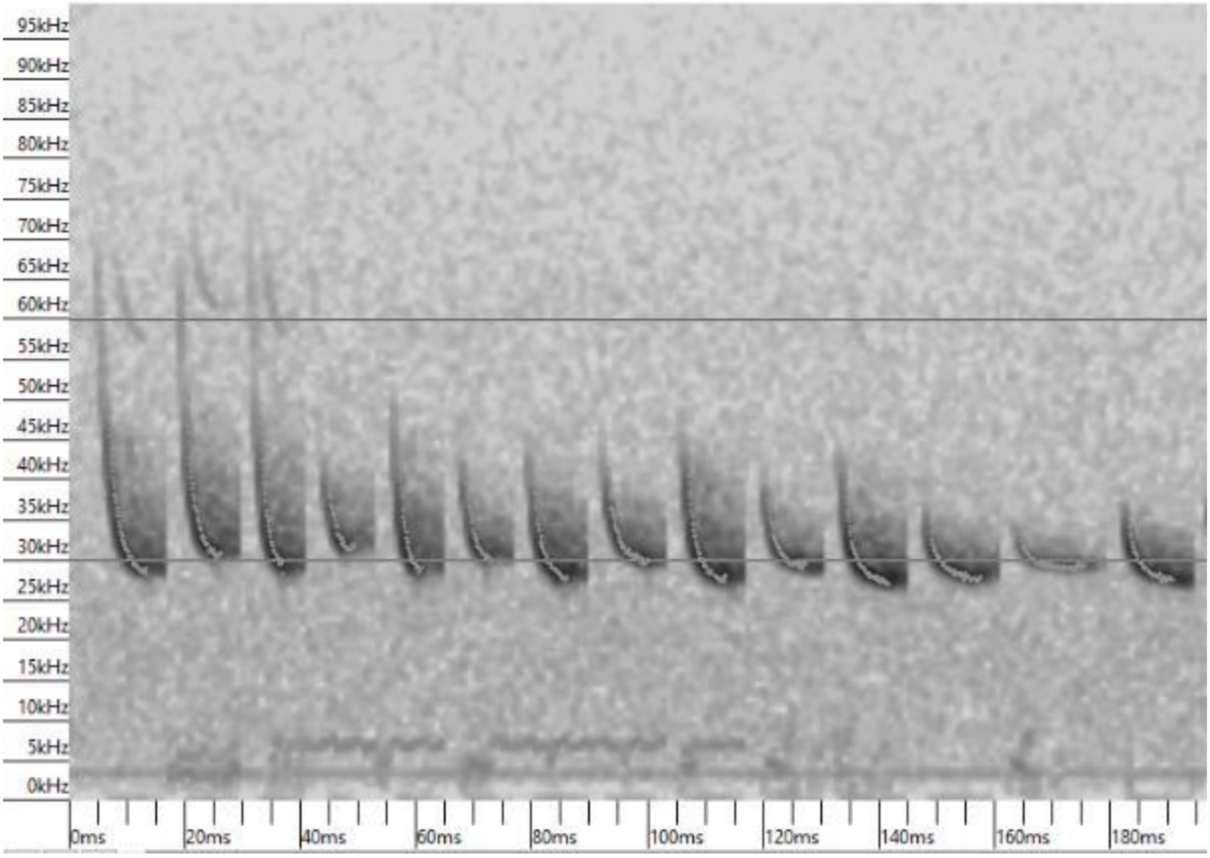

Figure 1: Sonogram of *Chalinolobus gouldii* showing characteristic alternating frequencies.

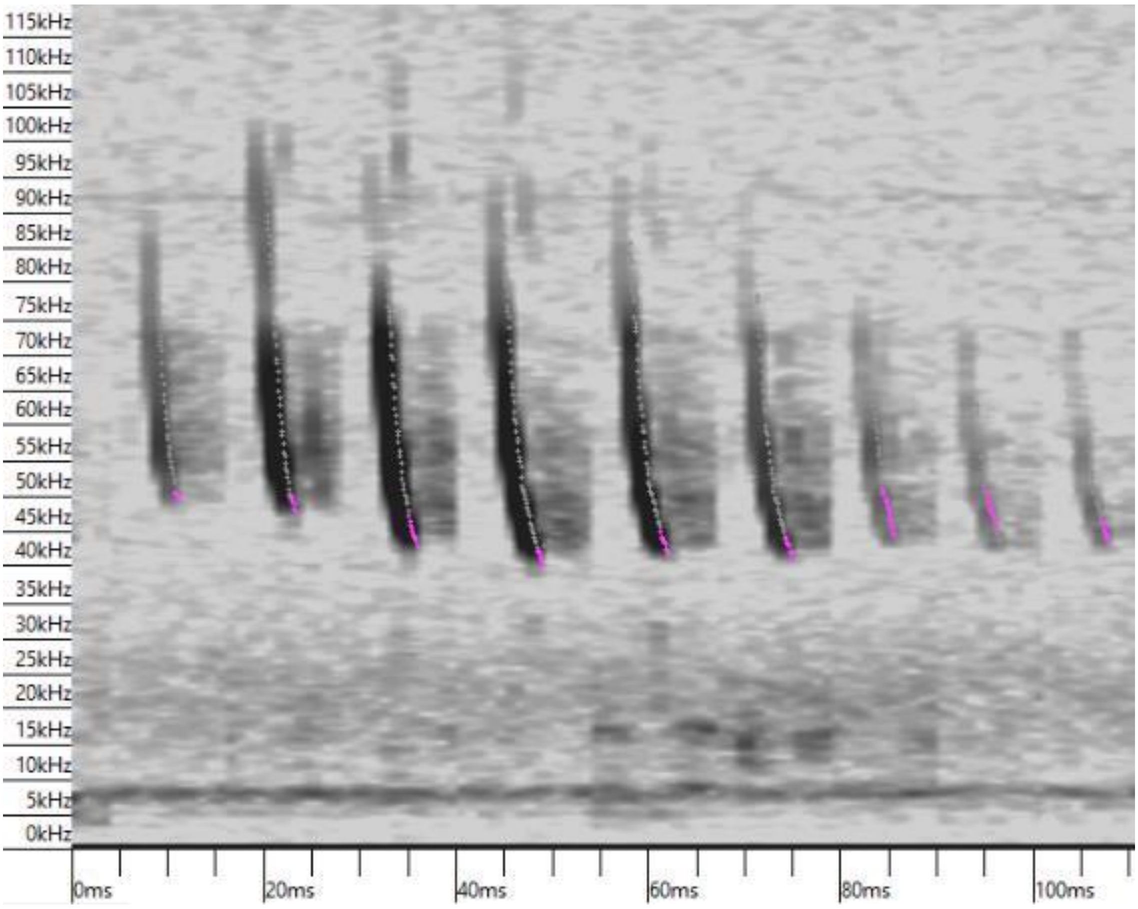

Figure 2: Sonogram of *Nyctophilus geoffroyi*.

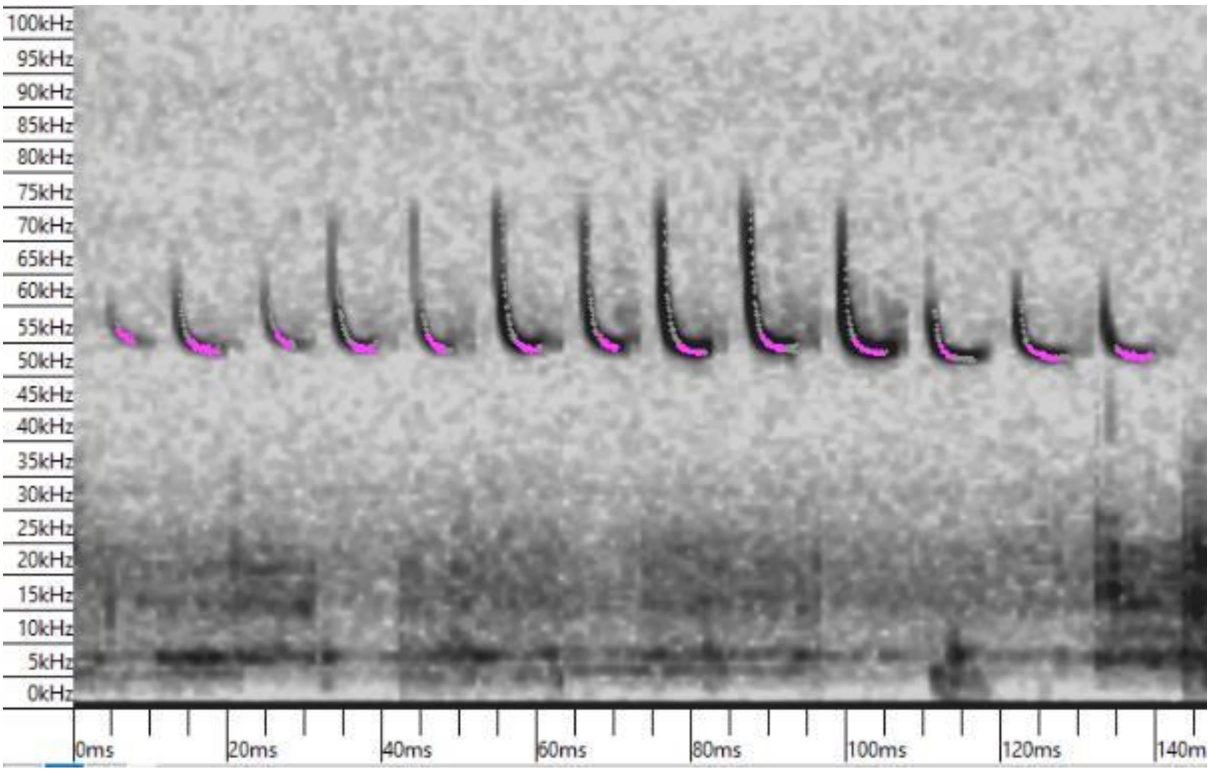

Figure 3: Sonogram of *Vespadelus finlaysoni*.

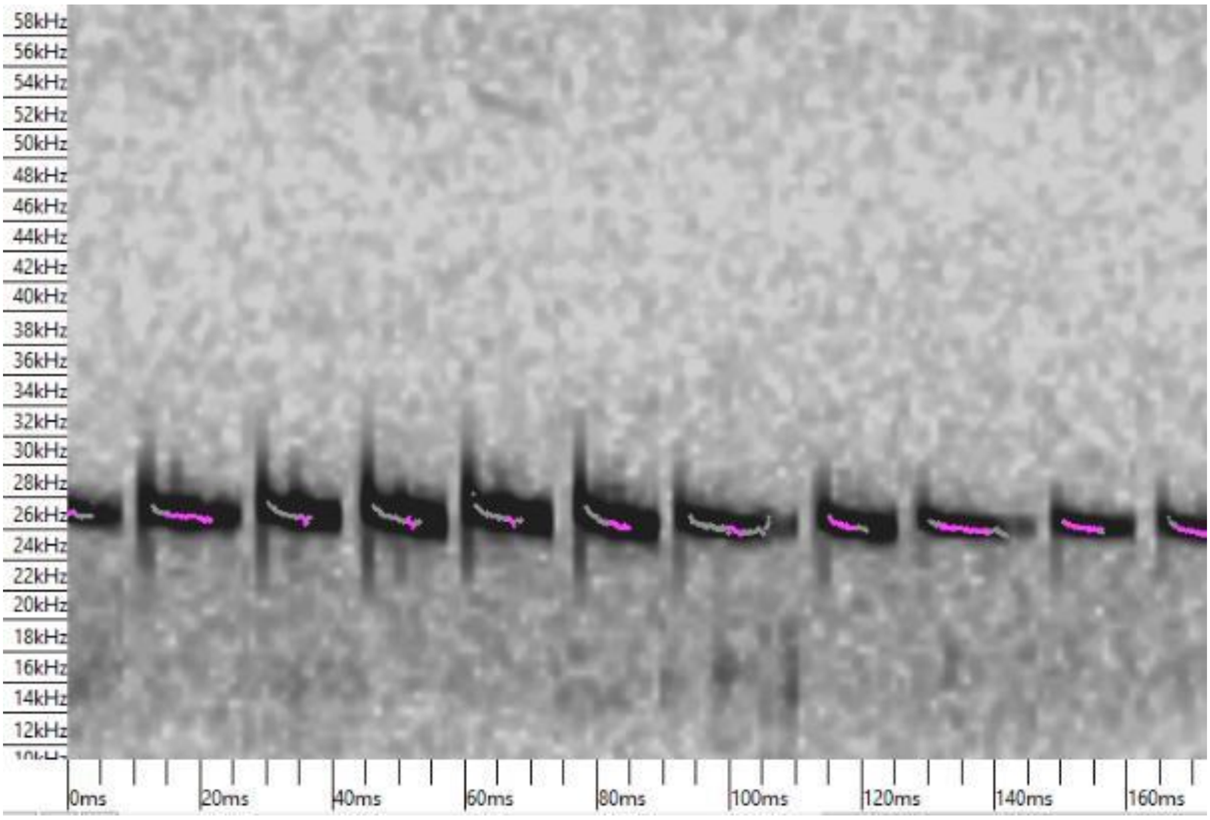

Figure 4: Sonogram of *Ozimops planiceps* (previously *Mormopterus* sp 3) echolocation sequence. Note harmonics just visible at around 55 kHz.

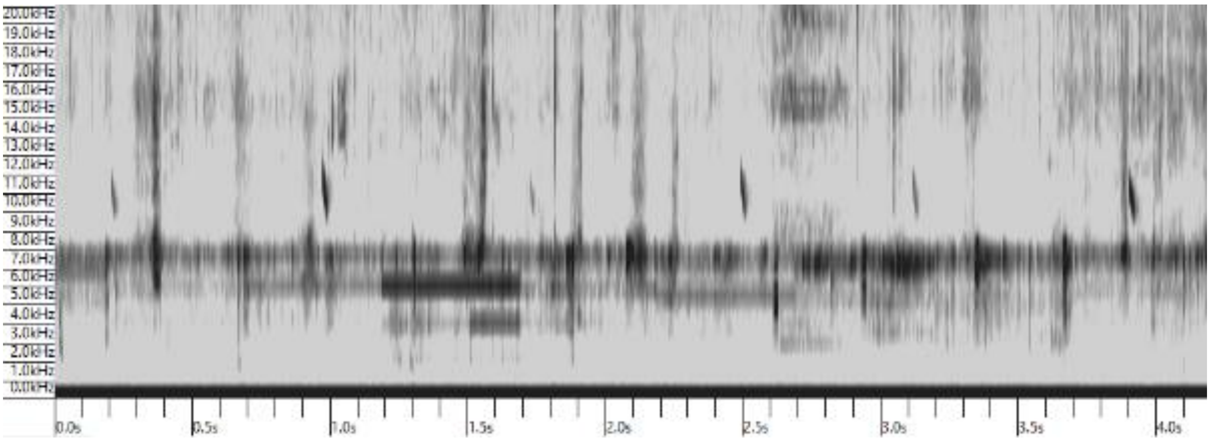

Figure 5: Weak sonogram of *Austronomus australis* call sequence. Characteristic low-frequency clicks are around 11 kHz.

Appendix 7. Annotated species list Bellevue Project Area, August and October 2018, October 2019.

Frogs and reptiles

1. *Litoria rubella*. 2018. Reported by staff and active some nights.
2. *Diplodactylus conspicillatus*. 2018. One found head-torching near site 8, on narrow clay flat with short grass between Mulga and Gypsum. Need to check current taxonomy. 2019. One caught in same area as in 2018.
3. *Diplodactylus granariensis rex*. 2018. One caught Site 3. Also one at site 8; very pale but appeared to be D.g. rex. 2019. A young animal (year 1) caught on flat (spotlighting) between dunes and gypsum ridge near site 12.
4. *Diplodactylus pulcher*. 2018. One caught at site 3.
5. *Gehyra variegata.* 2018. One caught at Site 2 and seen occasionally elsewhere. In this area, G. variegata has a dark reticulum tending to form two dark upper lateral lines. 2019. One caught site 11 and several spotlighting in south-west; on timber.
6. *Gehyra crypta*. 2018. Several caught spotlighting. In this area, lacks the dark reticulum, having just dark spots (not forming reticulum) and just behind and separate from these white spots; some quite free-standing white spots on back of head. 2019. One caught spotlighting near site 15. On rock which may be a feature of the species in the area. Several seen and caught when spotlighting on edge of rock heaps around Vanguard Pt.
7. *Heteronotia binoei*. 2018. Found at night at Boy's Well and Vanguard Pit, and caught sites 7 and 8. 2019. Seen around camp.
8. *Lucasium squarrosum*. 2018. One spotlighting near Vanguard pit (27/10). Specimen kept.
9. *Nephrurus vertebralis*. 2018. Caught site 1 (Mulga over sandy loam). 2019. Caught site 11 and site 13.
10. *Rhynchoedura ornata*. 2018. Active at night around camp. 2019. Caught site 10 and 11. Dead-torched near Vanguard Pit.
11. *Strophurus strophurus*. 2018. Caught at sites 3 and 4. 2019. Caught site 10 and when spotlighting near site 15.
12. *Underwoodisaurus milii*. 2018. Several caught Site 7 and 8. 2019. Head-torched near Vanguard Pit.
13. *Aprasia repens*. 2018. One caught at site 8 and one at site 7. One kept for WAM.
14. *Lialis burtonis*. 2018. A year 1 specimen hand-caught at Site 2.
15. *Pygopus nigriceps*. 2018. A year 1 trapped at site 1.
16. *Ctenophorus isopelis*. 2018. Seen in Site 1 on sandy soils.
17. *Ctenophorus nuchalis*. 2018. Caught site 4.
18. *Ctenophorus salinarum*. 2018. One caught in samphire on edge of gypsum dune west of site 8 (29/10).
19. *Ctenophorus scutullatus*. 2019. Caught sites 10 and 15.
20. *Pogona minor*. 2019. One juvenile seen site 15 (23/10).
21. *Ctenotus leonhardii*. 2018. One hand-caught at Site 1 (23/10) and seen regularly at sandy sites. Pitfalled at rocky and sandy sites. 2019. Few pitfalled.
22. *Eremiascincus richardsonii*. 2018. Caught at site 8 in pitfall near old Boodie warren.

23. *Lerista timida*. 2018. Caught site 5 and site 8. 2019. Caught at sites 10, 11 and 13. Some uncertainty about taxonomy but definitely fused frontoparietals.
24. *Lerista desertorum. 2018.* Caught sites 1 and 7. 2019. One caught site 12.
25. *Menetia greyii*. 2018. Several caught at sites 7 and 8, and one at site 2. All appeared to be female. 2019. One caught site 13.
26. *Varanus gouldii.* 2018. One seen at site 1.
27. *Varanus panoptes*. 2018. One checking pitfalls at site 3 (26/10). Roadkilled animal on highway: gravid female with 6 oviducal eggs. SVL: 390. Tot: 960. Good fat deposits. Stomach had a centipede (Scolopendra) scorpion (Urodacus), 4 cockroaches, a moth pupa and some bits of bone. 2019. One active at camp and one seen near site 13. One also using burrow in old Boodie warren near site 11. One caught on camera near burrow at site 15.
28. *Anilios hamatus*. 2018. One caught site 5.
29. *Anilios aff waitei*. 2018. One caught site 8; identification uncertain. Kept for WAM.
30. *Antaresia stimsoni*. 2018. Reported by staff around camp after summer rain. Eating *Litoria rubella*. Photo seen.
31. *Pseudonaja mengdeni*. 2018. One on night drive along highway (31/10).
32. *Pseudonaja modesta*. 2018. One reported by botanists. 2019. One seen during the day at site 14.
33. *Suta fasciata*. 2018. One found by head-torching at site 8.

Birds

1. Emu. 2018. Part skeleton near site 1. Tracks of single adult across part of Lake Miranda. 2019. Few feathers in fence near site 13. Tracks near cemetery.
2. Black Swan. August 2018. Dead bird on shore of Lake Miranda. Reported to have been common and breeding a few months earlier. 2019. Old nest found in samphire on Lake Way (SE).
3. Black-breasted Buzzard. 2018. One just south of Mt Keith on 23/10.
4. Wedge-tailed Eagle. 2018. Pair just north of cemetery (23/10). Pair over Tribune area (25/10). Few other sightings. 2019. Pair in south-west seen most days and a young male near site 13 (23/10).
5. Whistling Kite. 2019. One over north end of Lake Miranda (26/10). Also seen August 2018.
6. Nankeen Kestrel. 2018. One over Vanguard Pit (24/10) and one near ‘chimney’ (25/10). 2019. One in south-west area (21/10) and up to three around camp most days.
7. Brown Falcon. 2018. One in south near ‘chimney’ (25/10) and one near site 8 (29/10). 2019. One heard near site 11 (25/10).
8. Australian Hobby. 2018. One perched on power pole near Site 8 (29/10). 2019. One seen along Cosmos access road (23/10).
9. Diamond Dove. 2018. Seen once or twice; single birds.
10. Crested Pigeon. 2018. Seen occasionally in small numbers. 2019. Few seen around camp and occasionally elsewhere.
11. Common Bronzewing. 2019. Several seen in bushland including around Boyd’s Well.
12. Australian Bustard. 2019. Feathers under powerline near site 12; possible powerline strike?
13. Common Greenshank. August 2018. Two on flooded arm of Lake Miranda.

14. Sharp-tailed Sandpiper. 2019. One in dry, sparse, low samphire of northern arm of Lake Miranda. Appeared to be a juvenile.
15. Red-capped Plover. August 2018. About 20 birds on flooded arm of Lake Miranda.
16. Bush Stone-curlew. 2018. Three birds reported near camp by staff early in October.
17. Tawny Frogmouth. 2019. One flushed near Cosmos Haul road (23/10).
18. Mulga Parrot. 2018. Three just north of Vanguard Pit (24/10) and up to 7 seen in this location regularly. 2019. Few pairs seen while doing walking transects.
19. Australian Ringneck. 2018. Two seen between sites 5 and 7 (28/10, 30/10 and 31/10). 2019. Seen occasionally around sites 10 to 12, and seen occasionally along walking transects.
20. Red-backed Kingfisher. 2018. Seen occasionally. 2019. Two seen near site 6 (25/10).
21. Rainbow Bee-eater. 2018. Heard near site 5 (31/10). 2019. Seen and heard occasionally throughout.
22. White-winged Fairy-wren. 2018. Parties in samphire and low shrublands; coloured males present. Very abundant, especially to west where samphire in good condition. 2019. Heard and seen regularly in chenopod shrubland around sites 10 and 11, and seen along highway near Kathleen Valley area.
23. Splendid Fairy-wren. 2018. Party in northern hills, including coloured male. Few other groups. 2019. Very few groups seen. One coloured male seen.
24. Variegated Fairy-wren. 2018. One party with a coloured male just north of Vanguard Pit (31/10). 2019. Presumably same party in same location; with coloured male. Party also seen near site 12 (25/10).
25. Redthroat. 2018. Several seen and heard in northern hills. 2019. Seen and heard occasionally in northern hills.
26. Inland Thornbill. 2018. Seen occasionally in Mulga areas.
27. Chestnut-rumped Thornbill. 2018. The common thornbill in Mulga country. 2019. The common thornbill in Mulga country.
28. Yellow-rumped Thornbill. 2019. Few groups around.
29. Slaty-backed Thornbill. 2019. One bird seen very clearly (streaks on forehead and dark eye distinct) near site 12 (25/10). Probably present throughout in small numbers.
30. Southern Whiteface. 2018. One party seen near Site 3.
31. Spiny-cheeked Honeyeater. 2018. Seen regularly in Mulga. 2019. Heard around site 12.
32. Yellow-throated Miner. 2018. Parties seen regularly. At sites 7 and 8, feeding on green seeds of acacia by biting into the green pods. Seeds are large (lentil-sized) with a fat arel. 2019. Seen and heard occasionally throughout.
33. Singing Honeyeater. 2018. Common in Mulga. 2019. Common in Mulga.
34. White-plumed Honeyeater. 2018. Two seen in Tribune area (24/10).
35. Brown Honeyeater. 2018. Single juvenile with yellow gape seen in shrubs west of Site 8 (29/10).
36. Crimson Chat. 2018. Few seen on open country near Vanguard Pit. 2019. Few on open ground near site 13 (24/10).
37. Orange Chat. 2019. Group of 6 on Samphire in south-east of lease area. UNCONFIRMED as not seen very well, but only species likely based on location, flight pattern and what colour was seen.
38. Grey Shrike-thrush. 2018. One calling at Site 3 (25/10).

39. Crested Bellbird. 2018. Seen and heard regularly. 2019. Two birds heard on 24/10 in north, and one heard near Vanguard Pit (27/10).
40. Rufous Whistler. 2018. Seen and heard regularly. 2019. One heard near Boyd's Well (23/10).
41. Red-capped Robin. 2018. Along drainage line near site 2 (26/10) and several seen in walk through rocky hills in the north, including recently-fledged young (27/10). 2019. Single birds and occasional pairs seen throughout; often associated with thornbills and/or fairy-wrens.
42. Hooded Robin. 2018. Seen in hills in north (27/10). 2019. Pair along walked transect in northern hills (24/10).
43. Varied Sittella. 2019. Group of about six birds near site 15 then re-sighted near site 13 an hour later (27/10).
44. Grey-crowned Babbler. 2018. Party near site 5 and in hills east of Site 2. Also party near Boyd's Well. 2019. Heard and seen near site 12 and site 13.
45. White-browed Babbler. 2018. Party just north of Vanguard Pit. 2019. Small group near Cosmos turnoff (23/10) and one seen near site 12 (25/10).
46. Western Quail-thrush. 2018. Party in northern hills (27/10) and single bird (but more nearby?) on bare ground of the blind hill along entrance road (29/10).
47. Willie Wagtail. 2018. Single birds seen occasionally. 2019. Single birds seen occasionally.
48. White-backed Swallow. 2018. Several regularly around pits.
49. Fairy Martin. 2018. Several regularly around pits.
50. Welcome Swallow. 2018. Two seen at Boyd's Well (23/10) and occasionally elsewhere. 2019. Two seen near Vanguard Pit, Site 12 and near Boyd's Well all on 23/10.
51. Black-faced Woodswallow. 2018. Seen regularly. 2019. Seen around site 11 (21/10) and small groups seen a few times elsewhere.
52. Little Woodswallow. 2018. Seen occasionally around Vanguard Pit. 2019. Two seen near Vanguard Pit (23/10).
53. Black-faced Cuckoo-shrike. 2018. Two over Tribune (25/10; 28/10). 2019. Few in site 10 to 12 area most days.
54. Ground Cuckoo-shrike. 2018. Two flying past near Vanguard Pit (30/10). 2019. Single bird near site 15 (23/10).
55. Magpie-lark. 2018. Pair around camp. 2019. Pair around camp.
56. Grey Butcherbird. 2018. Heard occasionally. 2019. One heard near site 10 and 11 mot days.
57. Pied Butcherbird. 2018. Seen and heard regularly. 2019. Several around camp each day, including a juvenile. One bird seen near site 11 (25/10).
58. Australian Magpie. 2018. One near Miranda Crossing (25/10). 2019. One again near Miranda Crossing (26/10).
59. Zebra Finch. 2018. Small group and occasionally up to about 50 in flocks near Vanguard Pit. 2019. Occasional small flocks. One big group (50+) near Vanguard Pit on one occasion.
60. Australasian Pipit. 2019. One on open ground near Vanguard (23/10). Several along road near Lake Miranda (24/10).
61. Western Bowerbird. 2018. One flying over Site 5 (25/10; 27/10. Old bower seen at western end of Miranda crossing. 2019. One in camp (morning of 25/10).
62. Torresian Crow. 2018. Heard and seen occasionally. Two seemed more or less regular close to camp. 2019. Two birds near site 11 (23/10); on 25/10 about 10 birds present. Calls and

appearance seemed ambiguous, but wings clearly same length as or slightly extending beyond tail.

63. Little Crow. 2018. Flocks up to 20 seen regularly. 2019. Two around camp; low grating call heard clearly (26/10).

Mammals

Echidna. 2018. Diggings at site 8. 2019. Fresh tracks on track into sites 10 to 12 (22/10).

Boodie. 2018 and 2019. Old warrens present in calcrete and in northern hills throughout.

Euro. 2018. Small numbers throughout. 2019. Two seen near old chimney (23/10) and one photographed at site 15.

Red Kangaroo. 2018. Three seen Site 4 (26/10) and group of three, including female with large pouch young, grazing on edge of samphire west of site 8 (29/10). 2019. About four animals near site 11; grazing in samphire and retreated into Mulga when we approached (22/10).

Rabbit. 2018 and 2019. Burrows and scats abundant on gypsum soils and chenopod shrublands; less common elsewhere.

Cat. 2018. Tracks in sand at site 1 and occasionally elsewhere. One seen near dense vegetation just north of Vanguard Pit. 2019. Tracks in sandy and other soft substrates. One dead animal found in south-east.

Dingo. 2018. Tracks of single animal across mud of Lake Miranda. Photo of one taken west of Site 8. 2019. Fresh tracks near cemetery (23/10) and near site 10 (24/10).

Notomys sp. 2018.Burrow systems in mulga on sandy loam but no tracks. One found drowned in a trough at the camp in September. Described as being ‘large’. *N. mitchelli??*. 2019. Burrow system found near Kathleen Valley. Inactive and small so more likely *N. alexis*. An active burrow system found near old Sir Samuel townsite.

Austronomus australis. 2018. Heard over camp some nights; at least an hour after dark so travelled a long way.

Cows. Tracks occasionally throughout and a few seen.

Appendix C. Surface Water Management

BELLEVUE GOLD WATER MANAGEMENT PLAN

EWP20188.002
2
30 June 2021

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
0	For Client Review	NT, CT, JMcD, ER	NT	NT	15/2/2021
1	For Client Review	NT, CT, JMcD, ER	NT	CT	29/4/2021
2	Update to mine plan	CT, RS	RS		02/07/2021

Approval for issue

	[Date]

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Contents

EXECUTIVE SUMMARY

Bellevue Gold Limited (referred to as Bellevue hereafter) is looking to develop the Bellevue Gold Project (the Project) north of Leinster, with a planned operational period between 2023 and 2031. The works documented herein form part of a larger Feasibility Study for the site.

The Project comprises a series of open pits, and extensive underground workings. Vanguard pit is proposed to be reworked as part of the current project and Henderson Pit 2 developed as an additional open pit. The bulk of dewatering is associated with the proposed development of the (currently flooded) underground workings at the site.

Overview of work completed

Bellevue's mining plan requires the dewatering of underground workings at the site (2022-2031), concurrent with dewatering of the Vanguard Pit (2022). To understand the key risks to the programme from a water perspective the following were completed:

- Review of available data (historical abstraction, water level data)
- Hydrological and water engineering study
- Construction and calibration of a numerical groundwater model, to inform on long term dewatering volumes during the life of the mine
- Construction of a water balance for the site capturing key inputs (e.g. dewatering, storage capacity) and outputs (e.g. plant demand) to understand the likely risks in terms of water surplus of deficit over the life of the mine.
- Development of a water management plan

Surface Water Hydrology

An assessment was made on the potential risks associated with high rainfall events, including up to 1:500-year rainfall events. These flood maps can be used to assess the risks to infrastructure and aid in the planning and design of flood mitigation structures (if required).

These assessments highlighted that the risk to infrastructure from even a 1:500-year flood was very low and that the site topography encouraged flow away from the site naturally.

The study also investigated the potential for rainwater harvesting on site, concluding that there is the potential to capture over 500 ML per year in a typical rainfall year.

Groundwater Modelling

Groundwater modelling indicates that impacts associated with dewatering are anticipated to be largely benign, however it is apparent that there may be limited drawdown in the paleochannel to the south. Groundwater inflows of around 28 L/s (2,400 kL/day) are predicted in the first year of mining, declining to a steady 19 L/s (1,600 kL/day) towards the end of mining. Uncertainty modelling predicts inflows ranging between 10 L/sec and 55 L/sec depending on hydraulic conductivity and storage properties applied in the model, however the base case and low permeability scenarios are considered most likely and are applied in the water balance modelling.

Water Balance

The average water balance over the life of the mine is summarised in Figure 1(based on base case and low permeability groundwater model scenarios), which summarises available storage, key water demand and inputs and tracks the volume of water stored in above ground pits. The water balance model indicates a potential surplus of between 5,900 kL and 92,260 kL between April and August 2022 - during the early dewatering of the underground workings.

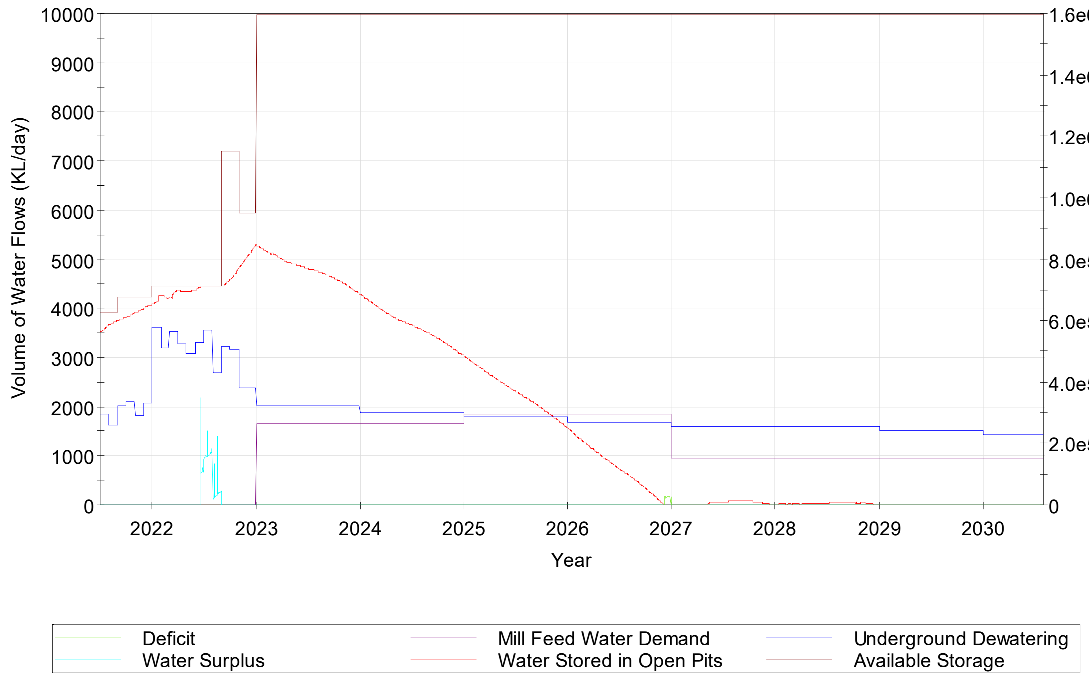

Figure 1 - Average Water Balance

With a given net process water demand of up to 1841 kL/day, these studies indicate that it is likely the mine will be supplied with process water from underground dewatering and water currently stored in open pits for the majority life of the project, with the potential for a period of deficit during 2027 when plant demand is greatest. During the early period of dewatering of the underground workings, between approximately April and August 2022, there is currently a risk that a surplus of water may be generated. However, there are various measures proposed by Bellevue that are expected to adequately manage the risk of this potential surplus such that there is no net surplus of water from the site.

The modelled deficit (in 2026) ranges between 0 and 123,000 kL, whilst the modelled surplus (in 2022) ranges between 5,900 and 92,260 kL. The deficit can be managed by sourcing alternative water supplies.

Water Management Strategy

Construction Phase (2021-2022)

The water balance modelling demonstrates that the Project is likely to have a water surplus during the late construction phase (i.e. mid-2022). This surplus occurs when dewatering in the model is greatest and onsite storage is relatively limited. There are several options available to manage the surplus of water anticipated:

- Delaying the bulk of underground dewatering from April / June to end of August when the additional storage capacity of Vanguard pit is available. Pumping capacity will allow for the mine to be completely dewatered by the end of 2022.
- Increasing the capacity of the planned evaporation pond from 200 ML to 250 ML.
- Complete mining of the Henderson 2 pit earlier in 2022 to make the additional capacity it offers available sooner.

The above are a range of options that could be used either individually or concurrently, depending on how dewatering progresses, to mitigate the risk of surplus water being generated. The available storage on site is a key constraint, and if necessary dewatering can be slowed / delayed or additional storage brought on line sooner to prevent surplus water being generated.

Operational Phase (2023-2031)

During the operational period, in particular during 2027 – when plant water demand is high, there is a risk of insufficient water that if dewatering volumes are low.   In this instance alternative water supplies should be sought if necessary. As dewatering progresses the water balance will be better constrained and the need for additional water supply better understood.

Recommendations

- Ongoing monitoring of existing (2018 drilled) monitoring bores to validate the groundwater model and track drawdown trends as well as additional monitoring bores to the south of the facility to assess the potential impacts of dewatering on the paleochannel aquifer.
- Reconciliation of the water balance with measured dewatering and drawdown data as work progresses – recommended that this is initially tracked on a monthly basis to validate the assumptions made in the model to date and capture any key changes to the mine plan over time.
- Consideration of alternative water supply options – based on the water balance this is not an immediate issue, but should still be looked into well in advance of the forecast period of potential temporary deficit (2026).
- Refinement of the mine plan to include the potential water management options – including update of the corresponding water balance.
- Consideration of the size of the proposed evaporation pond – to support management of potential periods of otherwise surplus water.

1 INTRODUCTION

Bellevue Gold Limited (Bellevue) is looking to develop the Bellevue Gold Project (the **Project**) north of Leinster. The Project extends across two mining leases (M36/24 and M36/25) held by Golden Spur Resources Pty Ltd (referred to as **GSR** hereafter), a fully owned subsidiary of Bellevue.

Bellevue is located about 40 km north of Leinster on the Goldfields Highway and 370 km north of Kalgoorlie and the general layout is shown in Figure A. The site is located on a series of hills to the north of Lake Miranda.

Bellevue have engaged RPS Group to complete investigations into the water-related aspects of the Project. These studies will be used to guide water management on site and act as a planning tool. This document details the investigations and modelling undertaken by RPS into the key water-related aspects for the Study, including:

- A **Hydrogeological Conceptual Model** for the local region, for use in groundwater modelling;
- A **Hydrology and Water Engineering Study,** to assess the flood risk and mitigation requirements;
- A **Groundwater Model**, to inform a quarterly dewatering schedule and estimate impacts to the local aquifer;
- A **Site-Wide Water Balance** to assess whether the project will be in water surplus or deficit, with quarterly resolution;
- Documentation of a **Water Management Plan** that would incorporate the development of new water sources if necessary, identify potential risks and opportunities, as well as mitigation of risk; and
- A **Construction Schedule** for each option to inform the overall project development schedule.

1.1 Background

RPS have completed numerous investigations for previous phases of the Project, and these have either been used as background information or incorporated into the Study. These investigations include:

Bellevue Gold Project – Groundwater Assessment and Data Gap Analysis (2016); This memorandum discussed the current understanding of the local hydrogeology and likely aquifer parameters, as well as the historical dewatering and discharge volumes. The report highlighted the possible need for discharge options for excess water in the near term, as well as the need to construct a detailed water balance to guide the development of new mining activity. Water supply/disposal options included disposal to nearby unused pits and sourcing water from nearby unused pits if required.

Bellevue Site Water Review (2018); Following a site visit RPS presented a review of existing infrastructure and made recommendations for development of a site-wide water balance. The review made recommendations for risk management in future development areas at ‘Long Island’ and near Lake Miranda and assessed the camp water supply. The review also highlighted possible TSF wall slumping and made recommendations for improving the monitoring network on the Lake Miranda – TSF interface to mitigate possible impacts to Lake Miranda.

Baseline water quality assessment (2018); This report summarised water quality in various pits and bores around the site as part of a baseline assessment. Most water was hypersaline, similar in quality to water found in the paleochannel, so-called ‘end-point’ water – old groundwater.

Bellevue Water Supply Desktop Assessment (2019); RPS outlined potential local water sources and provided a pathway for their development and a first order cost estimate. Broadly speaking, RPS outlined two options for water supply:

- *Access water from another nearby user:*

  Some nearby water users have very large allocations it may be pragmatic to approach them and assess if there is an opportunity to access water.

- *Develop a new borefield:*

  Developing a new borefield may give Bellevue more security of supply by ensuring they are in control of the water but there are likely to be additional costs and take additional time.

Bellevue Gold Process and Potable Water Supply (2020); Following on from the desktop assessment, this bore completion report summarised the recent drilling and completion of three potable supply bores in the Kathleen Valley, providing detail on water quality and recommendations for pumping rates from the bores.

1.2 Key Risks

In any mining project, the key risks associated with water are typically around security of supply and control of surface water flows. An insecure water supply can lead to mining delays and slow production. Initial analysis of the Bellevue Project suggests that the key risk for Bellevue will be around management of surplus dewatering. There does appear to be sufficient water onsite, or readily available nearby (sourced from nearby water users or the Carey Paleochannel), so if dewatering volumes were lower than the process water demand, Bellevue would be able to source additional water.

However, early indications from dewatering undertaken to date suggest that the volumes generated may exceed the demands onsite and the potential for a water surplus may need to be managed. This document reports on the development of a water balance for the Project and investigates the magnitude of a surplus (or deficit) during the life of the mine.

1.3 Basis of the Investigation

To complete these investigations, RPS used publicly available data and were supplied with project and background information from a number of sources:

- **Bellevue Gold** – Mining schedule, process and potable water demand, topographic data, nearby pit capacity for water storage, proposed infrastructure layout, proposed underground workings locations, current underground workings, and recent aerial photography, dewatering data, water monitoring data, monitoring bore data, Heritage sites, Significant Flora, and lithology model data
- **REC Geotechnical and Tailings** – Preliminary tailings water balance, including data on the tailings returns, retained water, slurry water content,
- **Bureau of Meteorology** – Rainfall data, evaporation data, other weather data.
- **Geological Survey of Western Australia** – Regional geology data
- **Department of Water and Environmental Regulation** – Regional hydrogeology data

In addition to the data sourced above RPS considered the aims of the Project and present some of the key aspects and Project goals that were used in undertaking the investigation.

1.3.1 Mine Status

The underground is currently being dewatered, with an aim to reduce the water level in the underground to 175 mAHD by the start of 2022 and 40 mAHD by December 2022. Pumping rates have varied through 2020 and the dewatering data have formed a valuable source of information for the Water Balance and the groundwater modelling. The water produced was originally discharged from the underground to nearby pits: Henderson, Westralia, and Vanguard. However, these pits are now essentially full (approximately 59,000 kL available storage as of June 2021), and alternate water management plans are being assessed. Currently Bellevue is managing the excess water through a combination of evaporation and dust suppression.

Bellevue currently de-water the workings under GWL 202924, which has an allocation limit of 1,000,000 kL/year.

1.3.2 Mining Schedule

A mining schedule for the underground working was provided by Bellevue, detailing the mining progression for each named mining expansion and the expected mining year. The progression of the planned workings is shown in Appendix A. The mine schedule shows that underground workings extend to -322 mAHD (approximately 780m below ground surface) over a nine-year mine life.

Additionally, it is planned to extract further ore from Vanguard Pit and develop an open pit at Henderson 2. In terms of this water balance study, these open pits offer opportunity for additional storage across the life of the operation.

1.3.3 Dewatering

It is assumed that dewatering of the underground during the Project life will be conducted using pumps installed in sumps at the bottom of the working level, rather than external dewatering bores. This means that dewatering will progress vertically with mining and new work areas will be dewatered as they are opened. It is also assumed that previously worked areas will need to remain dewatered for the life of the Project.

1.3.4 Water Processing Demands and Engineering

Table 1 lists the provided process water requirements and Table 2 presents the current potable water demand for the project. These water demand data are used in the Water Balance.

Table 1: Process Water Requirements for the Proposed Mining Scenarios

Process plant water requirement	
Criteria	**1 Mtpa Scenario**
Annual plant throughput rate	1,000,000 t
Annual plant operating hours (nom)	8,000
Plant raw water requirements incl. process make-up	950-1841 m3/d
Annual requirement	347-672 ML

Table 2: Potable Water Requirements for the Project

Potable water requirement				
Area	**Personnel/ Quantity**	**Consumption per day**	**Total daily consumption (kL)**	**Total annual consumption (kL)**
Village	400 people	250 L/person	100.0	36,500
Administration	220 people	100 L/person	22.0	8,030
Plant fresh water requirements			147	53,655
Subtotal			269	98,185
Contingency	15%			14,728
			Total	**112,913**

1.3.5 Project Water Supply

Two streams of water are required for the Project, a process water stream, and a potable water stream. The source of this water will be ultimately determined by the availability of water, the distance to the mine, the quality of the water and cost of treatment (if necessary).

1.3.5.1 Process Water Supply

As described in earlier studies (RPS, 2016, 2020) the most obvious source of process water for the project is dewatering from the mining operation. However, should Bellevue require additional water (either because dewatering rates decline faster than expected or process demand is higher than anticipated) then, broadly speaking, Bellevue has two alternative options for water supply:

- **OPTION 1 — Access water from another nearby user**:

  Some nearby borefields have very large allocations it may be pragmatic to approach nearby users and assess if there is an opportunity to use their water. Approximately 4 km north of Bellevue are the old Cosmos mine pits, which are licensed for 3,000,000 kL/annum for dewatering. The licence is currently held by Australian Nickel Investments Pty Ltd.

- **OPTION 2 — Develop a new borefield:**

  Developing a new borefield may give Bellevue more security of supply by ensuring they are in control of the water but is likely to cost more and take more time than using water from a separate project. This option was explored in detail in RPS (2020), where Bellevue would be able to expect a yield of up to 750,000 kL/annum from the Carey Paleochannel

1.3.5.2 Potable Water Supply

The potable supply for the project has been assessed in a recent water exploration drilling program in the Kathleen Valley area (RPS (2021)). This achieved very promising results with all four bores drilled intersecting low salinity water, and three constructed as production bores.

The expectations leading into the program were that only about 1 in 3 bores would intersect useful (> 1 L/s) flows. However, each of the four bores drilled exceeded 1 L/s with two bores achieving greater than 4 L/s on airlift. This indicates that future drilling programmes in the area may achieve similar success, and that the area in general is considered prospective for potable water.

1.3.6 Surplus Water Management

Should dewatering volumes be larger than the process water requirement, this surplus water will need management. Bellevue Gold had noted there was surplus water from dewatering the underground in mid-2020 and the nearby pits would not be sufficient to accommodate the higher than anticipated groundwater inflows. RPS supplied design details for an evaporation pond to accommodate 350,000 kL per year, which had been proposed to alleviate the surplus water issue.

As the evaporation rate near Bellevue is very high, evaporation is a key tool for water management. However, other options that may be considered are additional dust suppression around site and the possibility of re-injection of saline water into the nearby Carey Paleochannel. Lastly, there are some water users nearby, such as BHP Ni West at Mount Keith, who are using water from the Carey paleochannel and may consider using surplus water from Bellevue.

2 SITE SETTING

2.1 Location

Bellevue is located about 40 km north of Leinster on the Goldfields Highway and 370 km north of Kalgoorlie and the general layout is shown in Figure A. The site is located on a series of hills to the north of Lake Miranda.

2.2 Climate

The Bellevue area experiences a semi-arid to arid climate, with hot, dry summers and cool, mild winters. The region is influenced by the consistent winter rainfall patterns that affect central Western Australia as well as the variable summer rainfall typical of the northern regions. Summer rainfall activity is dependent upon thunderstorm activity and rain bearing depressions formed in the wake of tropical cyclones. The closest operating weather station to the site that records rainfall is at Yakabindie (BoM site: 12088), approximately 6km to the north-west which has recorded rainfall data from 1931 to present (summarised in Figure 2The closest weather station that records temperature data is the Leinster Airport (BoM site: 12314), this site is 27km to the south-east and has recorded temperature data from 1994. The mean annual rainfall for the site is 226 mm (1983–2017) with annual rainfall amounts varying significantly due to cyclonic activity. Annual pan evaporation is approximately 3200 mm. Average summer temperatures range between 35°C and 41°C during the day and between 18 °C and 23 °C during the night. Average winter temperatures range between 21 °C and 26 °C during the day and between 6 °C and 8 °C during the night.

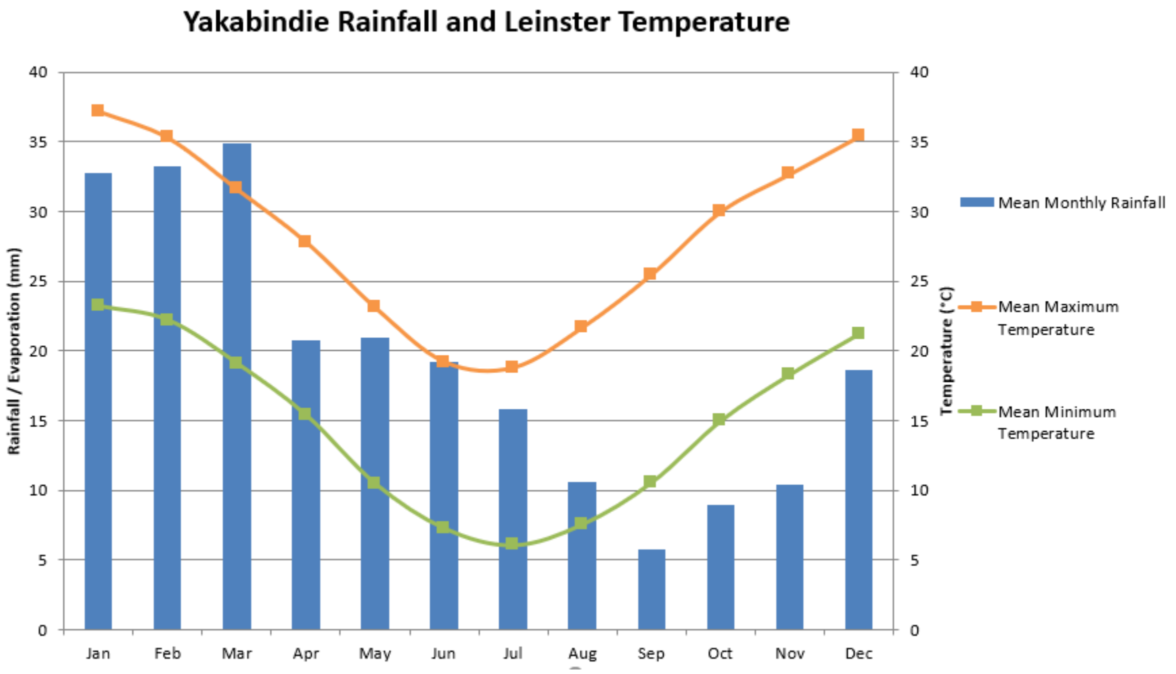

Figure 2 Bellevue area climate (mean monthly values)

2.3 Surface Drainage

The project leases are situated on a gently undulating landscape which consists of minor ridges, with slopes generally less than 10 degrees, and colluvial flats 50m to 200 m wide and 10 m to 20 m below the ridges. The lease area is described as drainage lines, with salt lake features to the south (Lake Miranda), undulating plains to the east and hills to the west (Figure 3). There are no wetlands or permanent surface water features on the site. All streams are ephemeral, driven by the erratic nature of rainfall.

The existing open pits are aligned with the local topographical high of the greenstone belt, which also defines the top of the local surface water catchments in the area. Drainage near the Site is generally to the south towards Lake Miranda (salt lake with periodic inundation driven by seasonal rainfall events). East of the Site lies a braided streambed with four major tributaries that converge at a point about 2 km east of the southernmost point of the Site. Large surface run-off occurs following thunderstorms or cyclonic activity, resulting in intermittent and short duration surface water flows in the local drainage lines. Run-off rates during these large rainfall events are generally high.

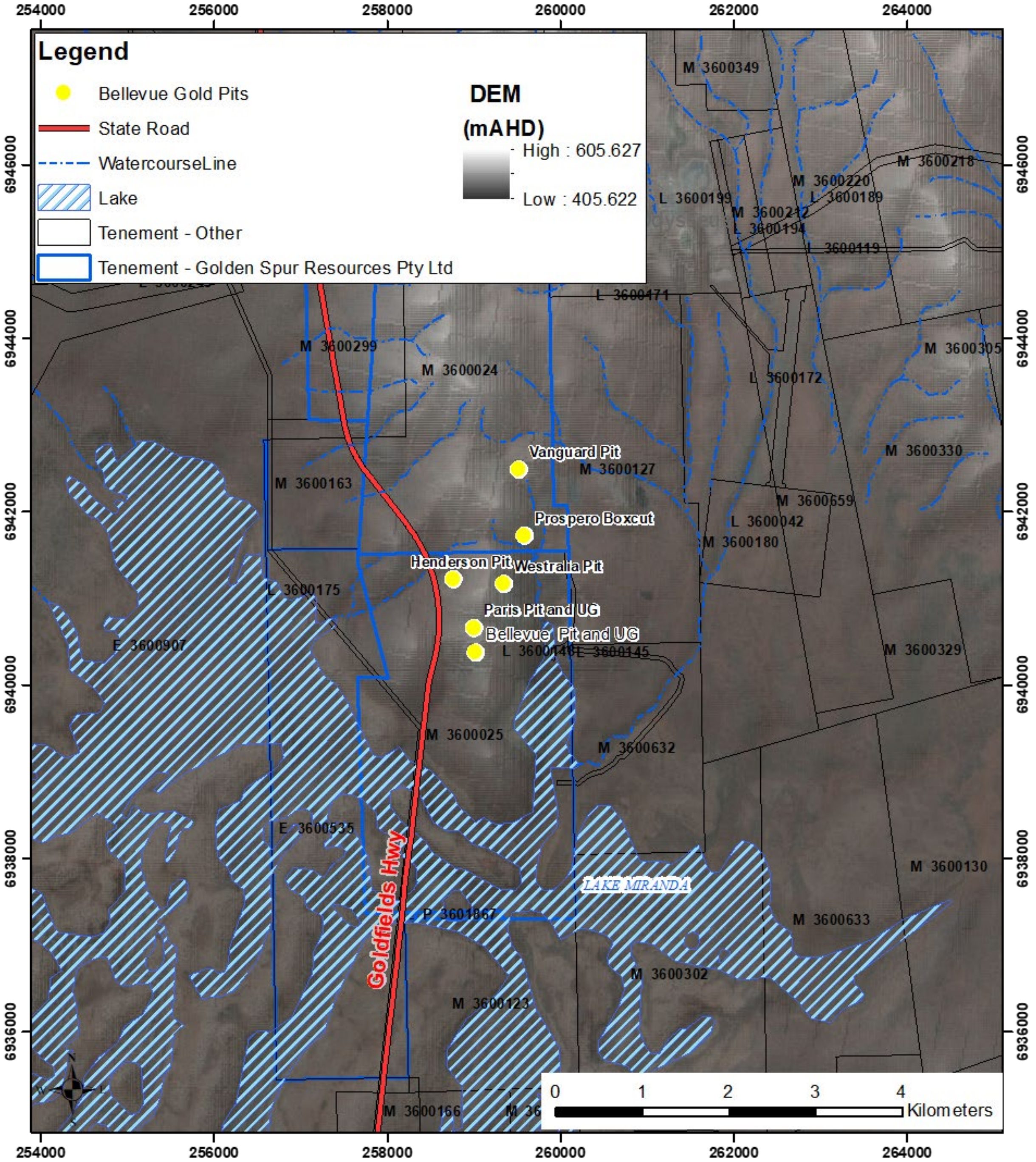

Figure 3: Topography and drainage

2.4 Geology

The Project lies in the Kalgoorlie Terrane of the Yilgarn Craton that comprises Archaean granite-greenstone rocks that have been deeply weathered and overlain by duricrusts or Cenozoic valley-fill deposits. Regional mapping undertaken by the GSWA (Liu et al. 1998) was used to create a simplified geological map (Figure 4). The area is characterised by Archaean mafic and ultramafic rocks adjacent to granitoid rocks. These hard rocks in the Goldfields typically feature the development of a moderately thick weathered profile and the formation of duricrusts (lateritic and siliceous) following humid weathering in the Mesozoic. However, in the Bellevue area, most of this weathered profile (especially in the immediate mine vicinity) appears absent and hard fresh rock is very close to the surface.

More recent humid conditions from the Palaeocene to the Miocene cut wide valley systems across most of Western Australia. These valleys have since filled with sediment following the onset of drier conditions in the Cenozoic and lower stream gradients (associated with slight tectonic uplift). These in-filled valleys form the local Paleochannels, such as the adjacent Carey Paleochannel.

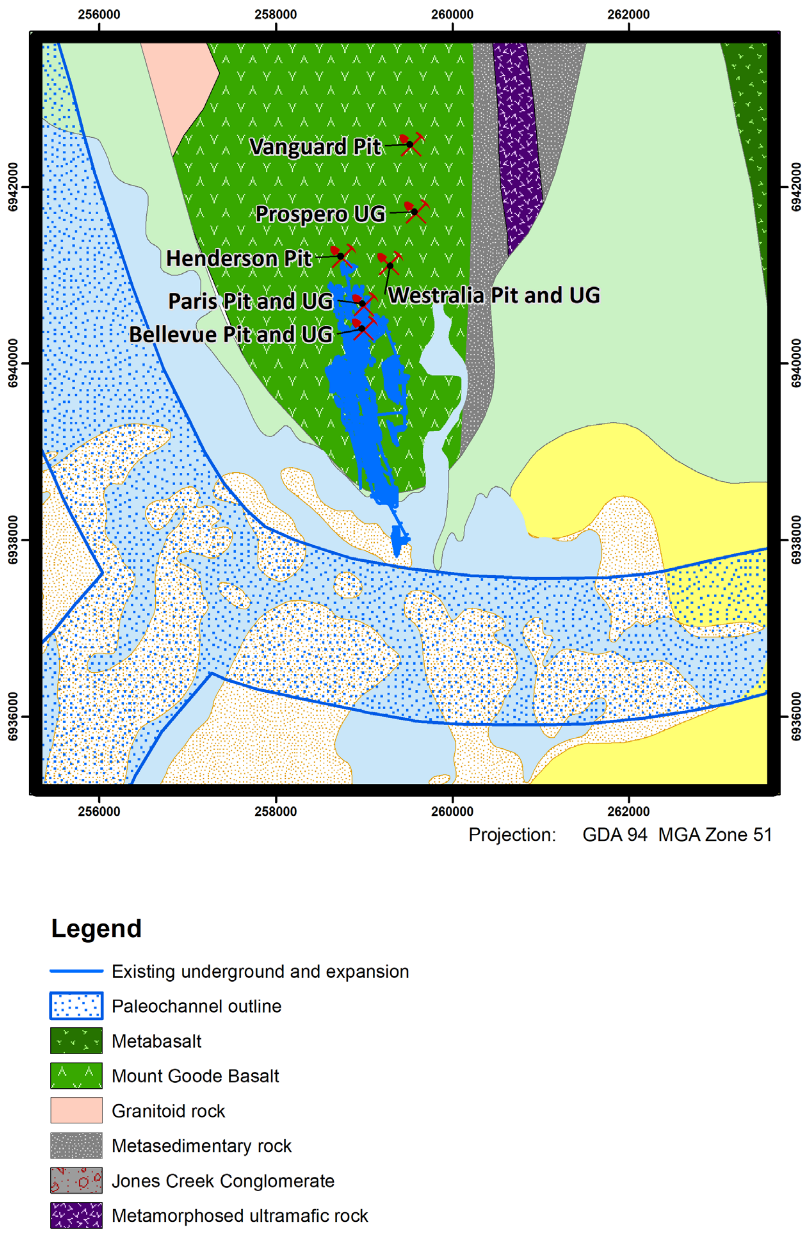

Figure 4 Simplified Geology in the Bellevue area (After Liu et al. 1998)

2.5 Hydrogeology

The hydrogeology in the Bellevue area is strongly related to the local geology. There are two defined aquifers in the region, the Fractured Rock Aquifer, and the Carey Paleochannel Aquifer (Figure 5The Archaean basement rocks at Bellevue offer low aquifer permeability and storage characteristics. Groundwater occurs mainly within the secondary porosity developed in the weathered lower saprolite horizon and structural defects such as faults, shears zones and fractures in the deeper saprock transition zone and fresh rock beneath. This forms a large discontinuous aquifer known as the Fractured Rock Aquifer. This aquifer is known for low yields of fresh to saline groundwater (Table 3).

The Carey Paleochannel Aquifer has formed in the more permeable sediments that infilled the Carey Paleovalley from the Palaeocene to the Miocene. This is a high yielding aquifer that typically produces hypersaline water (Table 3).

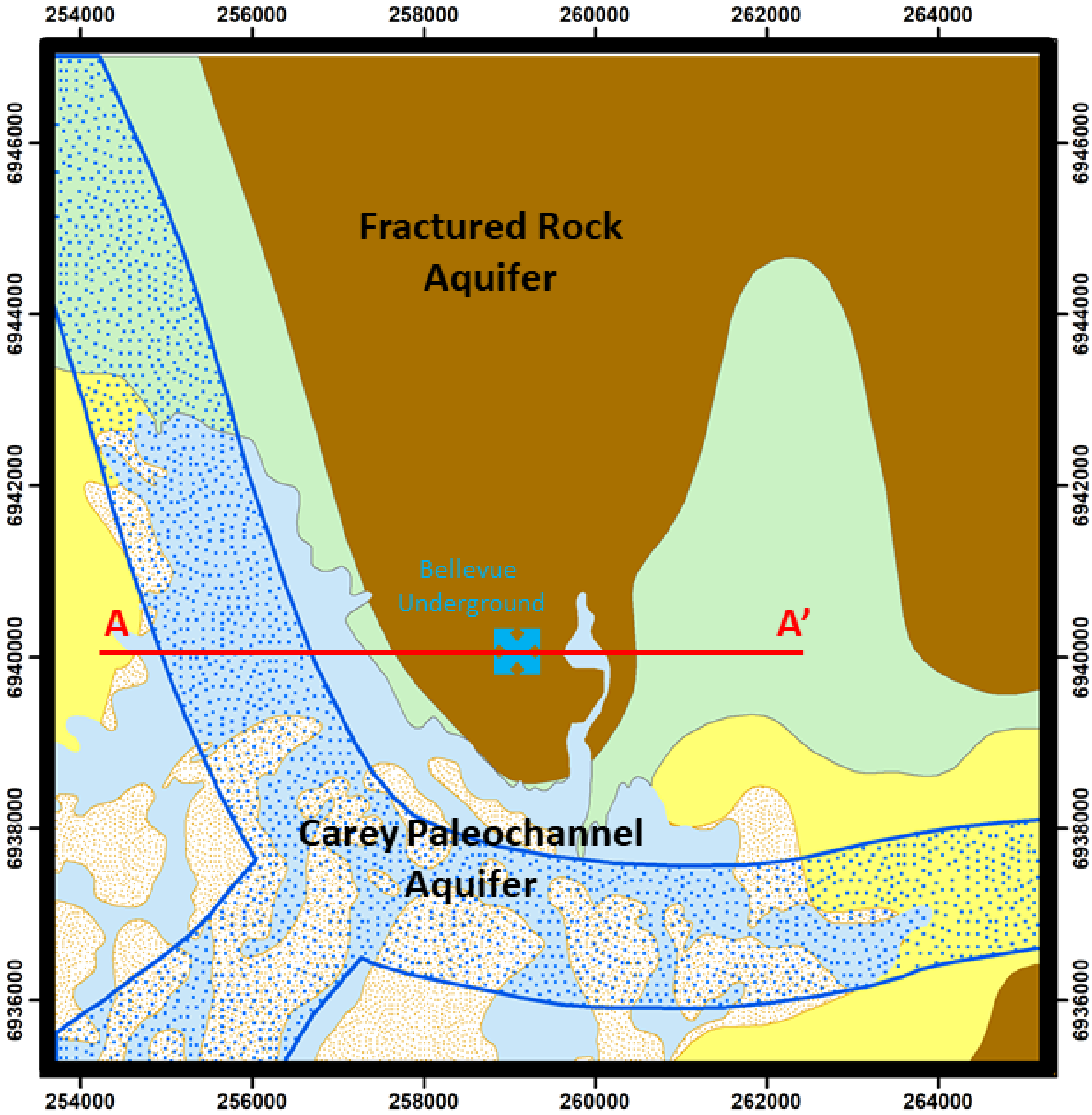

Figure 5 Aquifers in the Bellevue area

Table 3: Aquifer yields in the Bellevue area

Local Stratigraphy					
Aquifer	**Geological unit**	**Max Saturated thickness (m)**	**Bore yield (kL/d)**	**Aquifer potential**	**Water quality**
Paleochannel	Alluvial deposits and calcrete	14	0 to500	Low – moderate	Brackish – saline
	Perkolilli Shale	29	-	Aquitard	
	Werillup Formation	>81	200 to 2000	High	Saline-hypersaline
Fractured Rock	Upper Saprolite	~50	-	Low	Fresh – saline
	Lower Saprolite – Saprock (transition zone)	~100	0 to 1000	Low – moderate	Fresh – saline

2.5.1 Fractured Rock Aquifers

The weathered profile and underlying fractured bedrock can form moderately permeable aquifers, and locally may be highly productive. It is characterised by secondary porosity and permeability through the break-down of the primary rock material and fracturing that is typically more extensively developed about fault zones and about lithological contacts. A significant resource of groundwater is stored within the weathered profile, although the unit is not necessarily permeable. In contrast, a fractured rock aquifer contains a very small portion of groundwater relative to its volume but can have zones of high permeability.

The weathered profile normally extends to depths of around 50 m below surface but can be up to about 80 m thick in areas of shear zones, lithological contacts, and areas of mineralisation. Low yields of groundwater are typically produced from bores constructed in the weathered profile, particularly profiles developed upon greenstone rocks which normally weather to very low yielding clay. Moderate yields of up to around 100 kL/day can be obtained from the base of the weathered profile in the transition zone with the underlying bedrock. This is mostly achieved over granitic rocks, and mafic and ultramafic greenstone rocks.

In a fractured rock aquifer, fractures developed within bedrock below the weathered profile can form permeable aquifer zones. Fracture development is enhanced by the oxidation and dissolution of minerals, but these tend to close with depth and are typically not significant below 120 m depth. The permeability of fractured rock aquifers is related to the degree of fracturing and how open (or clean) that the fractures are. Fracture zones in some rocks can be clogged by the presence of clay minerals. Fractured Rock aquifers tend to be better developed within greenstone rocks compared to granitoid rocks (Johnson et al, 1999). Large bore yields can be obtained from fault and shear zones through greenstone rocks, along lithological contacts, intrusive contacts, and mineralised zones. The alignment of fracture zones with tectonic elements such as shear zones and particular rock types tend to make the fractured rock aquifer highly anisotropic.

The upper saprolite (also known as the pallid zone; the smectite zone; or the zone of strong oxidation) refers to the zone immediately beneath the ferruginous hard cap where the rock has undergone complete chemical decomposition into heavy textured clay minerals, which may display remnant rock textures. This clay can range in colour through red brown, yellow, tan or ochre, and in extreme cases may be totally bleached white or light grey. The upper saprolite is mostly unsaturated but can form a slow seepage zone where water is present.

The transition into lower saprolite (the zone of joint oxidation) is characterised by a change from heavy textured clay to soft, decomposed, friable rock 10–20 m thick. The change is commonly observed during air drilling as a sudden and significant sub-artesian water strike. The open blocky jointing in the lower saprolite zone is typically the most reliable water target in a fractured rock environment.

The zone of broken fresh rock between the lower saprolite and the hard, fresh rock can also contain open water bearing defects, particularly within faults, shears, and joints. These structures are mostly tighter than in the Lower saprolite but can occasionally produce high instantaneous yields of between 500 to 1000 kL/day, albeit that high yields tend not to be sustainable in the long term due to the limited fracture storage and variable connectivity. Defects tend to close with depth and the prospects of obtaining significant water bearing fractures diminishes beyond 90 metres depth. This zone of broken fresh rock is referred to as saprock.

Water quality in saprolite aquifers tends to be stratified with better quality potable to brackish water overlying more saline water at depth. If developed sustainably, saprolite aquifers have proven to be reliable sources for small camp supplies and mineral processing. Over abstraction, however, will locally deplete the fresh-water lens and cause the supply quality to deteriorate over time.

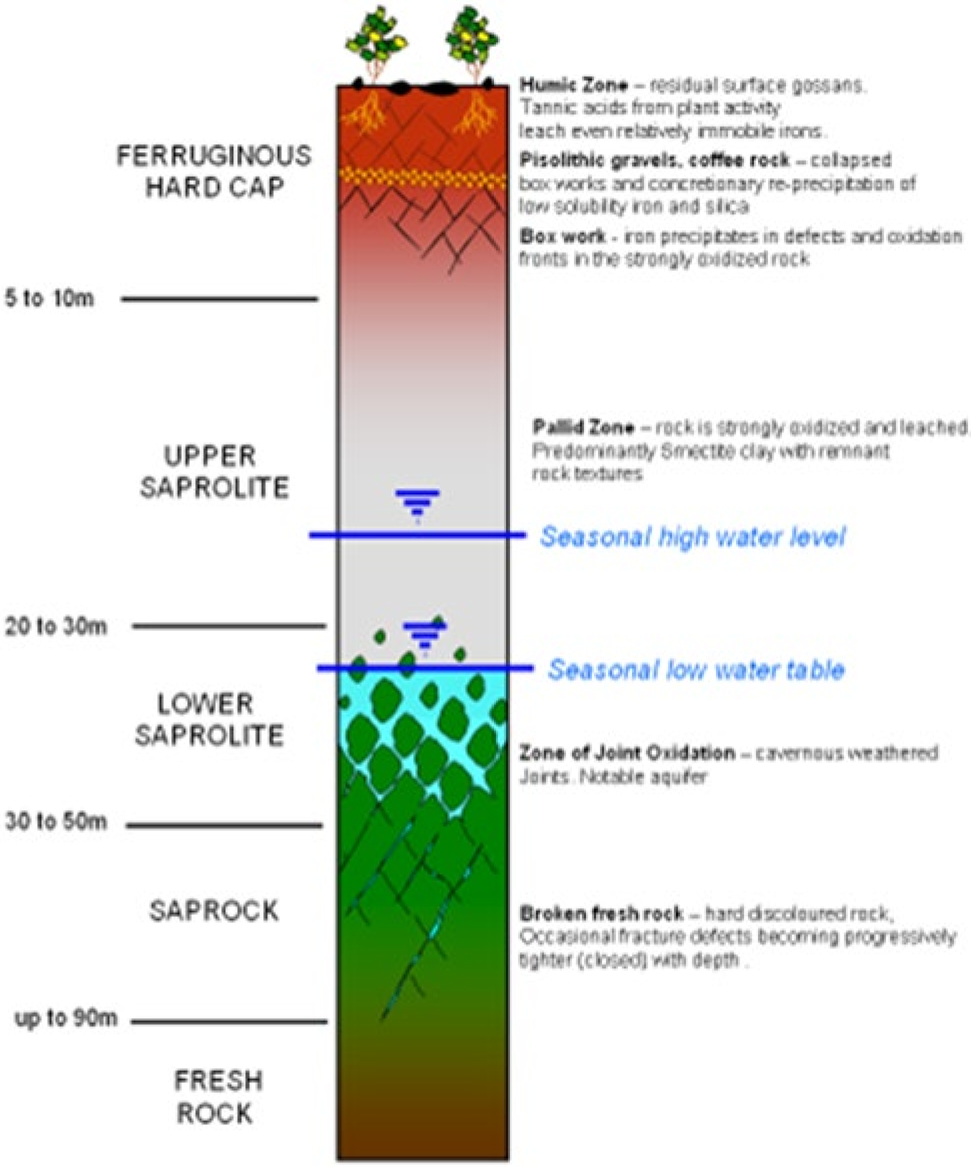

Figure 6 Schematic profile through a typical fractured-rock aquifer in the Goldfields

2.6 Paleochannel Aquifer

The nearby Carey Paleochannel Aquifer (which also includes the calcrete aquifer) has historically supported large water supply volumes for long periods of time.

The Carey Paleochannel is a two-level aquifer, with a confined lower aquifer within Eocene and Miocene sediments, and an unconfined upper aquifer in the shallower Cenozoic sediments. Figure 7 shows a schematic section through the Carey Paleochannel, with a water table around 7m below ground level.

The Werillup Formation is the basal unit of the paleochannel, and grades upwards from cobbles at the contact with basement through coarse sand to sand and clay interbeds. The unit is dominated by quartz, but also includes small fragments of rock and lignite locally. The Werillup Formation features high hydraulic conductivity and acts as a conduit for water flow, with the bulk of water drawn from the Perkolilli Shale above and the basement (especially where weathered) on the flanks.

The Perkolilli Shale is a thick unit dominated by grey clay that becomes progressively more sand rich towards the Werillup Formation below. The upper part of the Perkolilli Shale forms a confining layer to the paleochannel aquifer. There is also some evidence of calcrete formation near the top of the Perkolilli Shale.

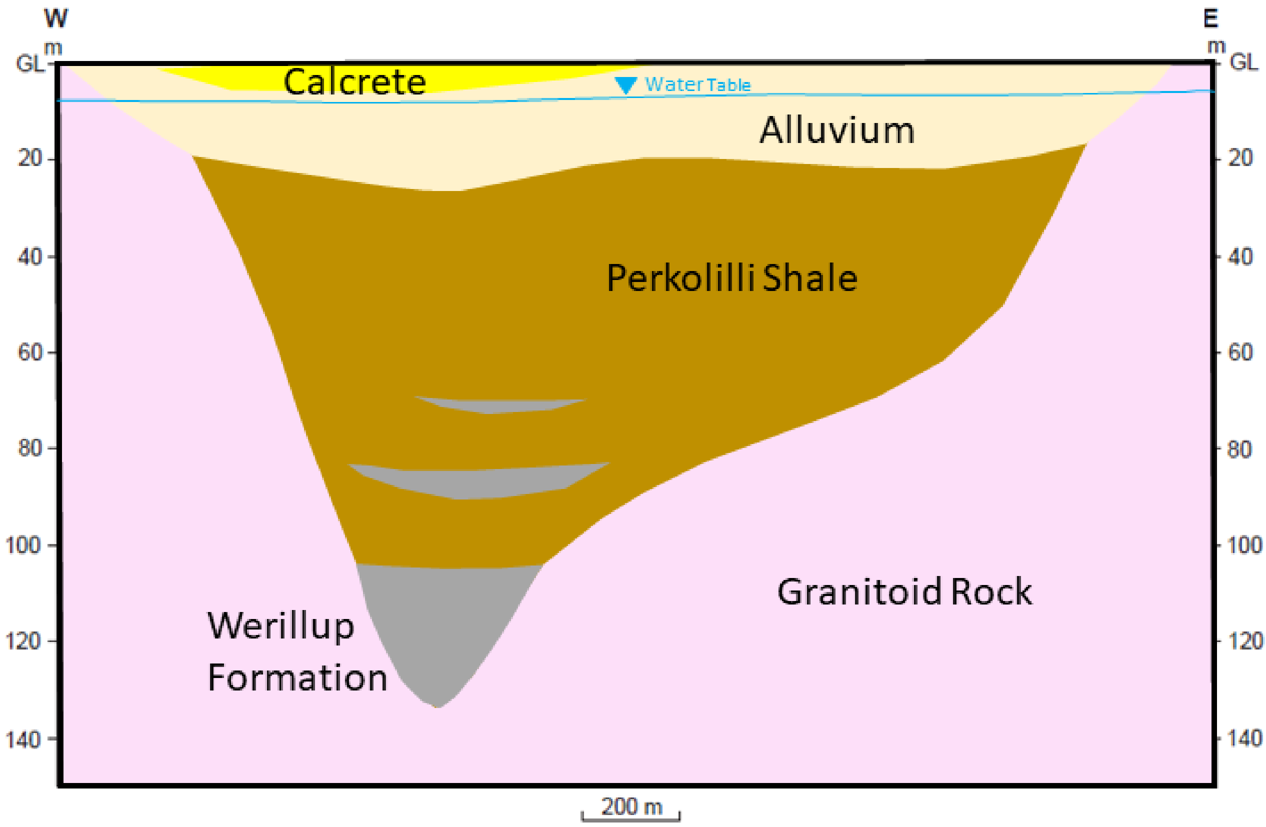

Figure 7 Schematic Section through Carey Paleochannel (after Johnson and Commander,1999)

2.7 Historical Information

Dewatering of the underground and the open cut operations has been undertaken at Bellevue on several previous occasions. However, no historical information on mine progression, mine dewatering rates or monitored groundwater levels were available for this assessment. Low ongoing dewatering inflows (<5 L/s) which were easily managed via traditional sump and transfer pipeline infrastructure are anecdotally reported in earlier documents (RPS, 2018), although the original source of this information is not known. The inflows apparently came from fractures and jointing within a generally low permeability basement unit.

Since the cessation of mining operations and the associated dewatering in 1997, groundwater levels in the underground workings recovered and equilibrated back to pre-mining levels (460 mAHD). It is not known how rapidly this occurred. In December 2019 dewatering of the existing workings commenced and required a minimum pumping rate of 17 L/s to induce drawdown in the workings, which is significantly higher than earlier estimates.

2.8 Information from Neighbouring Mines

To better understand the local environment, RPS investigated dewatering from nearby mining operations. Available data from the neighbouring Cosmos nickel mine (which includes the Cosmos Deeps and Prospero underground workings) include information on mine dewatering, identification of areas of key inflows and packer testing. The mines are primarily located within ultramafic and metamorphose felsic volcanic material.

The Cosmos Deeps ore body has a number of discrete groundwater inflow points that are associated with areas affected by extensive jointing. Initial inflows from these features are generally high, reducing to a lower pseudo steady state condition after the initial depletion of aquifer storage. There appears to be limited hydraulic interaction between local areas of fractured rock. Outside of these fractured zones the rock mass is generally dry, with occasional groundwater seepages marked by salt precipitation on the exposed surfaces.

Packer testing undertaken at Prospero (GRM 2005a,b,c) indicate low permeability conditions for the decline, orebody and surrounding rock mass. The reported range in calculated permeability ranges from 1.3×10^{-5} m/day to 4×10^{-3} m/day. The relative depths and locations of these tests are not available, therefore no potential relationship between depth or geology is able to be derived here.

Reported dewatering from the underground operations at Cosmos and Prospero in 2011 (Xstrata Nickel, 2012a,b) are shown in Table 4. It should be noted that some raw water from the Yakabindie bore field (AGR 172361) was utilised in the various underground operations and is eventually extracted from the operations via the underground pumps. Thus, the total dewatering figures in Table 4 include a proportion of raw water that has been supplied to each underground operation, as well as groundwater inflows to the workings.

Table 4: Dewatering abstraction from Cosmos operations in 2011

2011	Cosmos UG (kL)	L/s	Prospero UG (kL)	L/s
Jan	82,360	31	61,554	23
Feb	76,078	31	51,161	21
Mar	83,949	31	57,579	21
Apr	79,308	31	63,315	24
May	80,421	30	67,766	25
Jun	42,289	16	61,581	24
Jul	53,124	20	62,328	23
Aug	55,360	21	69,662	26
Sep	52,735	20	72,912	28
Oct	58,797	22	81,647	30
Nov	59,318	23	64,792	25
Dec	63,236	24	49,936	19
Total	789,975	25	764,233	24

Although it is not reported how much water from the Yakabindie borefield contributes to the dewatering totals, the total abstraction from the borefield is significantly less than the dewatering totals. Assuming all the water from Yakabindie (Xstrata Nickel, 2011) is used in the underground mine (which is highly unlikely as other uses such as dust suppression, processing and camp water supply are listed on the abstraction licence), the resulting net abstraction from the underground mines that can be inferred as groundwater inflows ranges from approximately 20 L/s to 40 L/s (Table 5). If only a third of the Yakabindie water is used underground (considered more likely), the groundwater inflows for the site are likely to total 40 L/s to 50L/s across both underground areas. The Cosmos mine has a depth of around 1km, but the area of open workings is not available.

Table 5: Dewatering from Cosmos operations in 2011 minus Yakabindie abstraction

Year - 2011	Total UG Dewatering (KL)	Yakabindie Abstraction (KL)	Net difference (KL)	Net L/s
Jan	143,914	54,559	89,355	33
Feb	127,239	48,220	79,019	33
Mar	141,528	38,449	103,079	38
Apr	142,623	53,995	88,628	34
May	148,187	56,791	91,396	34
Jun	103,870	5,462	98,408	38
Jul	115,452	52,988	62,464	23

2.9 Other Water Users

According to the DWER Water Register, the closest licenced abstraction bore/borefield to the site is located approximately 4 km east north east from the Bellevue Pit and is assumed to be the paleochannel tributary borefield associated with the Cosmos mine. There are no known groundwater dependant ecosystems (GDE's) within the immediate mine area. However, the calcrete deposits at Lake Miranda are listed as a Priority Ecological Community (PEC) as it is possible that unique stygofauna exist there.

3 HYDROLOGY AND WATER ENGINEERING

Management of surface water is required, and at Bellevue this management seeks to mitigate risks associated with uncontrolled surface water flows, such as:

- nuisance flooding;
- damage to plant and infrastructure;
- erosion;
- delays to production, and
- Contaminated soil material washing to nearby Lake Miranda.

This section assesses the local geography, climate, and flood impacts on the proposed infrastructure layout at the 100-year and 500-year ARI flood levels, to indicate where surface water management control is required

Additionally, the potential for rainwater capture on site is also assessed, as a potential source of water for the project should it be required.

The site (Figure A) is located on a series of hills to the north of Lake Miranda. The area includes dryland creek systems with unpredictably variable hydrological regimes and the regional surface water drainage in the area is relatively undefined. When active, surface water would flow to the east and west before across the site turning south and draining into Lake Miranda.

3.1 Seasonal Rainfall and Evaporation

Bellevue has an arid to semi-arid climate with hot, wetter summers and cooler winters with lower rainfall. The maximum temperature ranges from 30 °C to 37 °C in summer to 19 °C to 28 °C in winter.

The average annual rainfall at Leinster Aero (about 30 km south east of Bellevue) is 259 mm. Most rainfall occurs over summer from December to April (25 mm to 40 mm average per month), and drier over winter from May to November (4 mm to 16 mm average per month). The class A pan evaporation data is in the order of 3200 mm per year.

3.1.1 Intensity-Frequency Duration (IFD)

Intensity-Frequency-Duration (IFD) data is required to characterise rainfall intensities in the area. This is generally provided by techniques in ARR (Australian Rainfall and Runoff), a national guideline for the estimation of design flood characteristics in Australia.

Typical IFD rainfall data for various AEPs (Annual Exceedance Probability) and ARIs (Average Recurrence Interval) at Bellevue are shown in Table 6.

Table 6: Intensity-Frequency-Duration (IFD) in mm

Duration	Duration (mins)	63.20% 1yr ARI	50% 1.4yr ARI	20% 4.5yr ARI	10% 9.5yr ARI	5% 20yr ARI	2% 50yr ARI	1% 100yr ARI
0.5 hour	30 mins	10	12	18	24	29	38	45
1 hour	60 mins	12	15	23	30	37	48	57
2 hour	120 mins	15	18	29	37	46	59	71
3 hour	180 mins	17	21	33	42	52	67	80

3.2 Flood Estimation

3.2.1 Regional Flood Frequency Estimation (RFFE)

There are no relevant streamflow gauging data / gauged catchments from which flood estimates may be made directly. The main ARR flood estimation method for ungauged catchments is the RFFE technique, based on data from gauged (often very remote) catchments. The RFFE places Bellevue in a fringe “Pilbara & Arid” and “Semi-arid” area, located over 300 km from the nearest gauged catchment location used to develop the RFFE parameters. As such, results therefore have a lower accuracy, but are sufficient for these purposes as an indication of creek flows.

There are 16 catchments over the site, with catchment areas between 0.1 km^2 and 3 km^2 (refer Figure B). Over the range of catchments impacting the site, the 100-year flow estimates for small catchments <5 km^2 can be generalised as:

- $Q = 4.25 \times Ac^{0.67}$ (Ac in km^2)

More frequent flood flows can (again generally) be estimated as a proportion of the 100-year flows (Table 7).

Table 7: Flood Flow Estimates

AEP % /ARI (years)	Flow (as proportion of 100-year flow)
50% / 1.4 year	0.10
20% / 4.5 year	0.26
10% / 9.5 year	0.39
5% / 20 year	0.57
2% / 50 year	0.77
1% / 100 year	1.00

3.2.2 RAFTS

A nonlinear rainfall / runoff program, RAFTS, was used to calculate the flow for one large catchment impacting along the south east side of the site. Input data is derived for each sub-catchment (terrain slopes, roughness, local rainfall data and rainfall losses), with routing links between. The program simulates rainfall with time over a catchment, removing losses to calculate the rainfall excess/ runoff, and then routes this runoff through the model reaches and calculates the resulting flood flows (hydrographs).

A large catchment to the east of the site with an area of approximately 42 km^2 flows from the north into a salt-lake on the south east side of the site, joining into the north side of Lake Miranda.

This catchment was run for a 100-year storm with a 1-hour duration (to suit the 2D flood modelling). This gave a peak flow of 7 to 8 m^3/s.

3.2.3 2D Flood Modelling

2D flood modelling was undertaken using HEC-RAS. The site is located along a line of hills with small catchment areas, and a rain on grid method of flood modelling was used. Precipitation (with losses) was applied over the site with an added inflow on the south east side to accommodate the large catchment to the east. The rainfall losses were calculated using BoM rainfall intensity data and relatively impervious soil losses. For a 100-year, 1-hour duration storm, the runoff coefficient was estimated as 31% runoff (and the proportional loss factor for RAFTS estimated as 0.61).

A grid spacing of 25 m was used with a refined 10 m grid over the proposed infrastructure areas, and a Mannings roughness of 0.06 was applied uniformly across the site. No culverts were included beneath existing roads.

The model was run for several iterations to find the critical storm duration. As the catchment areas are small, it was found that the critical duration was 1 hour. The velocities across the site were generally <2 m/s, and therefore typically non-destructive to earth structures. The flood depths across the site are shown in Figure C.

3.2.4 Climate Change

Extreme rainfall events are projected to increase in intensity, with high confidence. As the atmosphere warms, its capacity to hold moisture increases, enhancing the potential for extreme rainfall events and the risk of flooding. Changes in the atmospheric circulation patterns that trigger heavy rainfall events could also change, thereby either enhancing or partially offsetting this effect. Studies of the observed record of extreme rainfall in Australia show some evidence of an increase in rainfall extremes.

The 500-year rainfall intensities are about 33% greater than the 100-year rainfall intensities. In addition, the Australian Rainfall Runoff recommendation is to allow a 5% increase in rainfall intensity per degree of warming. On this basis (as an extreme case), the 500-year storm with a 1-hour duration was used to approximate a 100-year storm, considering the impacts of climate change.

The 500-year storm was run in HEC-RAS and Figure D shows that the water depth in Lake Miranda has increased as well as a small salt lake to the north of the existing TSF by ~0.5 m. In addition, the flood extents increased by up to ~40 m.

3.3 Erosion and Runoff

3.3.1 General Principles

Activities such as vegetation and topsoil removal, mining, spoil stockpiling and general construction activities can increase the risk of erosion, generating coarse and suspended sediment that runs off from disturbed or degraded land. The largest surface water impacts relate to sediment laden run-off from waste dumps, although other potential impacts include the interruption to surface-water flow patterns, which may reduce runoff volume downstream; storage and spillage of chemicals and hydrocarbons as well as sediment may impact water quality downstream and dependent vegetation and ecological systems. Ponding of water with growth of invasive vegetation in low-lying areas can also be an issue related to poor drainage controls.

Generally environmental approvals for projects that involve land disturbance require adherence to surface water protection principles. The general objective is to maintain surface water regimes, to protect the downstream ecosystem.

Soil and water issues need to be identified, planned, managed, and monitored during the mine life to minimise adverse impacts. The commitment is to carry out activities in a manner that conforms to relevant regulatory and legislative requirements, by ensuring that controls are properly implemented, and regularly monitored and audited to assess their effectiveness. Changes to the stipulated controls are instigated if they are not achieving their objectives

3.3.2 Objectives

Objectives for water quality are outlined in “Water Quality Protection Guidelines”, Department of Water and Environment, 2000, a series for water quality management in mining and mineral processing.

Water quality guidelines for mine site stormwater runoff (and dewatering) due to environmental disturbance requires consideration / integration of water quality measures (erosion, sedimentation, groundwater, and site wastewater) as follows:

- Apply best management practices and innovation;
- Minimise work areas / exposed surfaces, as necessary for safe working operations;
- Minimise erosion and sediment deposited offsite, impact on downstream water quality;
- Comply with discharge limits for water discharged from site; and
- Provide specific work procedures and environmental control measures for activities which require more detailed attention, such as clearing and grubbing, topsoil stripping and stockpiling, disturbance and excavation, waterway crossings, chemical storage and use, refuelling operations, water monitoring methods, etc

3.3.3 Mitigation of Impacts

Generally, in mine sites, drainage through a site is interrupted due to the high level of disturbance, demarcation, and safety bunds, that act to trap water and control of erosion and sedimentation – formal sediment capture structures are not necessarily used. Where disturbed areas erode outside the mining area, the external terrain is often low gradient with commensurate low water transport power, where sediment cannot be easily mobilised across the plain. In addition, in arid areas, local flow paths do not support a marine ecology.

However, surface water management requires consideration of each catchments and drainage path to retain sediment (and other contaminants) on site rather than migrating into natural flow paths. Potential mitigation measures include:

- Minimise disturbance in general, use existing tracks, and keep vehicle movements to a minimum
- Engineering surface water controls to capture sediment laden surface runoff from disturbed (operational) areas, by directing dirty water to a low-lying area and bunding the perimeter (or where required designed sedimentation basins in high-risk areas, such as near a stockyard / crusher area, and waste dumps
- Construction on or near natural flow paths planned for the dry season
- Limit clearing / retain adequate buffer zones between disturbed areas, and natural flow paths
- Prevent to the extent possible, clean water from mixing with internal (disturbed) dirty runoff
- Shape waste dumps to drain internally with bunding to retain runoff on top, which is dissipated by evaporation and seepage. This reduces erosion on loose batter faces
- Construct access roads with a camber, side drains and regular “turnouts”, to discharge runoff into the road surrounds
- Locate storage areas (chemicals, hydrocarbons, etc) away from, or bunded off from, flow paths

3.3.4 Inspection, Auditing & Monitoring

Periodic site inspections / visual checks are required in the wet season to check for sediment and contamination pollution and check appropriate mitigation measures and controls are in place; and are operational and effective. Site inspections can include event-based inspections, prior to predicted rainfall events, following significant rain events, and prior to extended site shutdowns. The outcomes of inspections, monitoring, and audits facilitate the identification of problems and any recurring issues or areas for improvement.

3.3.5 Sedimentation Basin

Areas used for trapping sediment, and formal sedimentation basins, should meet minimum sedimentation times prior to overtopping.

Basins are located at low points and constructed by forming earth bunds. A basin has a settling zone above, and a sediment storage zone below, typically with a minimum overall depth of 1.2 m. The inlet and overflow points are located at opposite ends, with a minimum aspect ratio of 3:1 (length: width). The basin may be configured as a dry or wet basin. A normally dry basin drains continuously through a “control” outlet (such as an overflow pit / perforated pipe system) downstream and is therefore preferred. Flood flows pass through the basin and over a spillway. A wet basin (such as an informal trap location) holds water, which evaporates and infiltrates. Flood flows also pass over a spillway.

The top water surface area in the basin is designed to match the settling velocity of the target particle size with the rate of inflow (based on the duration and ARI of the storm considered). Larger particles are assumed to be captured in the basin, while smaller particles mostly stay in suspension and exit the basin with the flow. The target particle size can be based on site soil characteristics. To remove 70% of very fine sand particles (125 μm) requires a basin surface area of 80 m^2 per m^3/s of design flow. 100% removal of 125 μm particles requires 120 m^2 per m^3/s. Silt sizes are 2 μm to 60 μm - coarse silt (60 μm) requires 465 m^2 and medium silt (30 μm) 1800 m^2 per m3/s. The basin surface area increases rapidly as the target particle size becomes smaller.

There have been multiple criteria for sizing basins. One criterion is to use 100% removal of 50 µm particles (coarse silt), requiring 720 m^2 per m^3/s, together with a 5-year design flow. This results in manageable, effective basin sizes.

3.4 Surface Water Management

3.4.1 General

The mine site is located on a north-south ridge line, with runoff flow running either side to the east and west. Most of the proposed infrastructure is located towards the top of the ridge near the tops of catchment boundaries. As a result, there are no major flow paths impacting the site.

Surface water management principles are shown in Figure E and Figure F. Dirty water runoff from waste dumps/ stockpiles and cleared / disturbed areas should be captured and prevented from running off the site into disturbed flow paths (either allowed to infiltrate/evaporate or be treated in sedimentation basins). Clean water runoff from upstream should be diverted around infrastructure (such as pit bunds, or specific diversion bunds to prevent flooding) so that it does not (mix with dirty water and therefore) contribute to dirty water volumes, and to limit inundation of operational areas.

3.4.2 Pits

There are 11 proposed pits (three of which are expansions to existing pits, and three small pits) as part of the gold operation.

- Each pit is located towards the top of the ridge line near a catchment boundary (refer Figure B)
- There are some minor flow lines, local runoff off the ridge line, through and past the pits
- Standard (well-constructed) safety bunding around pits is sufficient to divert upstream flow paths around the pits (refer Figure E)
- The pits will capture (dirty) runoff from direct rainfall

3.4.3 ROM, Processing Plant, Portal, Non-Process Infrastructure (NPI)

The proposed Processing Plant, Portal, NPI (administration buildings) are located on the eastern side of the ridge line.

- These are all located close to the catchment boundary
- A north to south flow path runs along the east (downhill) side of the infrastructure, ponding against the existing TSF to the south east
- The proposed administration building is located on an existing raised pad ~15m above the flood plain, and is therefore not subject to flooding
- Runoff from this infrastructure should be collected downstream and capture to contain local dirty water runoff, and prevent it from running into nearby flow paths (refer Figure E)
- Locally where possible, internal pads can be graded to direct water against local bunding to collect and seep / evaporate

3.4.4 Waste Dumps / Stockpiles

There are two proposed waste dumps (each exceeding 25 ha) and two low grade stockpiles (Figure E).

- WD 1 is located to the north of the proposed administration building along the eastern side of the ridge
- WD 1 blocks off flow from an eastern flow path (running from north to south), and flow ponds against the northern edge of the WD
- The WD therefore reduces the flow downstream into a small salt-lake (that is partially blocked off by the existing TSF)

- WD 1 reaches up to the western edge of the catchment boundary (ridge line) i.e. minimal runoff from the western edge
- WD 2 is located over part of the existing TSF, on the eastern slope of the ridge
- Each of the waste dumps should be bunded off as required, to prevent dirty water run-off into nearby creeks and flow directed to low points around the waste dumps to capture points (refer Figures E and F)
- The two low grade stockpiles are located towards the top of the ridge on the western side. There is minimal surface water impact, and the stockpiles should be bunded off as required to capture dirty water runoff (refer Figure E).

3.4.5 Tailings Storage Facility

A Tailings Storage Facility (TSF) is proposed to the north of WD 1 on the eastern side of the ridge.

- The TSF is located over the proposed expansion of the Vanguard Pit
- The TSF is located primarily over one catchment with the edges of the TSF approximately along the catchment boundary (refer Figure B). Therefore, there is no surface water impacting the TSF
- All local rainfall will be captured on the TSF (refer Figure E and Figure F).

3.4.6 Evaporation Pond

An evaporation pond is proposed on the eastern side of the ridge to the north of the site.

- The evaporation pond is located on a catchment boundary and there will be minimal surface water impact to the pond
- All local rainfall will be captured in the evaporation pond (refer Figure F).

3.4.7 Village

The proposed village is located on the western side of the ridge line, with an access road from the Goldfields Highway.

- The village and access road are located along an east west catchment boundary
- A minor flow path is cut off by the proposed village on the south side; and a minor creek runs past the north side of the village – the estimated flood extents impacts the northern side of the village (refer Figures C and D)
- The village requires a flood bund along the northern side to protect it from flooding, with capture bunds to collect and trap dirty water from the western village area running downstream (refer Figure F).

3.4.8 Solar Farm / Power Station

An access road runs from the highway to the Cosmos mine. As solar farm/power station is proposed to the south of the access road (north end of the Bellevue site). A power station is proposed on the western side of the solar farm.

- In this area, flow is predominantly from west to east along the south side of the solar / power station
- A minor flow path runs under the existing road, and alongside the proposed power station access road. Figures C and D shows water ponding on the north side of the access road (no culverts assumed in the hydraulic model); however, culverts would allow the flow to continue past the infrastructure.
- Bunding is required along the southern edge of the solar farm and power station to prevent flow encroaching from the main flow line, refer Figure F.

3.5 Bunds and Channels

3.5.1 Typical Surface Water Diversions

The mine site lies outside (major) floodplains (and outside extreme floodplains), and therefore minimal diversion works, and erosion protection are required.

As required, diversions consist of earth bunds, excavated channels, or combined bund / channels. Earth bunds are typically trapezoidal shaped. Shallow excavated open (trapezoidal) channels typically have side batters of 1V:2H.

Construction materials are usually the most suitable available materials at the site (selected mine waste or diversion excavations). However, flood bunds should consist of watertight materials for stability reasons, with some clay content preferred (clayey gravels and clayey sands). The embankments are typically constructed homogeneously (i.e. not zoned).

3.5.2 Erosion Protection

If flow velocities are too high, then surface protection may be required (rock armour or good vegetation cover). For velocities <2m/s, compacted earth surfaces are not normally protected / armoured for the design storm (maximum velocities in unprotected soils is about 1.2 m/s to 1.5 m/s in clay loams, and much less in silty / fine sandy materials).

3.5.3 Bund Construction

Normal engineering standards include:

- Excavate base to strip depth, scarify in preparation for construction of the embankment
- Maintain moisture content in the embankment material at optimum (which allows maximum density to be achieved by the compaction equipment in use)
- Place and compact in layers e.g., 95% SMDD (Standard Maximum Dry Density) or 90% MMDD (Modified Maximum Dry Density)
- Control batter slopes to line and level.

3.6 Water Harvesting

3.6.1 General

The gold will be processed on the site, requiring a water supply. The proposed underground mine (previously inactive) is currently being dewatered and was being pumped to unused pits with a total storage capacity of about 627 ML. These pits are now filled to capacity. The Henderson pit has a capacity of 364 ML, Westralia pit 170 ML and Vanguard pit 192 ML.

3.6.2 Diversion and Capture of Surface Water

The capture of surface water runoff (from intense rainfall events) and directing it into mine voids demonstrates the viability of the final voids as potential surface-water reservoirs. The captured water enables mining operations to opportunistically reduce groundwater abstraction, with potential savings in pumping and treatment costs.

However, storm events of sufficient magnitude cannot provide a reliable, long-term water supply.

The capture of surface runoff and creek diversion into mine voids surface-water reservoirs is relatively common practice in the Goldfields region, to supplement process water. Significant flooding during Cyclone Bobby in 1995 was one good example but storm events of this magnitude would only occur every twenty years. The Windich pit at the Granny Smith mine was capable of filling with diverted creek runoff and holding three year’s supply of process water (the creek diversion captured peak surface runoff, which only represented a small percentage of the total flow into Lake Carey, with minimal impact on the regional hydrology). Mining operations at Mount Magnet are also using streamflow capture for supplementing process-water supply.

Mine closure strategies show that diversion of local creek systems may help to dilute concentrations in void lakes that may become progressively saline.

3.6.3 Water Harvesting (natural catchment)

Opportunities exist to capture surface runoff water to provide a (limited) fresh water supply to the process plant with the exhausted Henderson, Westralia and Vanguard mine pits in the area. The location of Bellevue with respect to the regional drainage patterns is shown in Figure A. A catchment to the east of the mine area drains to Miranda Lake, with a total catchment area of ~42 km². The bed slope of the main flow path is 0.3%.

Runoff from catchments depends upon several factors including rainfall intensity, surface steepness, surface soils / rocks, vegetation and catchment wetness. In the steeper parts of the catchments, natural drainage paths would typically be well defined and possibly have formed gullies. However, most of the study catchment areas are relatively flat with natural drainage occurring as sheet flow, and within indistinct creek lines. The main flow paths are typically wide and flow at a shallow depth. Frequently these flow lines are only recognisable by vegetation changes.

3.6.4 Volumetric Run-Off Coefficient (VROC)

Runoff from a catchment depends upon several factors, in particular rainfall intensity and catchment wetness. In a 1993 study ("The use of remote sensing to assess the flooding and drying cycle of salt lakes in the Eastern Goldfields, Western Australia", Johnson), it was concluded that runoff (to the lakes) would typically occur if a rainfall event exceeded 30 mm, with a daily intensity of > 5mm; and on average 3 flooding events drained to the lakes every year (and typically only caused partial inundation of the lake).

It is not possible to accurately predict the volume of runoff resulting from a rainfall event, due to both the variability of rainfall and the lack of rainfall-runoff relationship data in the region. The 1993 report estimated a volume runoff coefficient of approximately 4% from a May 1989 rainfall event (into Black Flag Lake). Centre for Land Rehabilitation, 1999 ("Proceedings of the Salt Lake Ecology Seminar") estimated a volume runoff coefficient of approximately 6% resulted from a December 1995 rainfall event. Dames & Moore (1999 ,"Gold Mine Developments on Lake Lefroy") provided an estimated VROC of 21% of the catchment rainfall for the runoff volume on Lake Lefroy, resulting from Cyclone Vance (though this was likely too high).

An analysis undertaken of Cyclone Vance (March 1999) flooding at the Mount Pleasant Gold Operations 35 km northwest of Kalgoorlie suggested, based on the volumes intercepted, volume runoff coefficients of 6.5% and 7.5% respectively – but only valid for Cyclone Vance, which deposited ~160mm of rainfall over 6 days on a previously wetted catchment.

An analysis of Kalgoorlie (1939 to 1999) rainfall record monthly, using monthly totals of 30mm or more, suggested runoff from Goldfields catchments is likely to occur on average 3 times per year and with a VROC of between 4 to 8% of the event rainfall, with wide variation year-to-year. The study noted that the volumes estimated were indicative and based on limited and poor-quality data.

The median VROC for these purposes has been assumed as 5%. Annual rainfall in the area is in the 200 mm to 300 mm band (and 260mm per annum at Wiluna varying from a minimum of 49 mm to a maximum of 712 mm). Wiluna averages 30 rain days per year, and 2 to 3 days with rain >25 mm. Pan evaporation is about 3200 mm pa. The rain is mainly in the first half of the year.

There is a 90% chance that the annual rainfall would exceed 118 mm, and a 10% chance that it would exceed 412 mm.

3.6.5 Potential Harvested Volumes

Runoff from a catchment depends upon several factors, in particular rainfall intensity and catchment size. Hence, run-off in any one year is highly variable and uncertain. Based on a 42 km² catchment, the anticipated run-off on average would be 546 ML/a, but in a dry year (90% chance of exceedance), the potential run-off would be about 200 ML.

To capture this water would require a low weir across the flow path and a pump set to pump the water into an exhausted pit.

3.6.6 Water Harvesting (other forms)

Various forms of harvesting have been used, other than diverting large natural catchments.

The Merredin Peak situation is one example where Merredin town in the wheat belt is located adjacent to a non-porous granite peak with high run-off coefficient. The peak has been ring fenced to capture the run-off from the rock and divert it into a large turkeys nest storage (the Railway Dam) that was used for a fresh water supply for steam locomotives, and is now used for gardening around the town).

Surface water capture from the small catchments around the Bellevue site is deemed to be not feasible. The site generally lies on a north-south ridge line, with flow off to the west and the east. Catchment areas are typically in the order of about 1 km^2, and the run-off from these small areas would be minimal and not worth the infrastructure required to capture it.

Other capture techniques have included artificial catchments which revolve around building roofs, sealed road surfaces, car parks, plastic sheeting laid down over a hillside, etc (the rainwater tank principal), but these areas are not sufficient to generate any reasonable quantities of water that could be used in a process plant.

4 GROUNDWATER MODELLING

RPS prepared a numerical groundwater model that incorporates all of Bellevue's existing and proposed underground workings to provide an indication of the potential inflows and drawdown associated with the excavation of future workings. The model provides a preliminary guide to the requirements for dewatering management and mine water balance.

The model has been built consistent with methods outlined in the *Australian Groundwater Modelling Guidelines* (Barnett *et al.*, 2012), and provides a Class 1 confidence level, which is considered to be suitable for its intended use of predicting the impacts of the proposed developments on low value aquifers and providing first pass estimates of dewatering volumes.

The key findings of this assessment are:

- Inflows to the future underground workings are predicted to be in the order of 2,400 kL/day (28 L/s) during early mining activities and decrease with time to approximately 1,600 kL/day (19 L/s) at the end of mining as the mine area becomes dewatered and workings are focused in deeper "tighter" rock.
- The extent of drawdown at the end of mining is predicted to have a radius of approximately 2km around the mine area (to the 1 m contour) and is unlikely to impact on ecological communities associated with the paleochannel and calcrete sediments.
- Water levels are predicted to return to pre-mining levels within 100 years of ceasing dewatering.
- Ongoing monitoring is required to verify the predicted drawdown in this model. Monitoring of recently installed (2018) monitoring bores should be undertaken on a monthly basis during dewatering and mining activities to determine the degree of groundwater drawdown and facilitate further calibration of the model.

4.1 Conceptual Model

The conceptual model for Bellevue relies on the geological information supplied by Bellevue and sourced from the Geological Survey of Western Australia. Although the Bellevue Project lies almost entirely within the fractured rock aquifer, the underground workings and associated dewatering will create a very steep hydraulic gradient between the underground and the adjacent Carey Paleochannel (Figure 8).

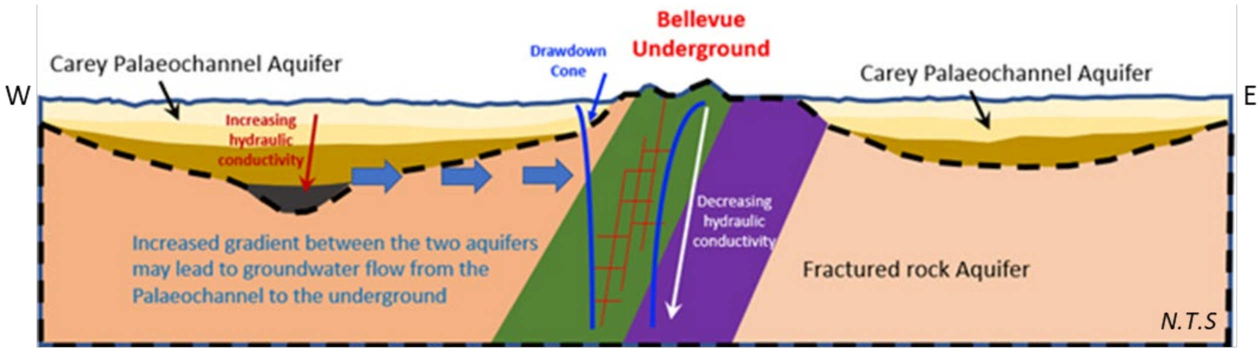

Figure 8 Schematic cross-section showing the aquifer relationship at Bellevue

4.2 Model Code

A numerical groundwater model was constructed to assess the likely groundwater inflows and drawdown that may be encountered during excavation of the future mine workings. The model was run using the MODFLOW-USG code (Panday et al., 2013) through the GMS 10.4 graphical user interface (Aquaveo, 2019). The MODFLOW-USG code was chosen primarily due to the ability to refine the model mesh at mine locations as well as for its stability in handling dry cells when run using the Newton solver (Niswonger et al., 2011), which is important in models simulating significant drawdown.

4.3 Model Set-up and Extent

Quadtree mesh refinement was used over an area of 140 km^2 to create a model mesh with 200 m x 200 m regional grid cells, and refinement to 50 m x 50 m cells in the vicinity of the mine area. This resulted in 6,354 cells per model layer, with 10 model layers giving a total of 63,450 model cells (Figure 9).

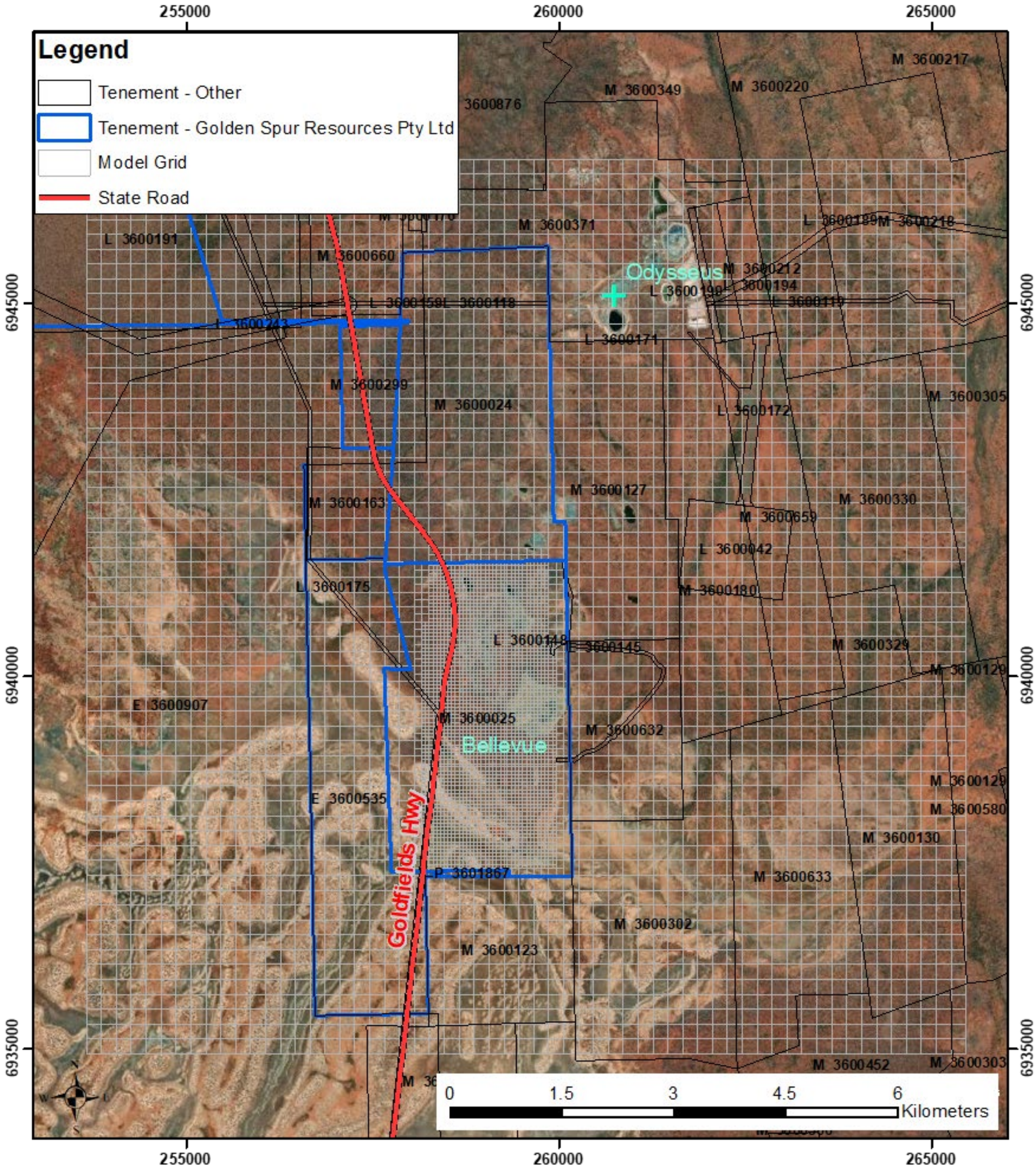

Figure 9 Model grid showing refinement over the Bellevue underground operations area

4.4 Boundary Conditions

Rainfall recharge of approximately 1% annual rainfall was applied across the model domain (equivalent to 2.4 mm/yr). Evapotranspiration was applied with a maximum rate equivalent to 3200 mm/yr, with an extinction depth of 2.5 m below ground level. The main source of water into and out of the model is conceptualised to be via the paleochannel. Flow through the paleochannel was simulated in the model using constant head boundaries at the north-west and south-east of the model within the paleochannel sediments.

The MODFLOW Drain package was used to represent mine underground mine workings. Open pits were not simulated in the model.

4.5 Model Layer Elevations and Parameter Zonation

The top of model Layer 1 was set using the available digital elevation model DEM derived from LiDAR. Layers 2 to 5 follow the topographic contour with elevation range and thickness as shown in Table 8. Layers 6 to 10 are flat. Model hydraulic parameter zones are based on surface geological mapping for layer 1, and an inferred thickness of the paleochannel of 140 m extending into layer 4 (Figure 10 to Figure 13). Model layers 5 to 10 are bedrock across the full model domain.

Table 8: Model layer elevations and zonation

Layer	Lithological units	Elevation Range (m AHD)
Layer 1	Paleochannel sand, calcrete, alluvium, lacustrine sediments, rock	511 to 428 (30 m thick)
Layer 2	Paleochannel sand, rock	481 to 398 (30 m thick)
Layer 3	Paleochannel sand, rock	451 to 368 (30 m thick)
Layer 4	Paleochannel sand, rock	368 to 318 (50 m thick)
Layer 5	Rock	371 to 200 (variable thickness, average 130 m)
Layer 6	Rock	200 to 100 (100 m thick)
Layer 7	Rock	100 to 0 (100 m thick)
Layer 8	Rock	0 to -200 (200 m thick)
Layer 9	Rock	-200 to -400 (200 m thick)
Layer 10	Rock	-400 to -600 (200 m thick)

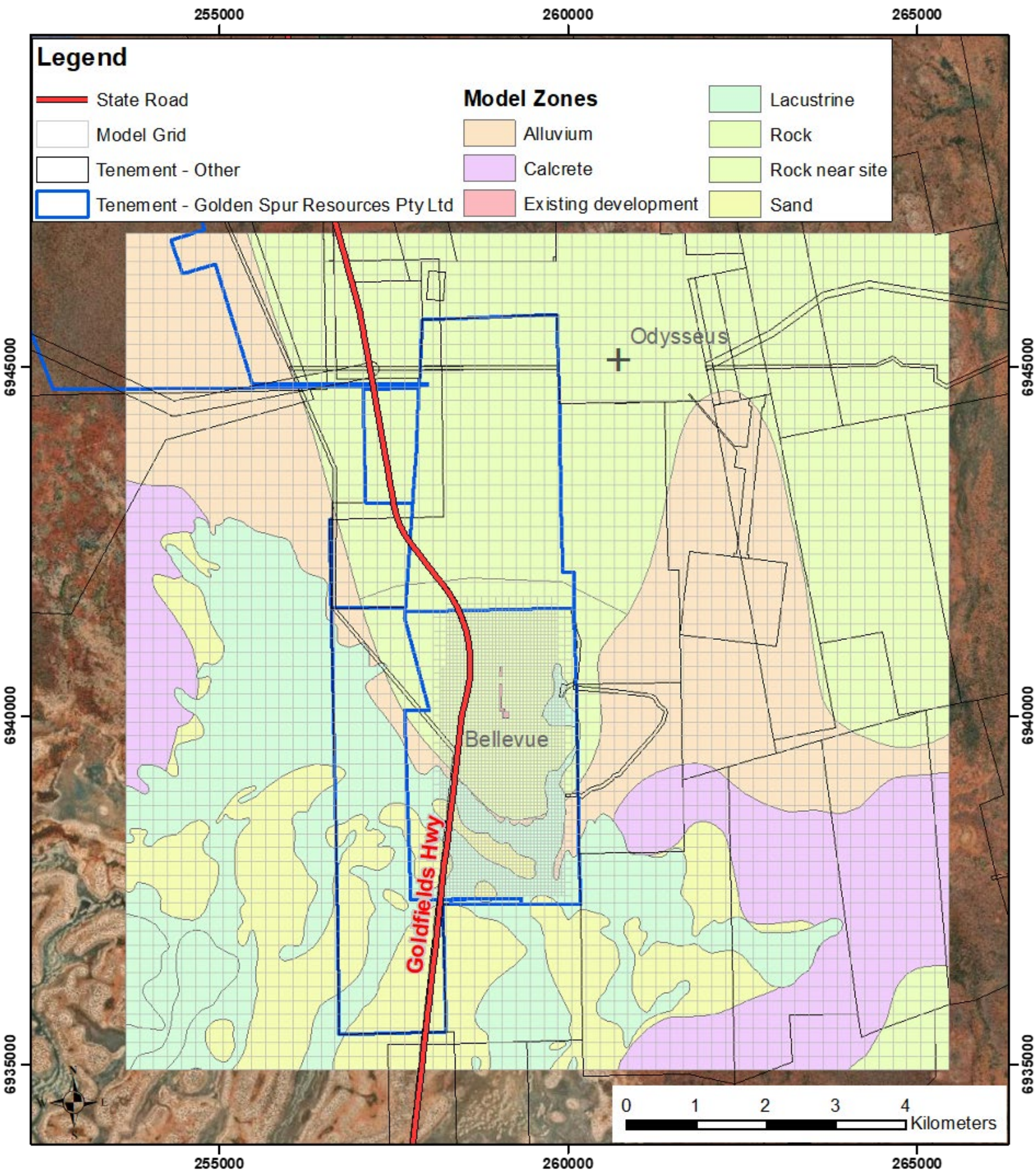

Figure 10 Model zonation Layer 1

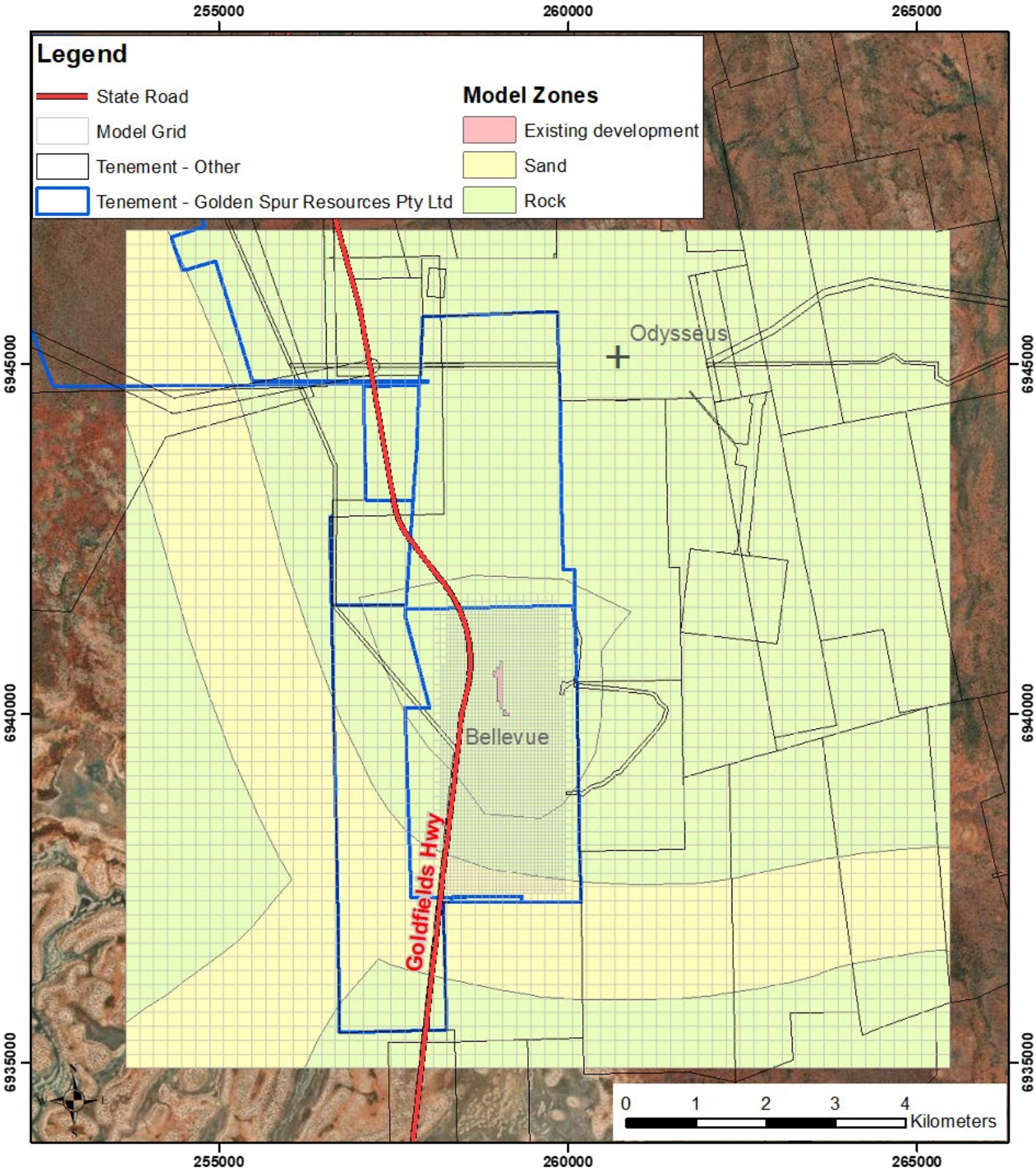

Figure 11 Model zonation Layer 2

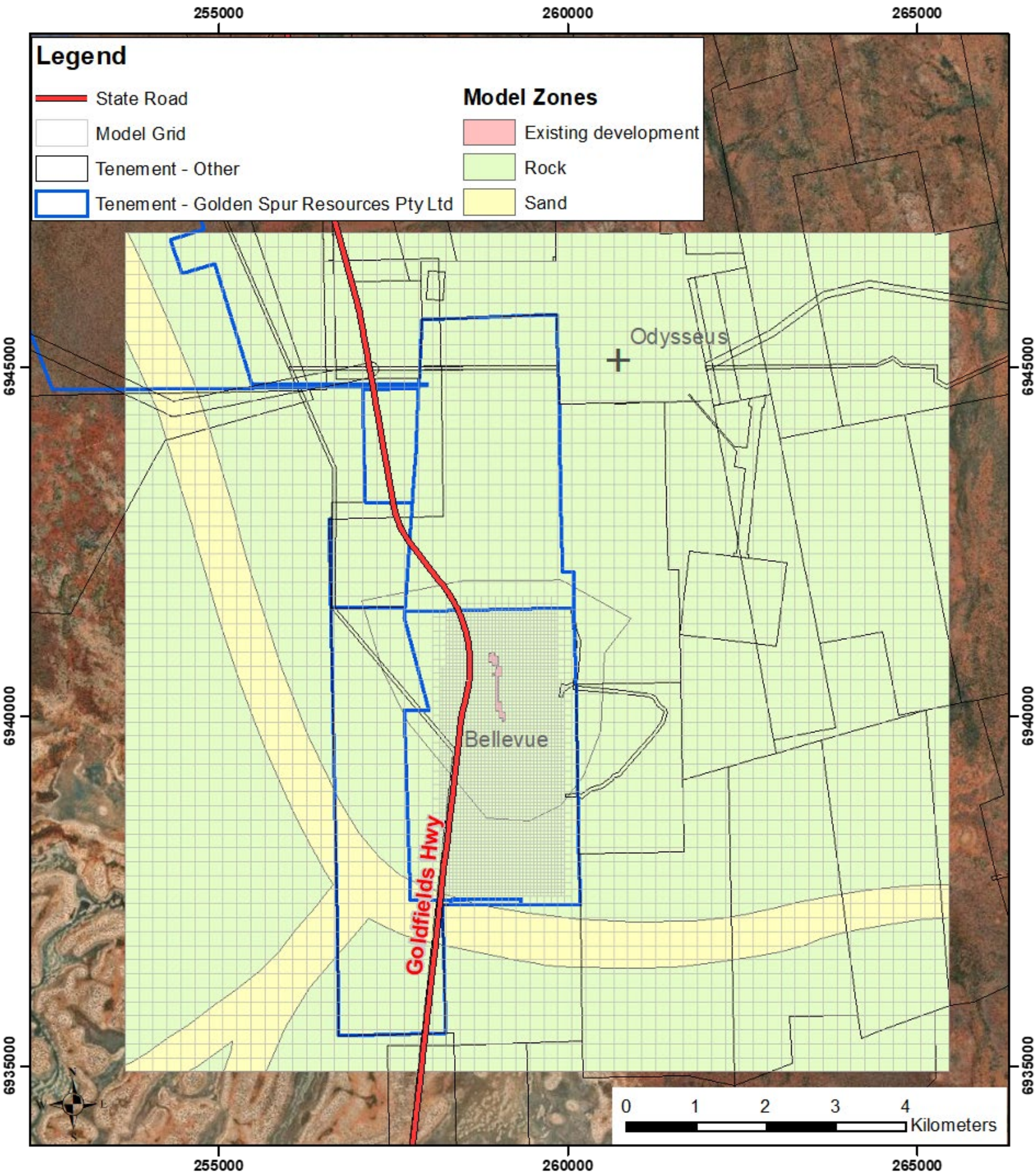

Figure 12 Model zonation Layer 3

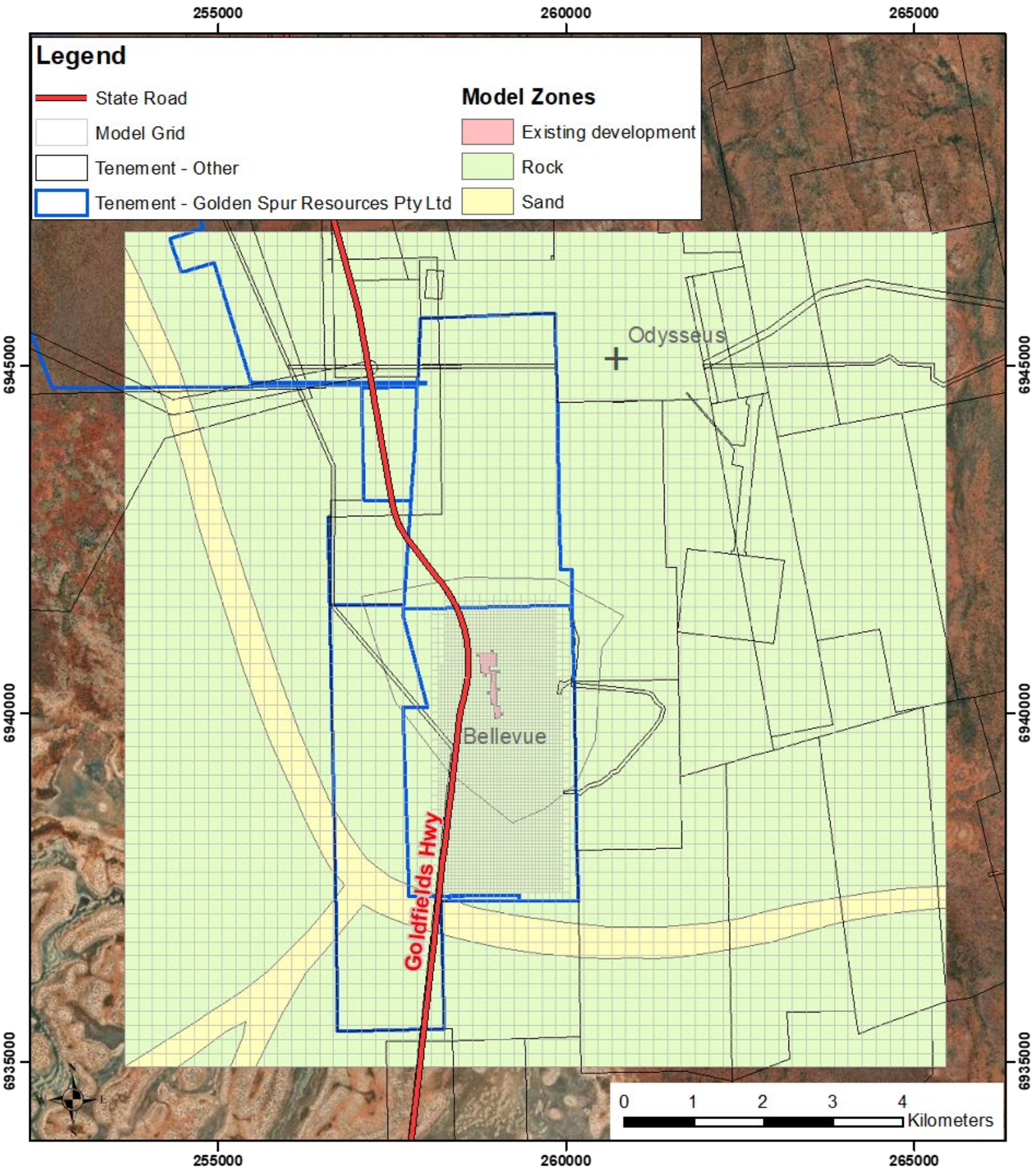

Figure 13 Model zonation Layer 4

4.7 Model Calibration

The regional model was initially calibrated in steady state mode to match pre-mining water levels. Following this, a transient calibration was run to simulate dewatering of the existing mine workings and associated water level monitoring. This included:

a. Incorporating existing development areas (mine shafts etc).

b. Assigning measured pumping rates between December 2019 and October 2020.

c. Calibrating the model to the measured water level at the pump and monitoring bores

These calibrations focused on the hydraulic conductivity (K) and storage (Sy) in the existing development area and rock near the site. The modelled steady state groundwater contours are steeper in the low permeability rock areas and more subdued in the higher permeability areas (Figure 14).

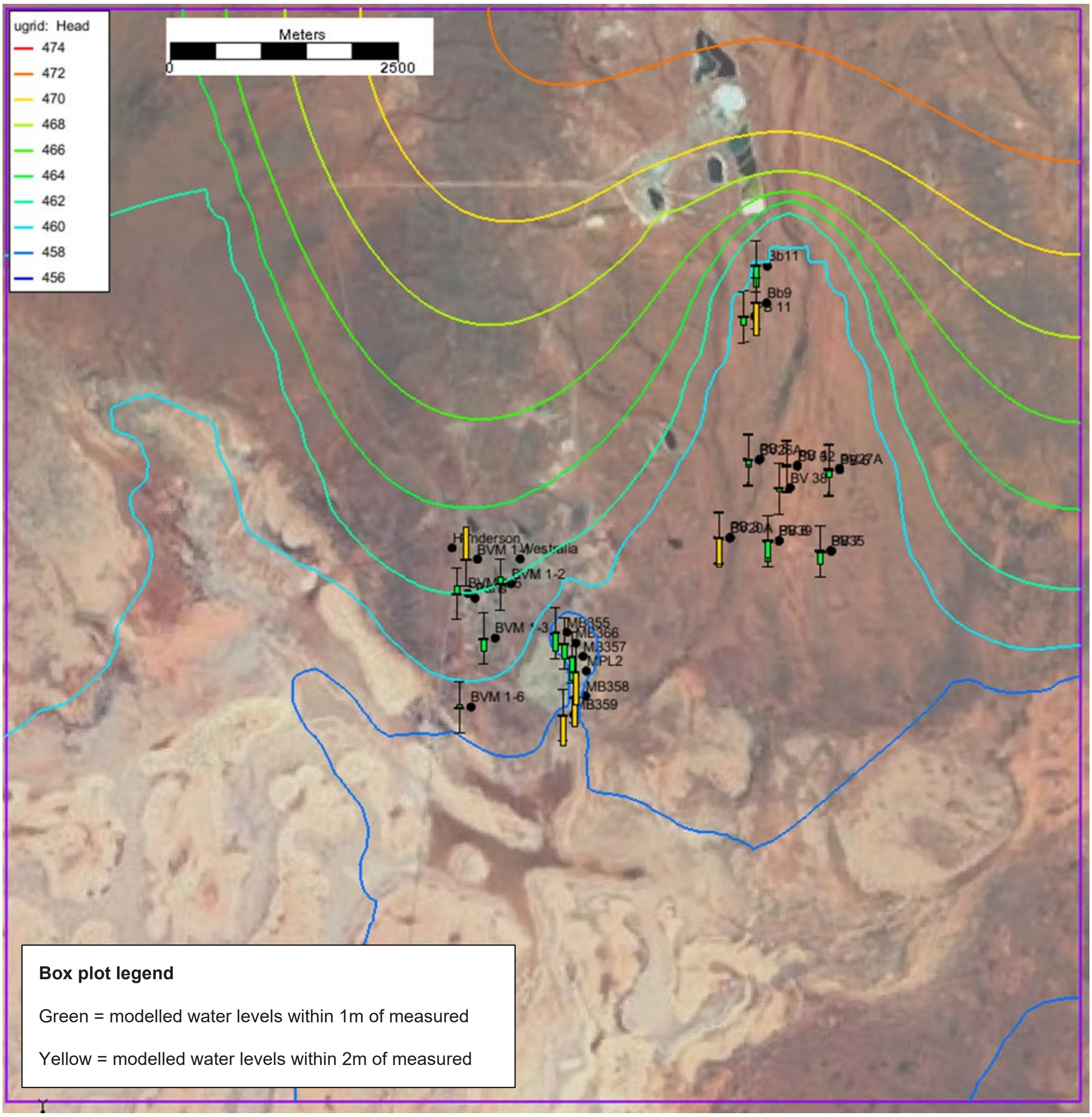

Figure 14 Steady state groundwater contours (mAHD)

Table 9: Steady state water balance

	Inflow (m^3/day)	Outflow (m^3/day)
Recharge	858	
Evapotranspiration		1134
Constant Head Boundary	793	519
Total	1951	1653
Error (%)	-0.14	

The modelled and measured water levels at the pump are well represented by the model following the water level trend with dewatering to approximately 250 mAHD, where the modelled water level rebounded sooner than the measured water levels. This may be due to a discrepancy in the simulated timing/pumping rates of dewatering in the model versus reality, however the water level recovery trend is similar (although offset) to that measured when the pumps are switched of in July (Figure 15).

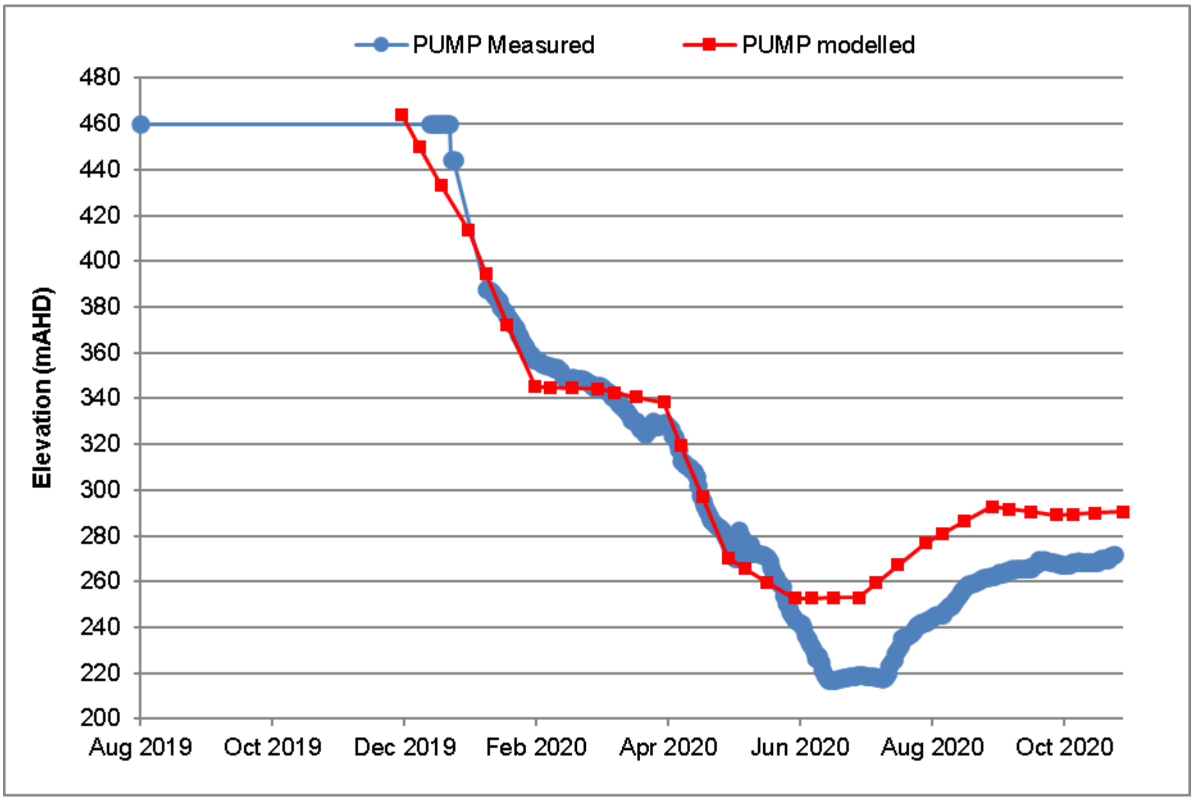

Figure 15 Measured vs modelled water level at pump location

The calibrated parameters are given in Table 10. Of these parameters, the modelled dewatering levels were most sensitive to the K of the rock in the upper 300 m of the model (the depth of dewatering). Calibration was largely insensitive to parameter changes at depth, however a bedrock K of 0.0001 m/day was chosen based on the conceptual understanding of reduced fractures with depth as well as consideration of packer testing data from Cosmos.

Table 10: Calibrated model parameters

	Kh (m/day)	Kv (m/day)	Sy	Ss (m^{-1})
Rock (Layers 1 to 6)	0.001	0.001	0.005	1×10^{-6}
Rock (Layers 6 to 10)	0.0001	0.0001	0.005	1×10^{-6}
Sand	20	2	0.2	1×10^{-6}
Calcrete	10	1	0.1	1×10^{-6}
Alluvium	1	1	0.05	1×10^{-6}
Lacustrine Sediments	0.1	0.01	0.01	1×10^{-6}
Existing Workings	200	200	0.15	1×10^{-6}

4.8 Model Predictions

4.8.1 Mine Progression

The MODFLOW drain package was used to simulate future mine progression over time using annualised planned working areas provided by Bellevue over a 9-year mine life. Drain conductance was set sufficiently high (10,000 m^2/day) so as to not provide any resistance to flow between the drain and the aquifer units.

The model also assumes that all workings will remain dewatered until the end of mining i.e., no localised isolated areas of workings are allowed to flood and all inflowing groundwater into the workings will be pumped out.

Neighboring mines have not been included in the model, however there is potential for interaction of drawdown between the workings, particularly to the north where the Bellevue underground approaches Western Areas' Prospero mine. Additionally, the use of open cut pits and other surface infrastructure to store or dispose of water has the potential to induce additional seepage into the underground workings which has not been accounted for in this model.

4.8.2 Predicted Inflows

Resulting predicted inflows for the base case model (using calibrated parameters listed in Table 10) over the life of mine are shown in Figure 16. Initial inflows of around 28 L/s (2,400 kL/day) are predicted in the first year of mining, declining to a steady 19 L/s (1,600 kL/day) towards the end of mining.

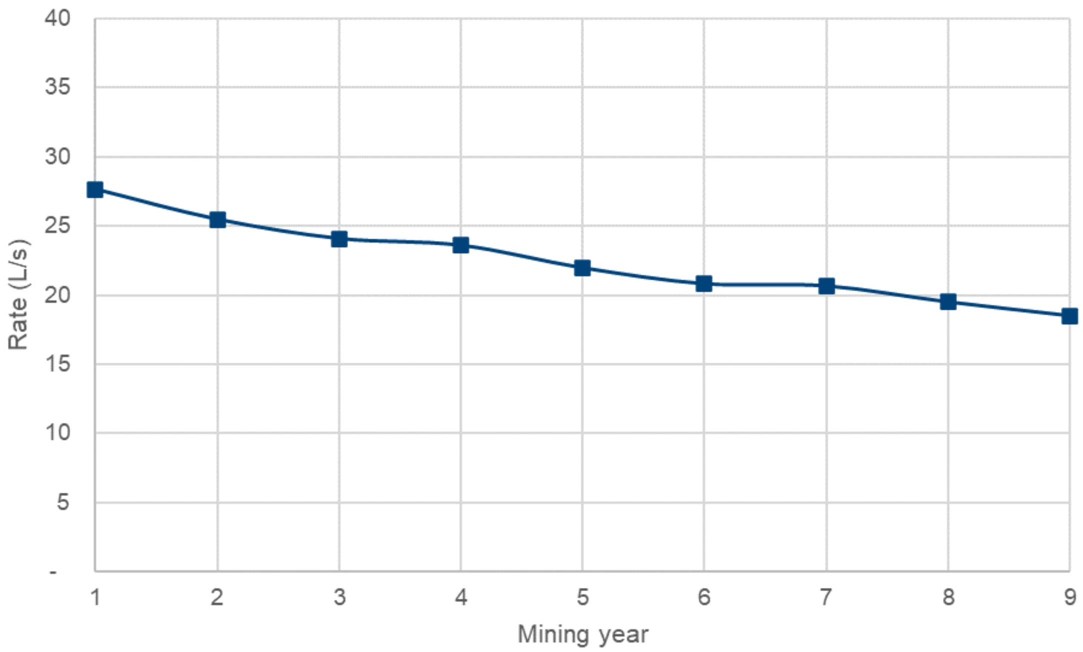

Figure 16 Predicted groundwater inflows over 9-year mine life

4.8.3 Predicted Groundwater Levels

At the end of the 9 years of mining, groundwater levels immediately above the mine are predicted to have drawn down to approximately 50 mAHD in the top layer of the model (at the water table). The groundwater gradient in the area surrounding the mine is modified from pre-mining conditions such that there is a steep cone of depression resulting in groundwater flow towards the mine from all directions (Figure 17).

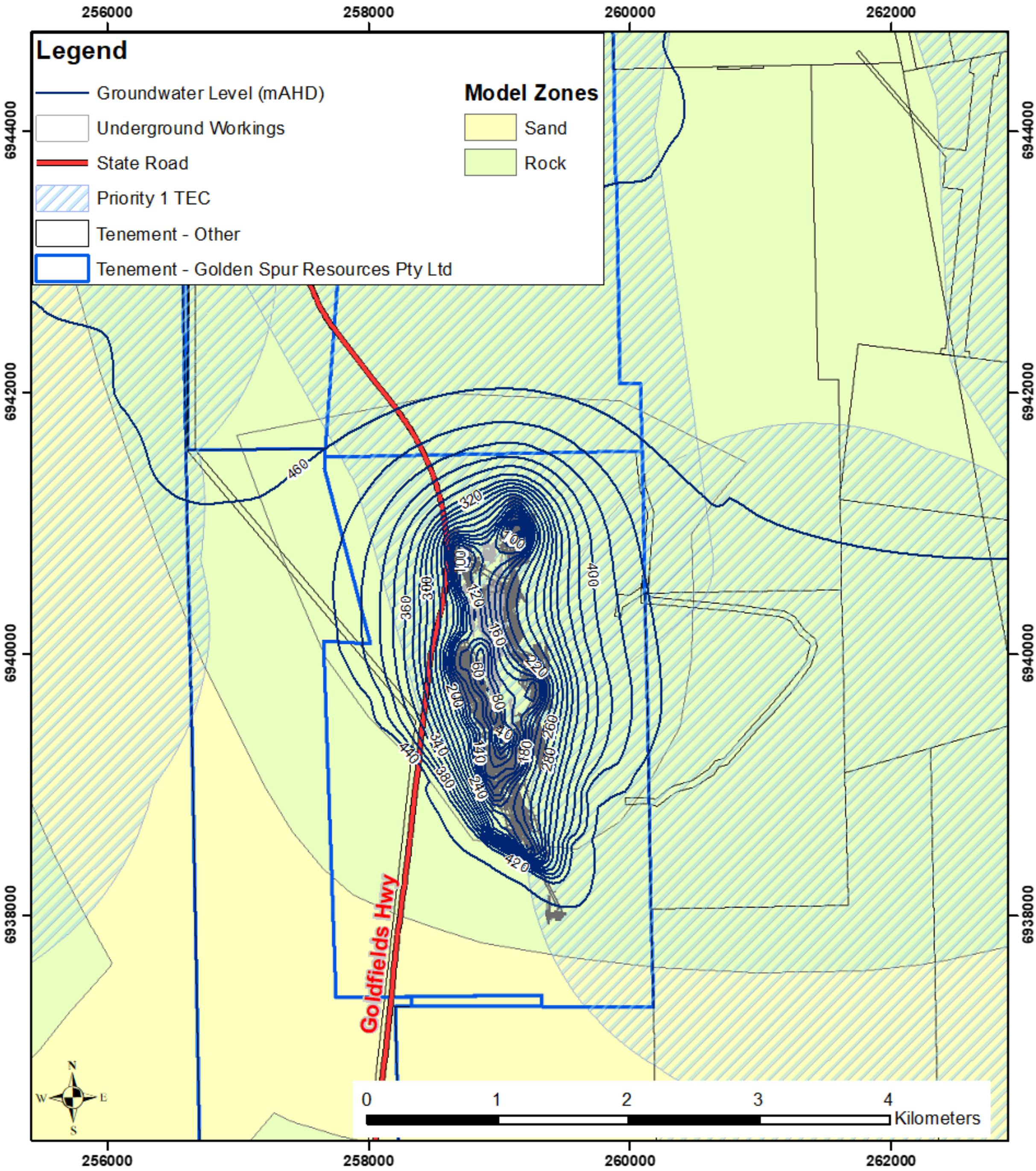

Figure 17 End of mining groundwater contours

4.8.4 Predicted Drawdown

Predicted drawdown to the water table at the end of mining is shown in Figure 18. The extent of drawdown (to the 1 m drawdown contour) is predicted to be approximately 2 km in radius around the underground mine. Note that borefield abstraction, dewatering and/or seepage from open pits or other water storage infrastructure is not included in this modelling and may affect the extent of drawdown. Drawdown extends top the paleochannel sediments and the south and through several areas of Priority 1 TEC areas, requiring further investigation for potential environmental impacts.

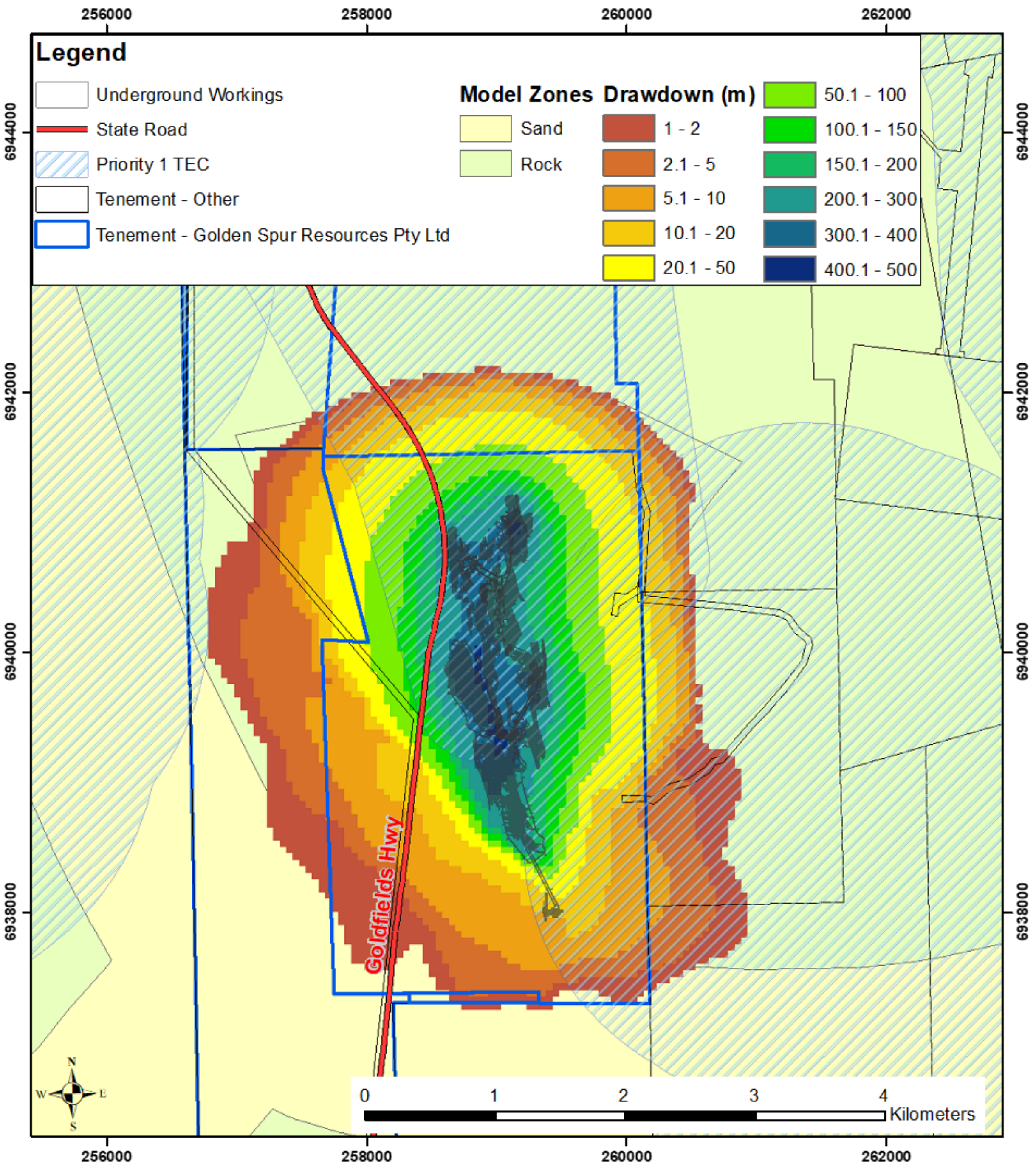

Figure 18 End of mining drawdown to water table

4.9 Groundwater Recovery

At the end of the 9-year mine life it is anticipated the dewatering will be switched off and groundwater will be allowed to flood the workings resulting in a recovery to pre-mining groundwater levels. Water levels immediately above the workings (i.e., in the area most affected by groundwater drawdown) are expected to recover to initial levels within approximately 100 years (Figure 19).

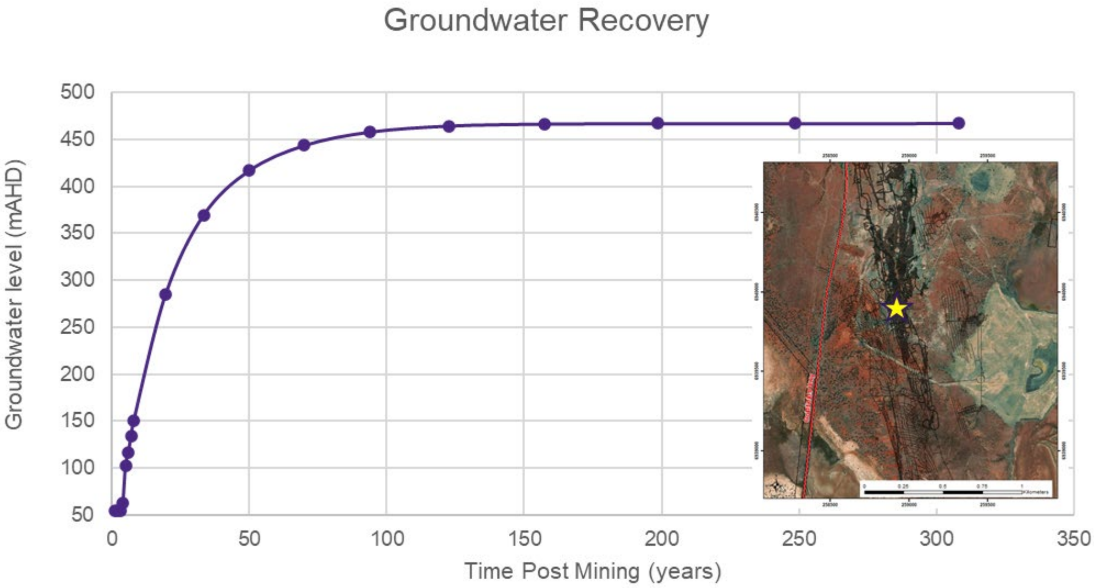

Figure 19 Groundwater recovery post mining

4.10 Uncertainty

The outputs from this modelling are primarily used in the site water balance to determine likely water management requirements. Due to significant uncertainty around the hydraulic properties of the basalt, which is largely dependent of presence of open fractures, model uncertainty scenarios have been run to determine a range in inflows as follows:

1. Increased deep[1] bedrock K of $1x10^{-3}$ m/day (1 order of magnitude higher than the base model).
2. Reduced deep[1] bedrock K of $1x10^{-5}$ m/day (1 order of magnitude lower than the base model).
3. Reduced shallow[1] bedrock K of $1x10^{-4}$ m/day (1 order of magnitude lower than the base model).
4. Bedrock Sy of 0.01 (1/2 order of magnitude higher than the base model).
5. Bedrock Sy of 0.001 (1/2 order of magnitude lower than the base model).

Results of the uncertainty runs are shown in Figure 20 below. Maximum predicted inflows are up to 55 L/s (4,750 kL/day) for the increased deep K scenario, and minimum inflows of 10 L/s (850 kL/day) for the reduced shallow K scenario. Inflows towards the end of mining range from 43 L/s (3,750 kL/day) for the high K scenario, down to 9 L/s (800 kL/day) for the low K scenario.

[1] shallow is above 100 mAHD (model layers 1 – 6); deep is below 100 mAHD (model layers 7 – 10)

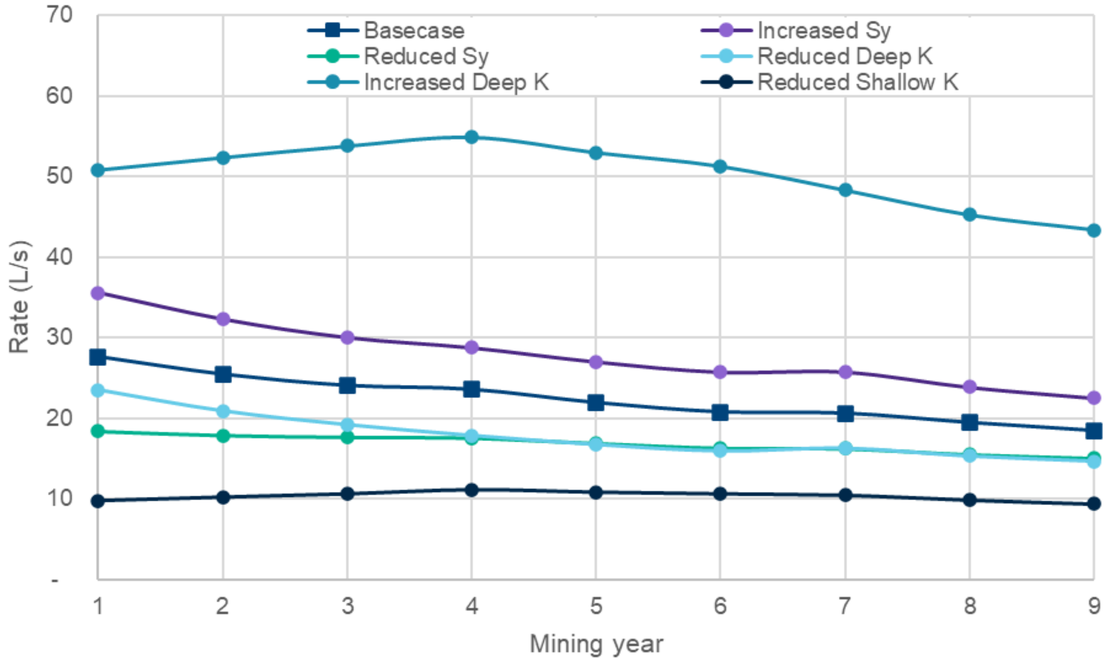

Figure 20 Modelled uncertainty scenario inflows

4.11 Limitations

Calibration to historical water levels and inflows during previous mining operations (up to 1998) where not possible due to lack of available data. Therefore, calibration to drawdown induced by the recommencement of the dewatering of the existing shafts provides only limited information regarding the possible hydraulic parameters of the upper 200 m (the depth to which current dewatering has taken place). There is significant uncertainty pertaining to the properties of deeper bedrock material and no knowledge of any noteworthy inflow zones that may have been intercepted during earlier mining.

Due to insufficient data regarding the timing and depth of mining at the neighbouring Cosmos operations, no representation of activity at Cosmos has been included within the model. Dewatering from Cosmos has historically been discharged into pits at Bellevue which is likely to have impacted hydraulic head locally. Drawdown from the dewatering of the Cosmos and Prospero underground mines possibly extends into the area to be dewatered by Bellevue, which would result in a reduce inflow during dewatering at Bellevue and would increase the magnitude (depth) of drawdown between the two projects. However, given the highly localised nature of drawdown in the low conductivity rock material the impact of drawdown from neighbouring mines is likely to be minimal.

The location and depth of all historical workings and exploration drilling is not clearly known, and if intercepted during mining these have the potential to provide rapid pathways to groundwater inflow particularly if these are in connection with high conductivity paleochannel sediments or flooded historical voids.

5 WATER BALANCE

To assess the likely water surplus or deficit a water balance for the life of the Bellevue Project was created using GoldSim. The model was set-up using data provided by Bellevue Gold and is based around the water flow diagram shown in Figure 21.

Although largely developed to provide a detailed timeline of water usage and possible water surplus or deficit, the water balance has also provided some insights into the current rate of seepage from the pits and the 'steady state' inflows to the underground. These insights were established during test runs of the model, designed to find water imbalances through investigation of the last 15 months of dewatering on site.

To estimate the likely water surplus or deficit, three scenarios were created based on the range of likely dewatering rates: low permeability scenario (1D), base case scenario (2D) and an intermediate scenario (3D).

Further model refinement could be achieved with a more precise measurement of the holding capacity of the open pits, detailed monitoring of pumping rates to and from the pits and regular water level measurements. This would lead to a better understand of the seepage rates and help define expected water loss from the system.

These results are presented as a guide to the likely water surplus or deficit. The actual water volumes and flow rates encountered will vary with changes to the mining plan. As the project continues

5.1 GoldSim Model Set-up

The model comprises an array of 'reservoirs' that are filled or emptied according to demand. These reservoirs may have fixed capacity, such as those representing the historic mine voids, the process plant, and the proposed raw water storage pond, or may have effectively infinite capacity or storage like the TSF, evaporation and rainfall, and dewatering from the underground. Flows between the various reservoirs are based on the provided water demand data, computed evaporative loss and rainfall gain, and the modelled dewatering rates. The structure of the connected flow pathways is shown in Figure 21.

The model is constructed to maintain full production through the project life. Water to the process plant is sourced solely from the raw water pond. When the raw water pond exceeds capacity, water is transferred to the pit reservoirs, and when the pit reservoirs exceed capacity the water is considered 'surplus'. This surplus water is not able to be managed under existing controls and will require some form of water management.

Although there are many well defined inputs to the Water balance, including the rate required for processing, expected returns from the TSF and thickener, moisture content of the ore, effluent from RO system and dust suppression, there are many that were unknown. To complete the water balance RPS used the following data:

- Rainfall has been estimated using data from the Bureau of Meteorology. Prior to setting up the GoldSim model a stochastic model was run over 100 realisations using historical rainfall to generate a synthetic rainfall series for the whole of project life, based on the Annual Exceedance Probability for Leinster. This synthetic rainfall series was used in each scenario
- Evaporation is only estimated from open water bodies on site, such as the pits and raw water pond. Average monthly pan evaporation data is available for Leinster, and this was used to create a daily evaporation rate using a lake evaporation factor of 65%. This same rate was used for each year of the Project in each scenario.
- The schedule of dewatering rates was sourced from the groundwater modelling and is based around the proposed underground mining schedule. The three scenarios produced used the upper, lower, and likely dewatering rates provided by the modelling.
- Processing plant raw water demand was provided by Bellevue (Guy Ware, Pers. Comms, email 30/06/21) and ranged between 1841 m^3/d (2025 to 2026) and 950 m^3/d (2027 onward). These values accounted for process water circuit make up, RO reject and TSF decant return.

In addition, an estimate is needed for the current rate of inflow to the underground as well as the seepage rates from the Henderson, Vanguard and Westralia Pits.

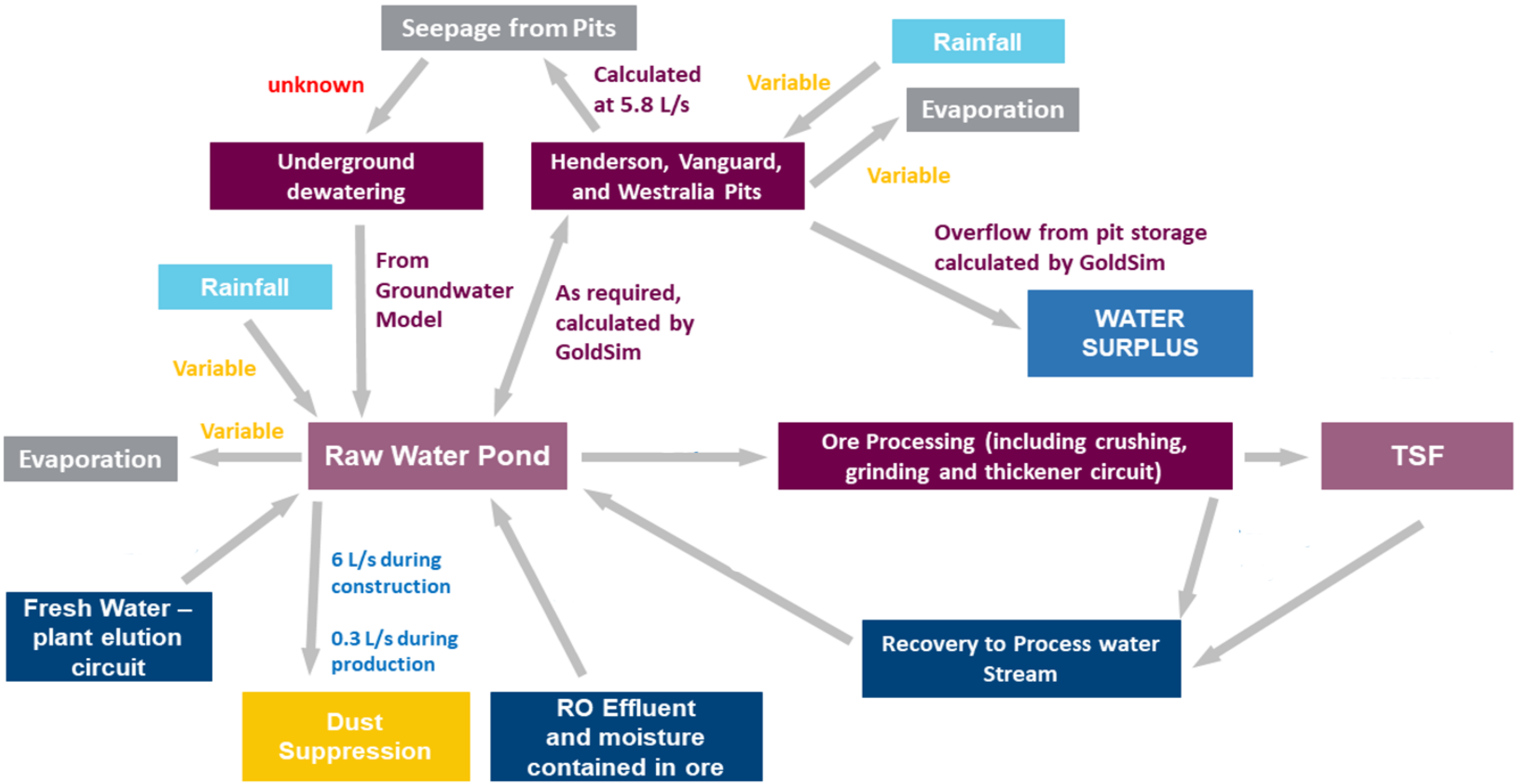

Figure 21 Schematic Water Balance

5.1.1 Estimating Current Underground Inflows

An initial assessment was made to see if dewatering from the underground was in balance — i.e. does it operate as a large, contained system with no additional inflows water. A smaller model was set-up initially, without the processing loop, but including the known rainfall and evaporation data, pumping rates and water volume sin the pit voids.

In this GoldSim model we would expect to see a linear relationship between cumulative volume abstracted and water level in the underground. Figure 22 shows the cumulative abstraction from the underground and the drawdown in the underground. The figure shows a good linear relationship between mid-December 2020 and mid-June 2020, and that with declining abstraction there is a stabilisation in rate of drawdown (mid-June 2020 to mid-July 2020). Pumping was halted from mid-July to mid-August with an associated period of recovery (drawdown declining), and finally a stabilisation in the drawdown with reduced pumping from mid-August to late October 2020. The recovery and lack of drawdown in the last few months of 2020 indicates that there must be additional water entering the system as inflow to the underground.

To estimate the underground inflows, RPS compared the pumping rates and the rate of drawdown. The pumping record can be broadly divided into seven periods where abstraction rates were relatively stable, these are summarised in Table 11 along with the drawdown rate computed for those intervals. Pumping rates range between 0 L/s and 65 L/s (5600 m^3/d). The data in this table were used to create a graph of the rate of drawdown vs abstraction rate (Figure 23).

Figure 23 shows that there is a strong a linear relationship between the pumping rate and the rate of drawdown. Water levels in the underground workings during June and July 2020 were at their lowest levels, with the water level maintained at 218m AHD with a relatively steady pump rate of 15 L/s to 18 L/s. As drawdown only occurs when the average pumping rate exceeds 17 L/s (1470 m^3/d), therefore a seepage rate of 17 L/s into the underground workings has been adopted for the initial water balance period (2021). Note that the groundwater modelling (2022 onward) outputs supersede this value, as inflow is anticipated to change as drawdown increases (and groundwater gradients change).

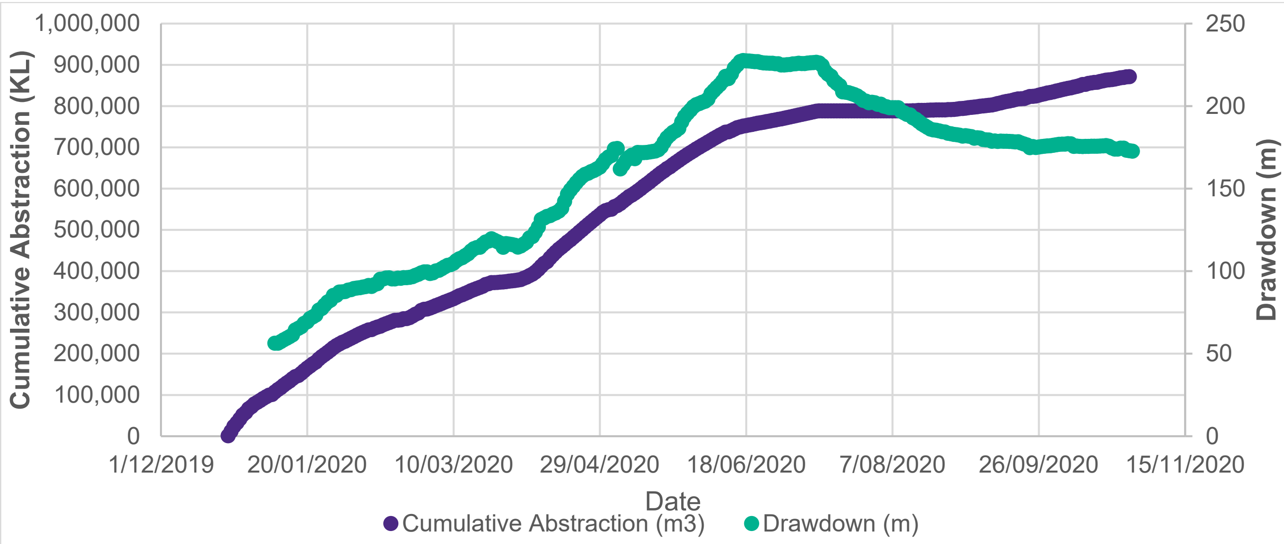

Figure 22: Cumulative volume abstracted and drawdown within the underground workings

Table 11: Rate of drawdown due to varying pump rate during the active pumping period.

Period Start	Period End	Average Abstraction (kL)	Average Abstraction (L/s)	Period (days)	Change in WL (m)	Rate of Drawdown (m/day)
24-Dec-19	06-Apr-20	3739	43	88	64.6	0.7
06-Apr-20	05-May-20	5657	65	29	53.4	1.8
06-May-20	10-Jun-20	4835	56	35	53.2	1.5
16-Jun-20	12-Jul-20	1477	17	26	-0.5	-0.02
01-Jul-20	13-Aug-20	0	0	30	-29.9	-1.0
14-Aug-20	10-Sep-20	406	5	27	-14.2	-0.5
11-Sep-20	16-Oct-20	1356	16	45	-5.7	-0.1

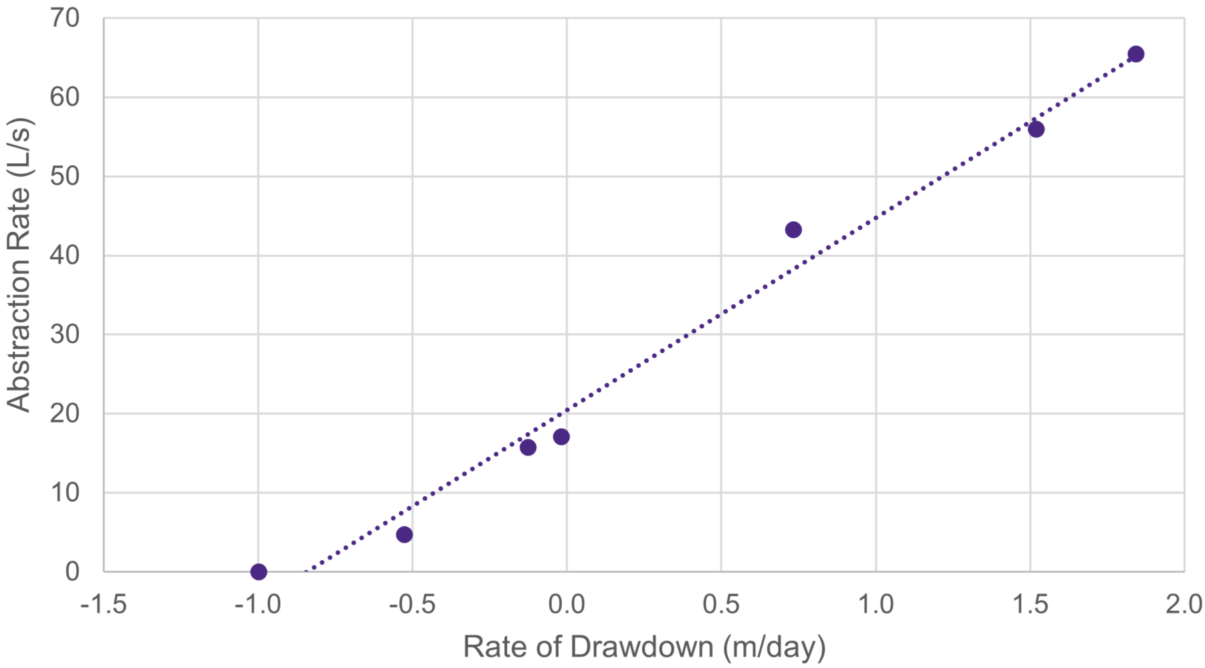

Figure 23 Observed rate of drawdown at various pump rates

5.1.2 Pit Seepage Rate Estimation

Three pit voids (Westralia, Vanguard and Henderson) on site are currently used as storage for the initial dewatering of the underground. As these pits are not lined, there is likely to be seepage from beneath the pits into the fractured rock aquifer. There may also be connection to the underground workings either through historic un-mapped workings or drill holes, or through existing fractures and interconnections between the aquifer and the underground.

To simulate this in GoldSim and attempt to estimate the seepage rate from the pits, the model was run without the process stream, with flows from the underground dewatering directed to the pits based on reported pumping records. The inflows to the pits were used to compute an expected water level in the pits and this was compared to the measured water levels. The GoldSim model results are plotted in Figure 24.

Water levels in the Westralia pit were within 0.4 m of the measured water levels (466.9 mAHD in July 2020). The Vanguard pit has a slightly more complex history as it included a period of initial dewatering as water was pumped to the Prospero mine. The Vanguard pit required an additional 1.2 L/s (103 m^3/d) inflow into the mine void to calibrate to the known water levels. This could be due to an overestimate of the total capacity of the mine void as the true size of the vanguard pit is unknown, requiring estimates of pit shape at depth.

Water levels recorded in July 2020 were 476.0 mAHD. The Henderson Pit required significant loss of water from the pit to account for the recorded pumping and observed water levels during 2020. A seepage from the pit of 7 L/s (605 m^3/d) was necessary to match the 476.1 mAHD water level recorded in July 2020.

Due to the uncertainties around the actual pit void volumes and the rates of inflow to the pits, a combined pit seepage rate of 5.8 L/s (500 m^3/d) has been assumed, which combines the 7 L/s loss from Henderson and 1.2 L/s gain from Vanguard.

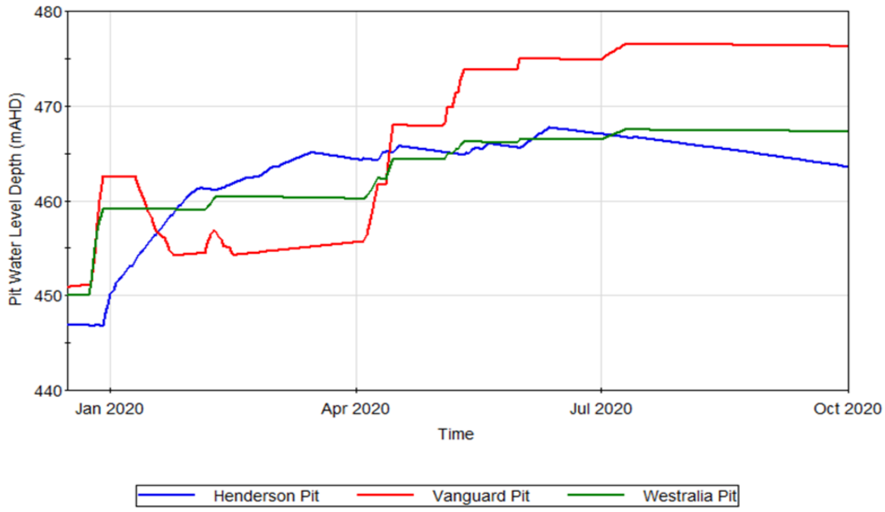

Figure 24: Modelled mine void water levels during active pumping.

5.2 Future Projections

Following the determination of the seepage rate from the pits and the likely current inflows (that will affect the early dewatering) a GoldSim water balance model was developed and run over the nine-year operational period of the mine period to inform the expected future water balance of the Bellevue Project, an additional pre-mining period was incorporated (mid-2021 to end of 2021) to assess the water abstracted to drain down the flooded existing workings that would occur prior to commencement of mining.

To assess the water balance, three scenarios were run. Each scenario incorporated a pre-mining dewatering phase and an operational phase.

5.2.1 Pre-mining Phase

Prior to underground mining starting, the existing workings will need to be dewatered. To estimate the volume of water that will be abstracted from the underground, the GoldSim model was run, without the processing stream active (i.e. no plant demand for water) for the first 18 months of the Project.

The starting water level for the Pre-mining phase is assumed to be 250 m RL (as indicated by Bellevue) with a water level of 175 mRL in the underground workings at the start of 2022 (start of the groundwater model), The target water level in the underground is 40 m AHD.

The various components of the water balance, include:

- A construction phase dust suppression of 160 kL/d (1.9 L/s);
- The estimated inflows to the underground of 17 L/s (July to December 2021, then input from the numerical model as dewatering progresses during 2022);
- The anticipated volumes of water required to dewater the underground workings (provided by Bellevue) at 5 m depth intervals;
- A seepage rate of 5.8 L/s (500 m^3/d); and
- Evaporation and rainfall as computed for the first year of the Project.

- Construction phase water demand as summarised in Table 12.

Table 12: Construction phase water demand (kL/d)

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2021	Model starts in July 2021						0	355	400	710	733	419
2022	0	893	1774	1833	2097	1333	1613	0	0	0	0	0

5.2.2 Operating Phase

The key purpose of the Operating Phase GoldSim model is to determine the likely magnitude of any water surplus or deficit across the life of the Project. Most parameters in the model have been fixed by Bellevue or from the earlier Pre-Mining Phase study. The Operating Phase model incorporates the processing and mining schedules and uses the results of the groundwater modelling as input. During the operational phase the demand for water from the plant is a key driver.

As the groundwater modelling presented a range of outcomes based on the likely estimated hydraulic conductivity of the rock mass, it is important to look at the effect these outcomes have on the Water Balance. Three scenarios were run, using the low-conductivity results (Scenario 1B from the groundwater modelling (1D in the WB scenarios), base case results (Scenario 2B from the groundwater modelling (2Din the WB scenario)), and a mid-case (or average) result (Scenario 3D in WB scenario)). This mid-case result will be used as the likely outcome.

The operating phase of the mine was modelled using the network design shown in Figure 21, using the details outlined below.

5.2.2.1 Processing and other water use

All scenarios used the same scheduling and water demand data provided by Bellevue, as summarised below:

- **Net Process water demand**: As summarised in Table 13. The values are nett demand values incorporating allowance for TSF decant returns, moisture in ore, fresh water supply and RO effluent supply.
- **Dust suppression requirements:** 500 m^3/d (5.8 L/s until December 2022) – ramping down to 0.3L/s from January 2023.

Table 13: Process Plant Net Water Demand (kL/d)

Year	2023	2024	2025	2026	2027	2028	2029	2030
Plant Demand (net)	1665	1665	1841	1841	950	950	950	950

5.2.2.2 Dewatering

The three GoldSim scenarios used a different dewatering rate, according to the groundwater modelling results, as summarised in Table 14.

Table 14: Average annual underground dewatering rates (L/s) from the groundwater modelling

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030
Scenario 1D (Lower expected dewatering – low permeability scenario)	23.5	20.9	19.2	17.9	16.8	16.0	16.3	15.3	14.7

Scenario 2D (Upper expected dewatering – base case of groundwater model)	27.7	25.5	24.1	23.6	22.0	20.8	20.7	19.5	18.5
Scenario 3D (Average dewatering of the two scenarios above)	25.6	23.2	21.7	20.8	19.4	18.4	18.5	17.4	16.6

5.2.2.3 Water storage

The available pit voids / storage facilities during the operational period of the mine are summarised in Table 15.

Table 15: Water storage facilities - key dates and volumes (m^3 or kL)

	Henderson	Henderson 2 Pit	Westralia	Vanguard	Water Storage Dam	Change in available storage	Total Available Storage
Current	314,000		147,000	166,000			627,000
September 2021			197,000			+ 50,000	677,000
January 2022					200,000	+ 200,000	877,000
March 2022				Rehab		-166,000	711,000
September 2022				439,538		+439,538	1,150,000
November 2022					Change to TSF use	-200,000	950,000
January 2023		644,850				+644,850	1,595,000

At the start of the model the initial free storage is 59,000 kL – reflecting currently available storage minus water already stored (as of June 2021). Noting that Vanguard pit is removed from the available storage for rehabilitation (March to September 2022) water stored in this facility will need to be moved to one of the other storage facilities. Similarly, when the Water Storage Dam (effectively acting as an evaporation pond, with an area of approximately 10 ha) becomes the Tailings Storage Facility in November 2022 the water stored there will need to be transferred elsewhere (i.e. into Vanguard Pit).

Additionally to the open pit storage facilities, the following are also captured in the water storage part of the balance.

- **Raw Water Pond:** 10,000 kL
- **Seepage from pits**: 5.8 L/s (500 m^3/d)

5.2.2.4 Water Balance Calculation

Although the water balance layout is shown in detail in Figure 21, a simplification is provided in Figure 25 to show how the model transports water and determines the surplus or deficit for the Project. Figure 25 shows that in the GoldSim model the raw water pond is initially used to store all water inputs from all sources, the total process demand is then taken from the RWP and remaining water inputs that exceed the capacity of the raw water pond storage are then transferred to the pit storage. Any transferred water that exceeds the available pit storage is then transferred to 'surplus water' and is eliminated from the model.

5.2.3 Scenario 1D Results

The results from the low dewatering scenario are summarised in Figure 26. The water balance model shows a brief period of surplus in August 2022, following ongoing dewatering of the underground workings and just prior to the availability of Vanguard (September 2022). The surplus water predicted totals 5,900 kL. Once Vanguard is available for storage, and later when Henderson 2 is also available, there is sufficient capacity for the anticipated volumes of water based on projected water demand. Management of underground dewatering (i.e. a temporary slowing in dewatering rate) during the period that Vanguard is unavailable would be expected to be sufficient to manage this surplus.

From 2023, when the plant is operational, water demand is broadly similar to supply, but as water is anticipated to leak from the storage pits – over time the water volumes in the pits deplete. During 2026 a water deficit is forecast, during which time alternate water sources would need to be considered to support plant demands. The estimated deficit is approximately 123,000 kL (between April to August 2026)

From 2027, when plant water demand declines - the incoming water (accounting for losses – e.g. seepage from pits, evaporation etc) approximately balances demand – although there is very little water retained in storage in the open pits.

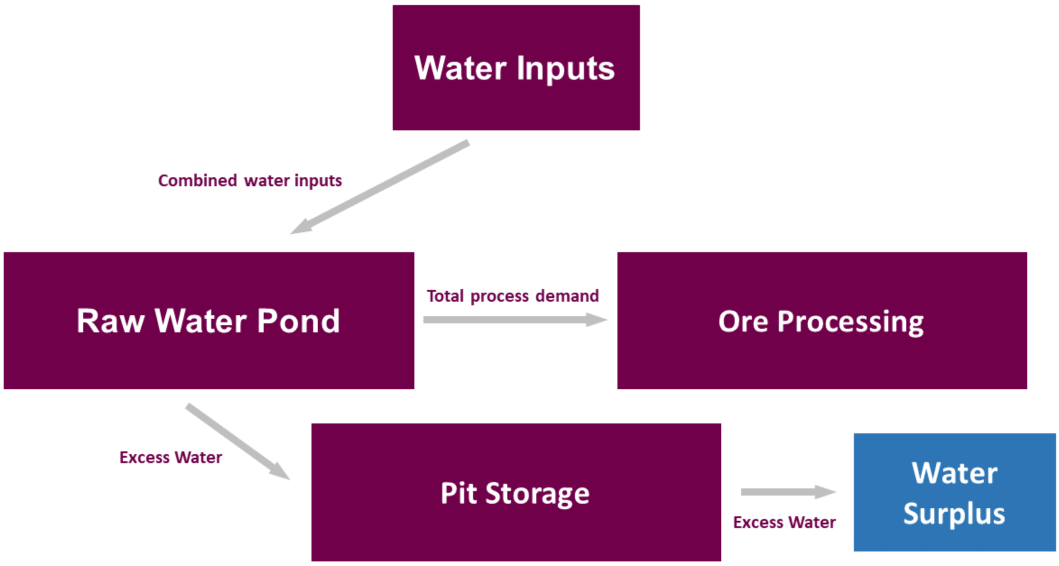

Figure 25 Simplified water balance flow diagram

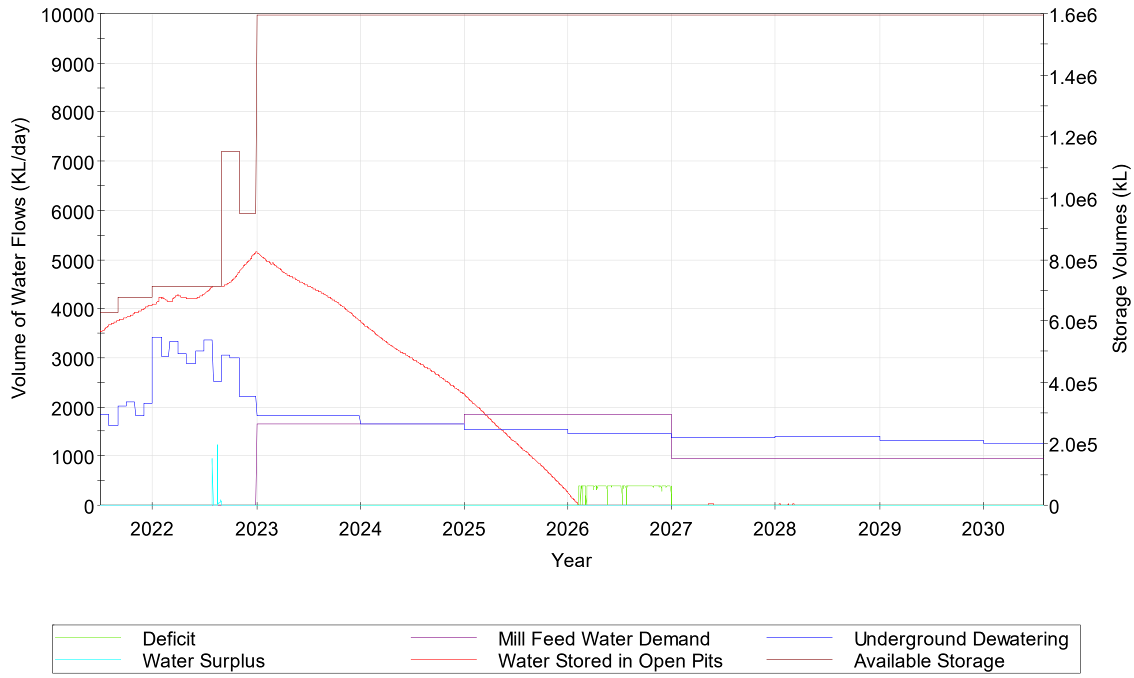

Figure 26 Scenario 1D — Water balance with low dewatering rate

5.2.4 Scenario 2D Results

The results from the base case dewatering scenario from the groundwater model are summarised in Figure 27. The scenario shows the Project has a surplus of water during 2022, when underground dewatering progresses rapidly (including draindown of water from the existing flooded underground workings). The surplus water predicted totals 92,260 kL and occurs between April 2022 and September 2022. Once Vanguard Pit is available for storage there is sufficient capacity for the water generated from dewatering associated with the underground working.

From 2023, when the plant is operational, water demand is broadly similar to supply, but as water is anticipated to leak from the storage pits – over time the water volumes in the pits deplete. Due to the greater volumes of water generated in the high dewatering scenario there is no net deficit of water, with water stored in the open pits able to support plant requirements for the period that plant demand is high (2023 to 2026). From 2027 onward plant demand drops and there is a slight accumulation of water in the open pits.

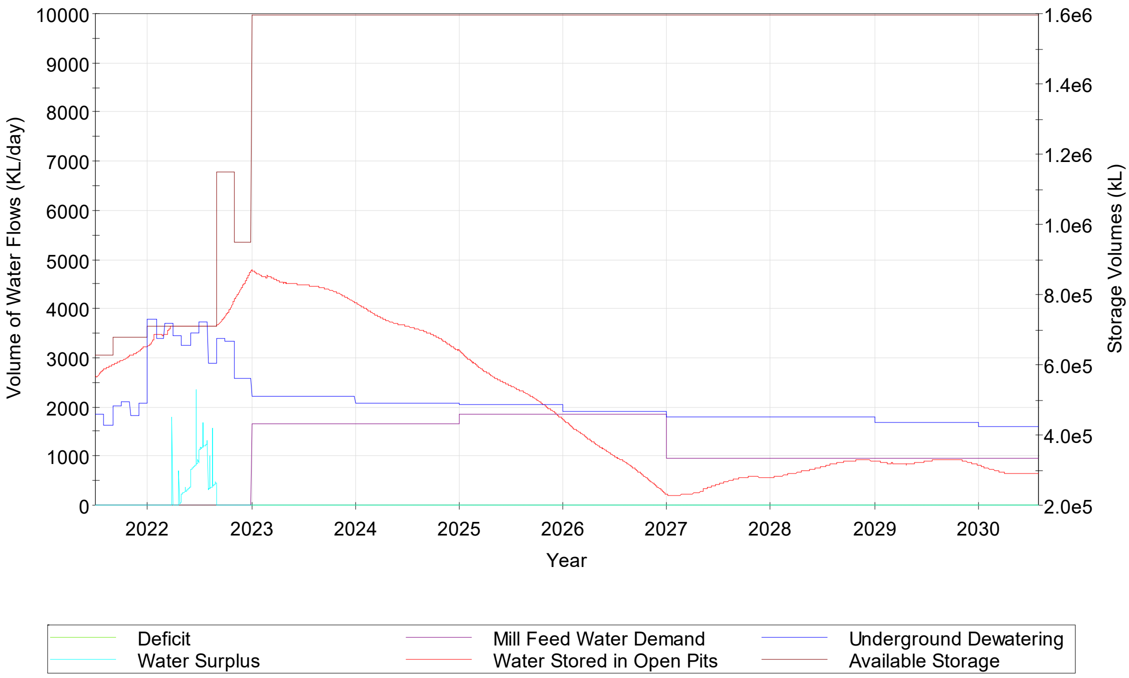

Figure 27: Scenario 2D — Water balance with high dewatering rate

5.2.5 Scenario 3D Results

The averaged dewatering scenario is presented in Figure 28. This shows a middle ground between the upper and lower anticipated dewatering outcomes – with a short period of surplus during 2022, when dewatering of the underground workings is greatest. The surplus totals 49,640 kL and occurs between June and August 2022.

The model predicts a slight deficit in late 2026 (December) of a total of 3,800 kL.

From 2027, when plant water demand drops the incoming water (accounting for losses – e.g. seepage from pits, evaporation etc) approximately balances demand – although there is very little water retained in storage in the open pits.

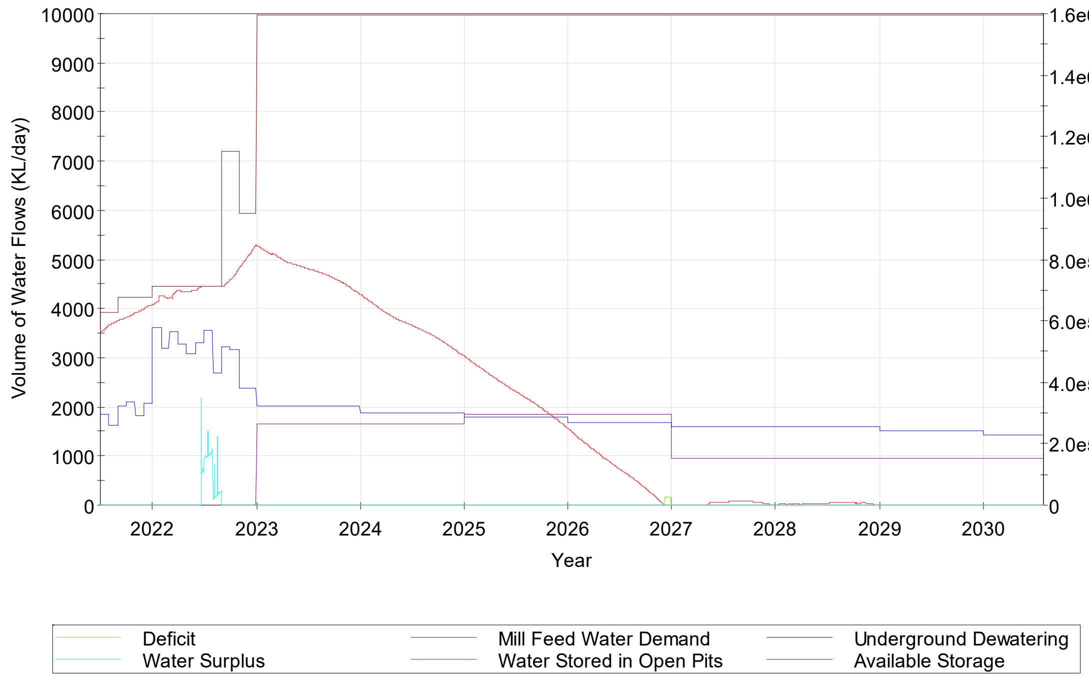

Figure 28: Scenario 3D — Water balance with averaged dewatering rate

5.3 Conclusions

The scenarios all show an initial accumulation of water in the storage pits as the flooded underground workings are drained down and dewatering progresses. Storage is generally sufficient until the period between April 2022 and August 2022 when a surplus of between 5,900 kL (low dewatering scenario) and 92,000 kL (high) is generated. From 2023 onward there is sufficient storage for the dewatered water and demand typically exceeds supply, leading to a potential short term deficit (requiring water from alternative sources) during late 2027,

6 WATER MANAGEMENT PLAN

6.1 Construction Phase (2021-2022)

The water balance modelling demonstrates that the Project is likely to have a water surplus during the late construction phase (i.e. mid-2022). This surplus occurs when dewatering in the model is greatest and onsite storage is relatively limited. There are several options available to manage the surplus of water anticipated:

- Delaying the bulk of underground dewatering from April / June to end of August when the additional storage capacity of Vanguard pit is available. Pumping capacity will allow for the mine to be completely dewatered by the end of 2022.
- Increasing the capacity of the planned evaporation pond from 200 ML to 250 ML.
- Complete mining of the Henderson 2 pit earlier in 2022 to make the additional capacity it offers available sooner.

The above are a range of options that could be used either individually or concurrently, depending on how dewatering progresses, to mitigate the risk of surplus water being generated. The available storage on site is a key constraint, and if necessary dewatering can be slowed / delayed or additional storage brought on line sooner to prevent surplus water being generated.

6.2 Operational Phase (2023-2032)

During the operational period, in particular during 2027 – when plant water demand is high, there is a risk of insufficient water that if dewatering volumes are low. In this instance alternative water supplies should be sought if necessary. As dewatering progresses the water balance will be better constrained and the need for additional water supply better understood.

6.3 Groundwater Licence

The current Dewatering licence for Bellevue has an allocation limit of 1,000,000 kL/year. This should be sufficient for the life of the Project and no recommendations are made to amend this licence.

6.4 Potential Impacts to Paleochannel Aquifer

The groundwater modelling indicates that there may be some drawdown impacts on the margins of paleochannel sediments associated with Lake Miranda. The lake has four mapped Priority Ecological Communities (Lake Miranda West, Lake Miranda East, Violet Calcrete and the Yakabindie Calcrete). Blueprint Environmental Strategies (2021) has assessed the potential impacts of drawdown to these Ecological Communities as part of the EPA referral and have concluded that the influence of the localised drawdown predicted as a result of mining would be negligible.

Possible pathways for water stored in paleochannel sediments and the mine workings include:

- Intercepting historical exploration drill holes;
- Potential connection between the paleochannel sediments and mine workings via bedrock fractures.

Bellevue plan to grout all historical exploration drill holes to remove this possible pathway between the mine workings and the paleochannel sediments.

Any potential pathways via bedrock fractures are likely to be very localised in nature. Therefore, it would be impractical to attempt to verify the occurrence of any connection between the proposed underground workings and the paleochannel with a surface-based field-testing program. As an alternative, Bellevue proposes to implement a program of probe drilling the face of the underground workings that progress close to/below the paleochannel to undertake pressure testing and monitoring for potential inflows, and then pre-grouting features as and when required to prevent any significant inflow events.

To confirm the validity of the hydrogeological model and the effectiveness of these controls it is recommended that an additional four environmental monitoring bores are constructed in addition to the exiting monitoring network: two within the area immediately above the mine workings where they cross beneath the sediments of Lake Miranda and two regional bores outside of the main area of potential impact. The bores outside the potential impact area will provide data to show seasonal fluctuations unrelated to mining as well as establishing a basis for assessment of the extent (if any) of drawdown propagation into the paleochannel. It is recommended that water level monitoring be undertaken monthly for this purpose.

6.5 Construction Schedule Inputs

As the Project is likely to be supplied with process water from dewatering and onsite storage, there is no immediate requirement for new production borefields or extensive pipe networks from neighbouring projects. Based on the findings of the water balance, management of the surplus water from the initial dewatering phase is critical to avoid delays to the Project.

Consideration should made of the evaporation basin design in RPS (2020); designed to accommodate up to 350 ML. Surplus water is currently being managed onsite through dust suppression on waste dumps. Used in conjunction with dust suppression the evaporation basin would greatly assist in surplus water management. Because the initial dewatering period is the only time during the mine life that surplus water is a large issue, building a larger evaporation pond to accommodate the entire surplus volume may not be the most cost-effective choice. The ultimate sizing of the evaporation basin should be based on the cost benefit. Assessing the costs of slower dewatering (which would affect the mining schedule) vs the costs of constructing a larger evaporation basin.

Additional monitoring bores near lake Miranda are also recommended to assist in gaining regulatory approval, should it be required.

7 RECOMMENDATIONS

Various recommendations have been made in the report, as summarised below. These are to provide a further degree of surety around assumptions and uncertainties identified during the review and modelling process.

- Ongoing monitoring of recently (2018) installed monitoring bores to verify the predicted model drawdown and facilitate further calibration of the model.
- Additional monitoring bores to the south of the facility to assess the potential impacts of dewatering on the paleochannel aquifer.
- Reconciliation of the water balance with measured dewatering and drawdown data as work progresses – recommended that this is initially tracked on a monthly basis to validate the assumptions made in the model to date and capture any key changes to the mine plan over time.
- Consideration of alternative water supply options – based on the water balance this is not an immediate issue, but should still be looked into well in advance of the forecast period of potential temporary deficit (2026).
- Refinement of the mine plan to include the potential water management options – including update of the corresponding water balance.
- Consideration of the size of the proposed evaporation pond – to support management of potential periods of otherwise surplus water.

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Appendix A — Hydrology Figures

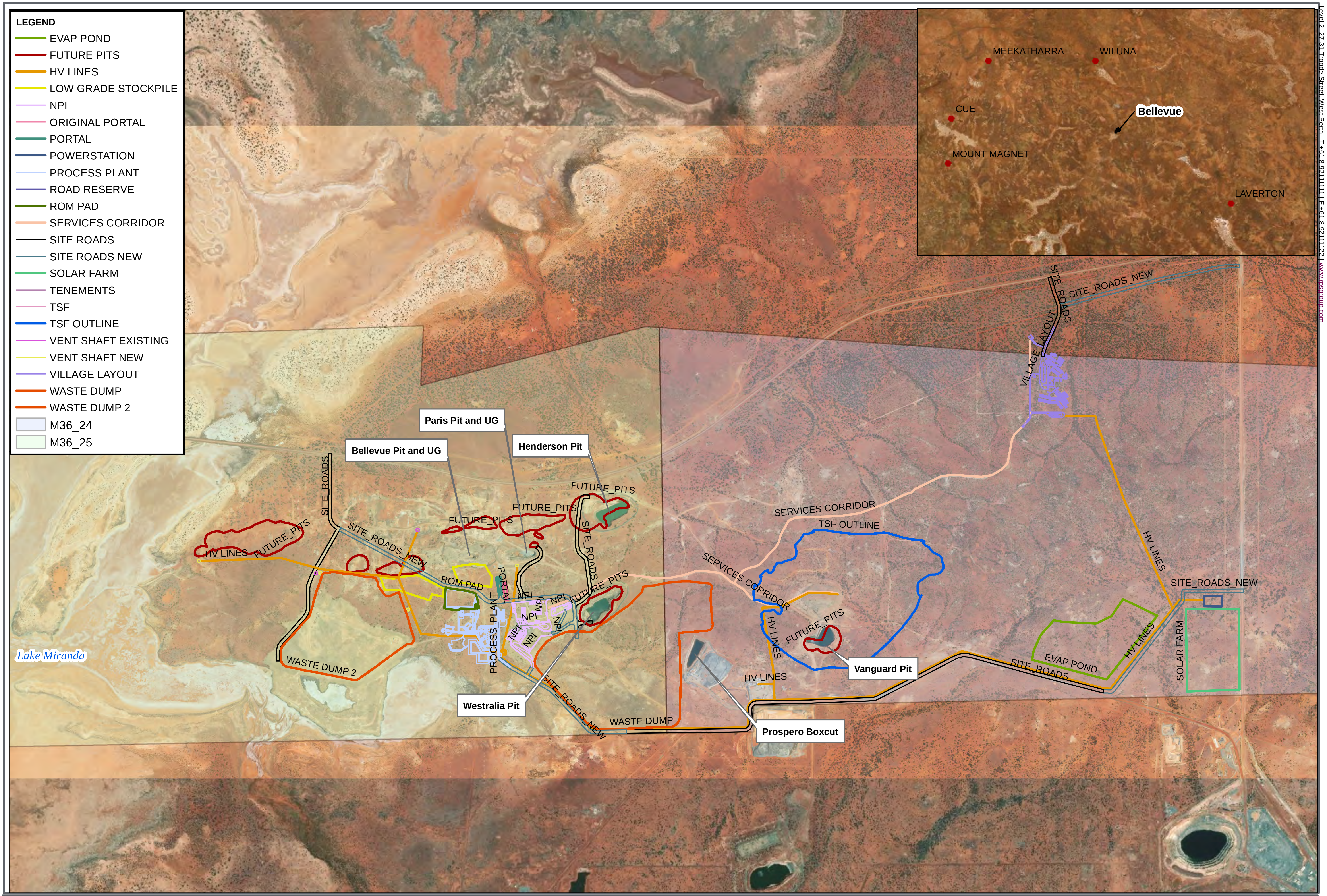

Figure A
Bellevue
Location Plan and General Layout

GDA 1994 MGA Zone 51

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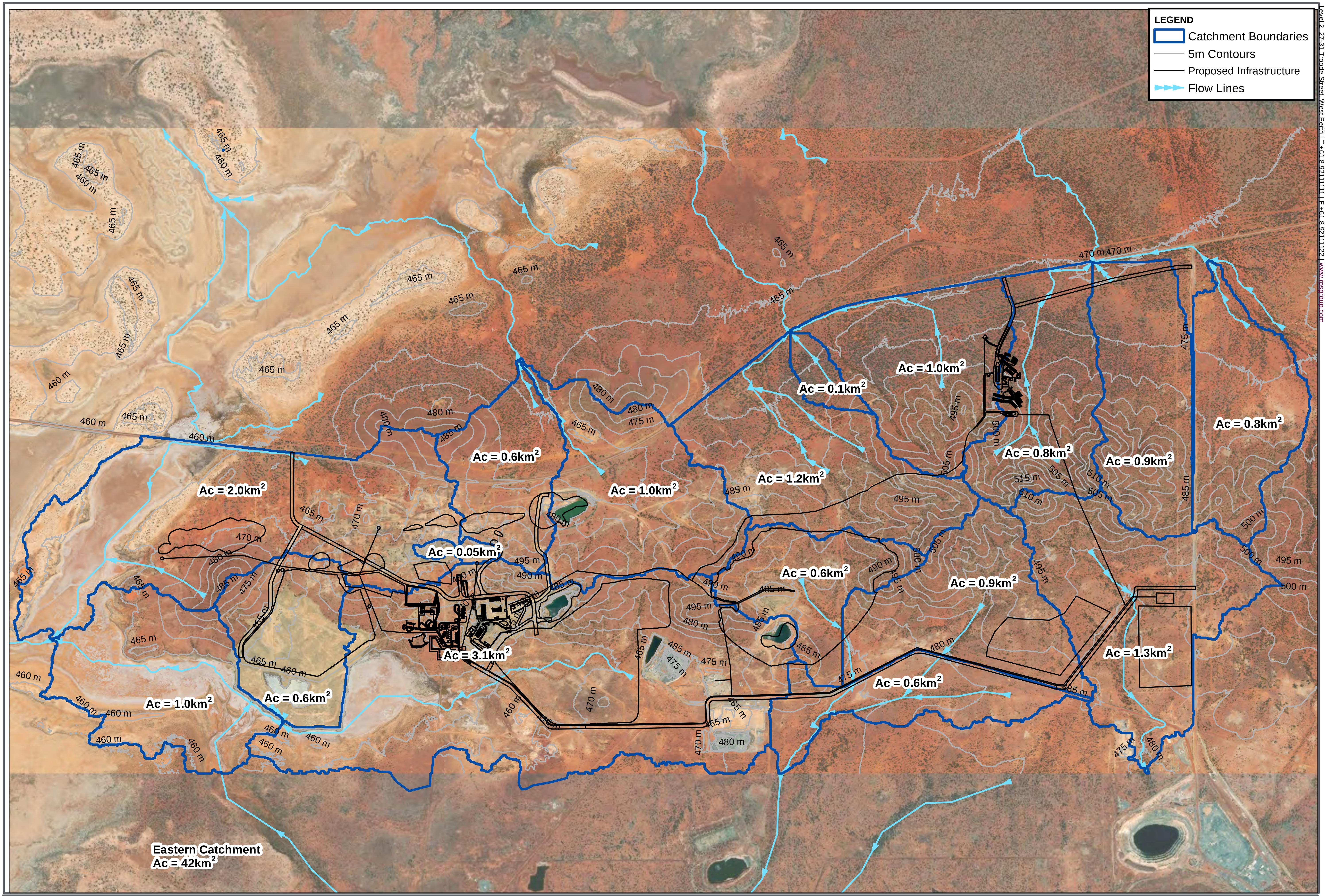

Figure B
Bellevue
Surface Water Catchment Boundaries

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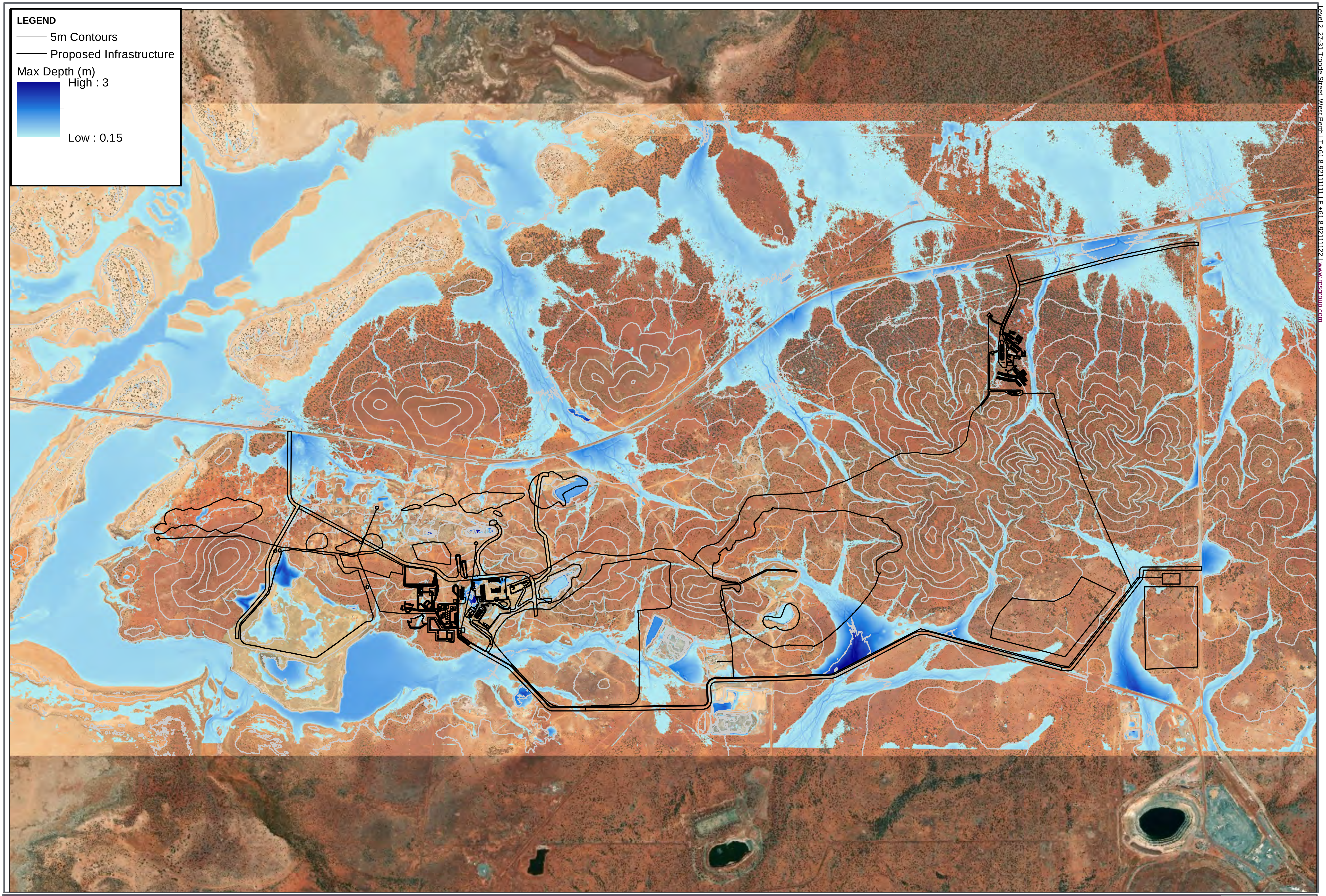

Figure C
Bellevue
100-Year Flood Depths

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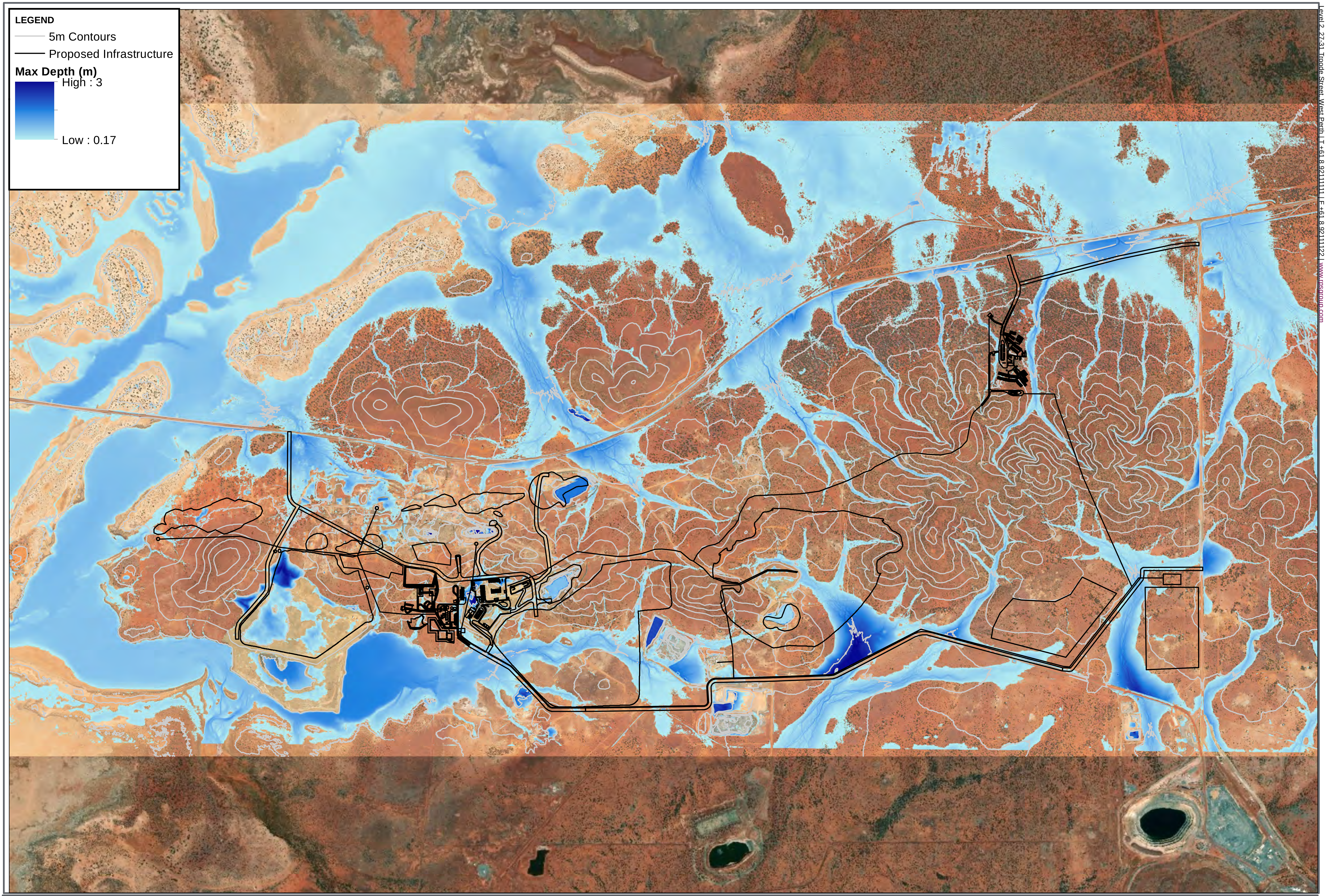

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Figure D
Bellevue
500-Year Flood Depths

GDA 1994 MGA Zone 51

0 300 600 1,200 m

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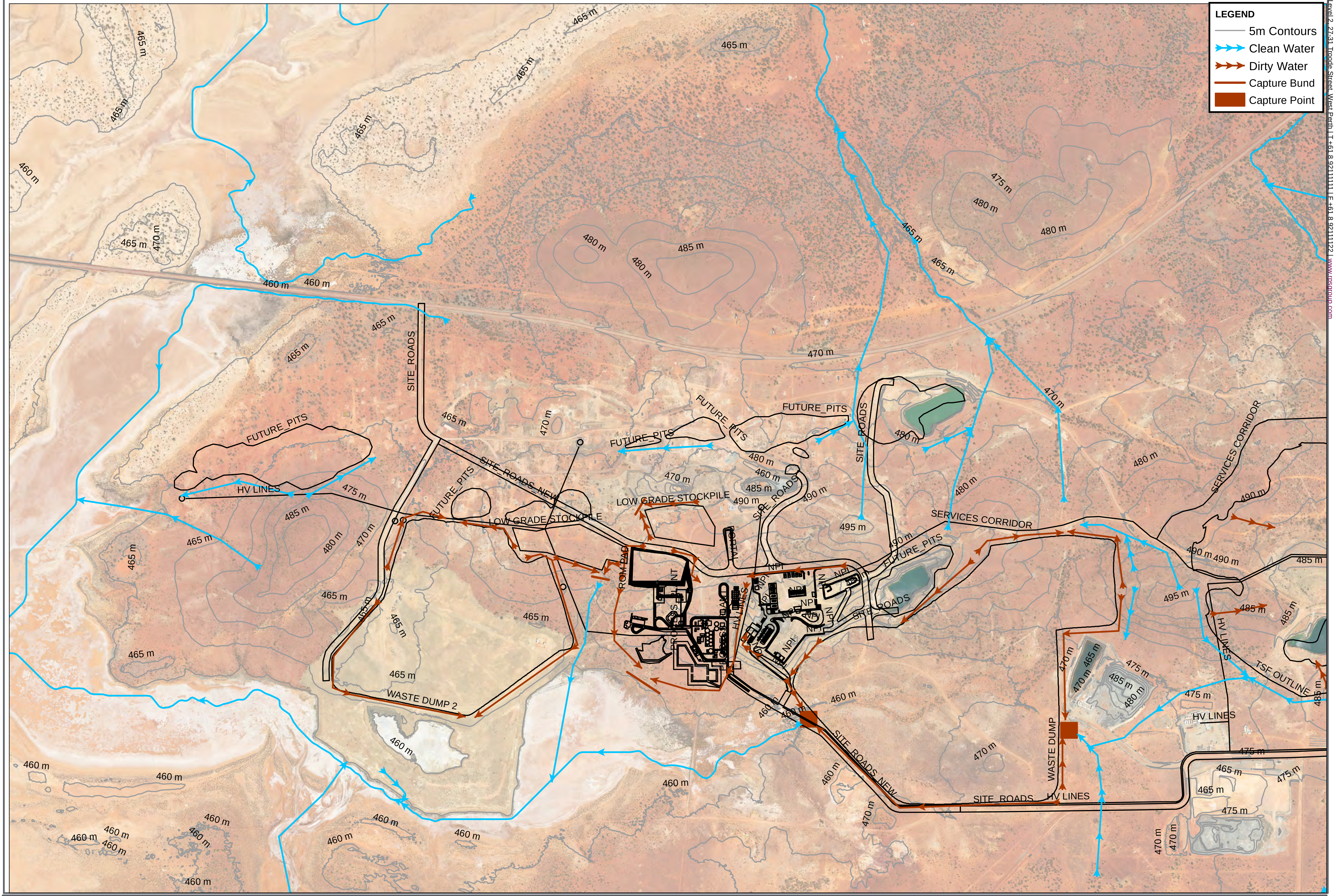

Figure E
Bellevue
Surface Water Management Plan 1

GDA 1994 MGA Zone 51

0 170 340 680 m

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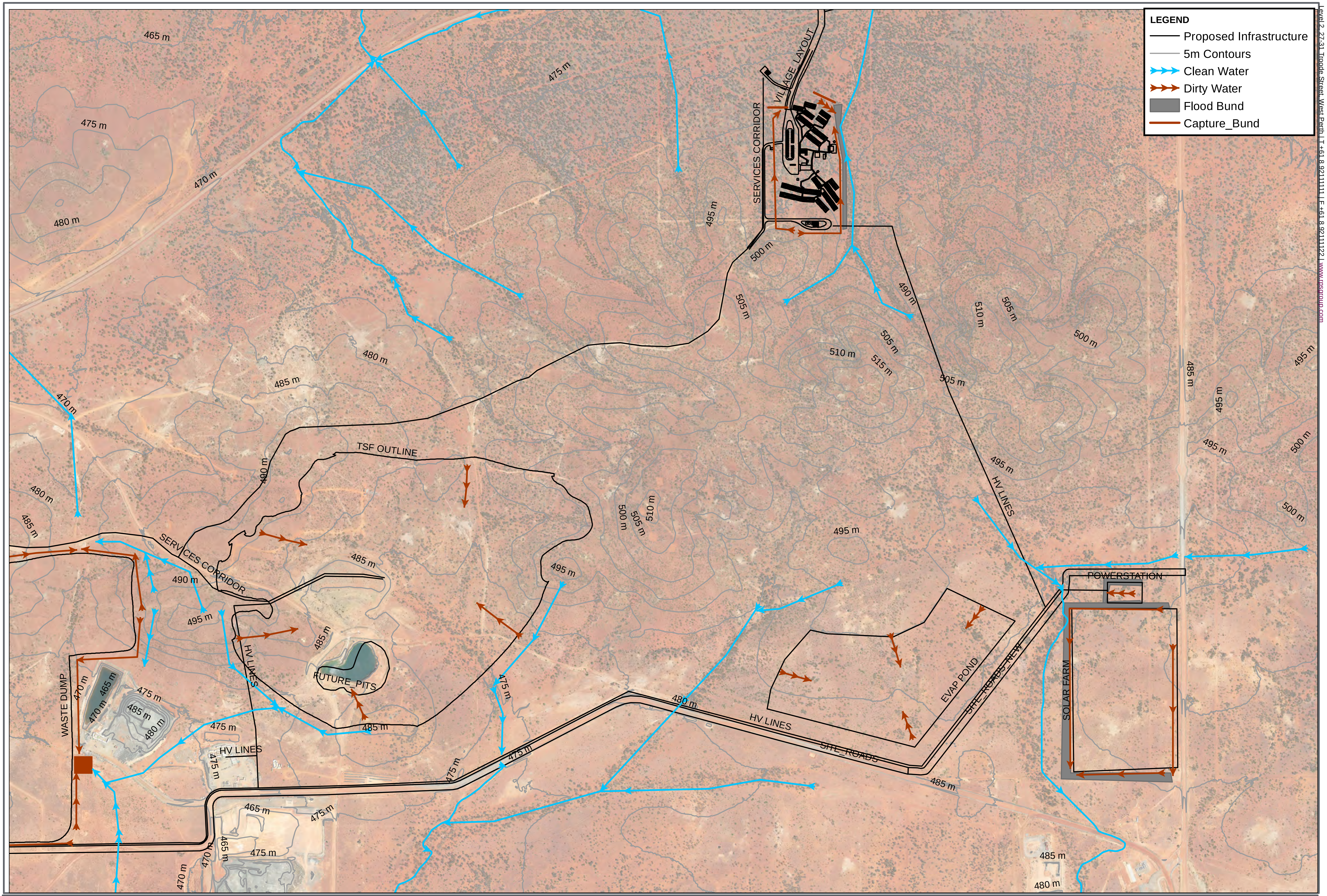

Figure F
Bellevue
Surface Water Management Plan 2

GDA 1994 MGA Zone 51

0 155 310 620 m

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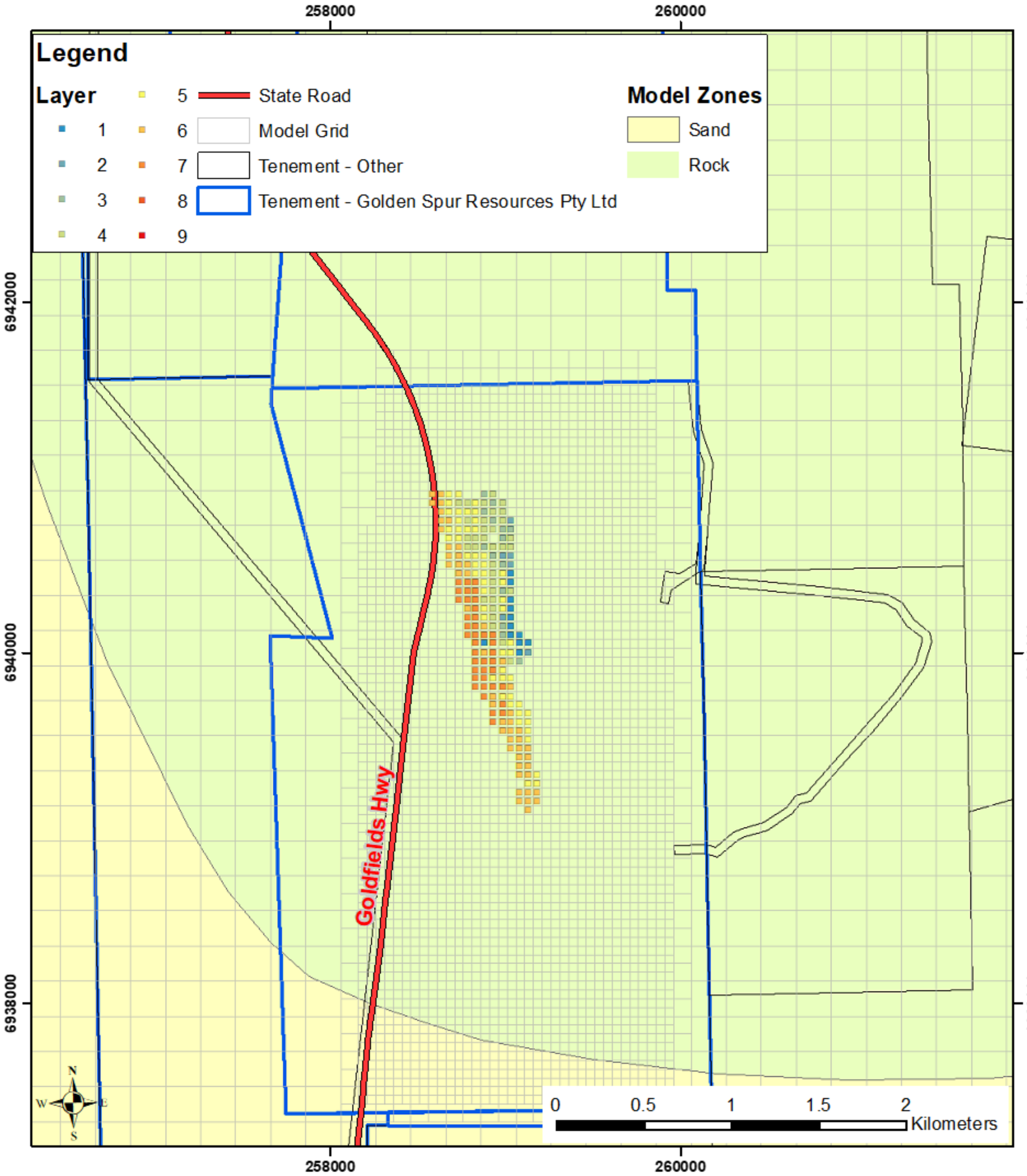
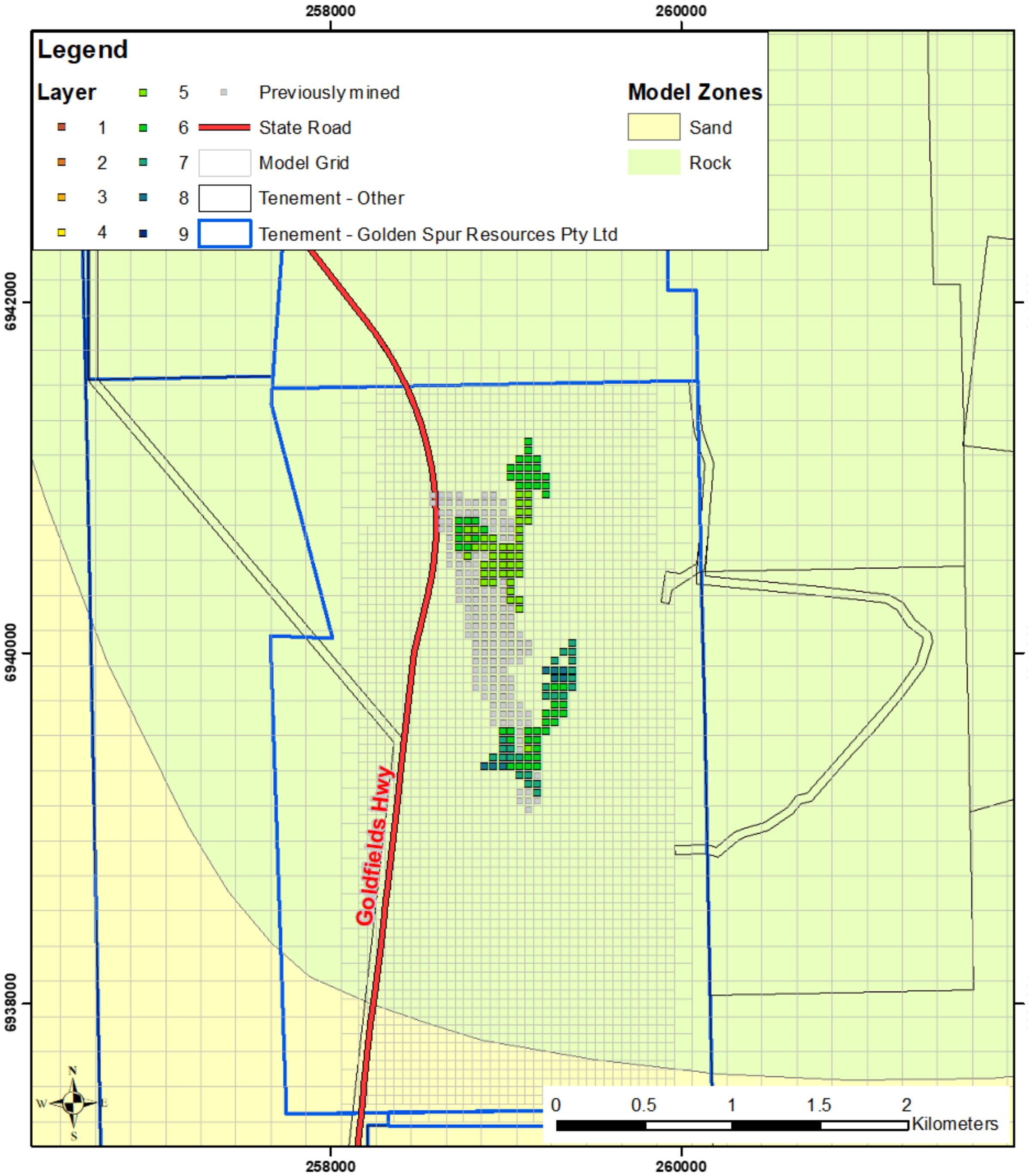
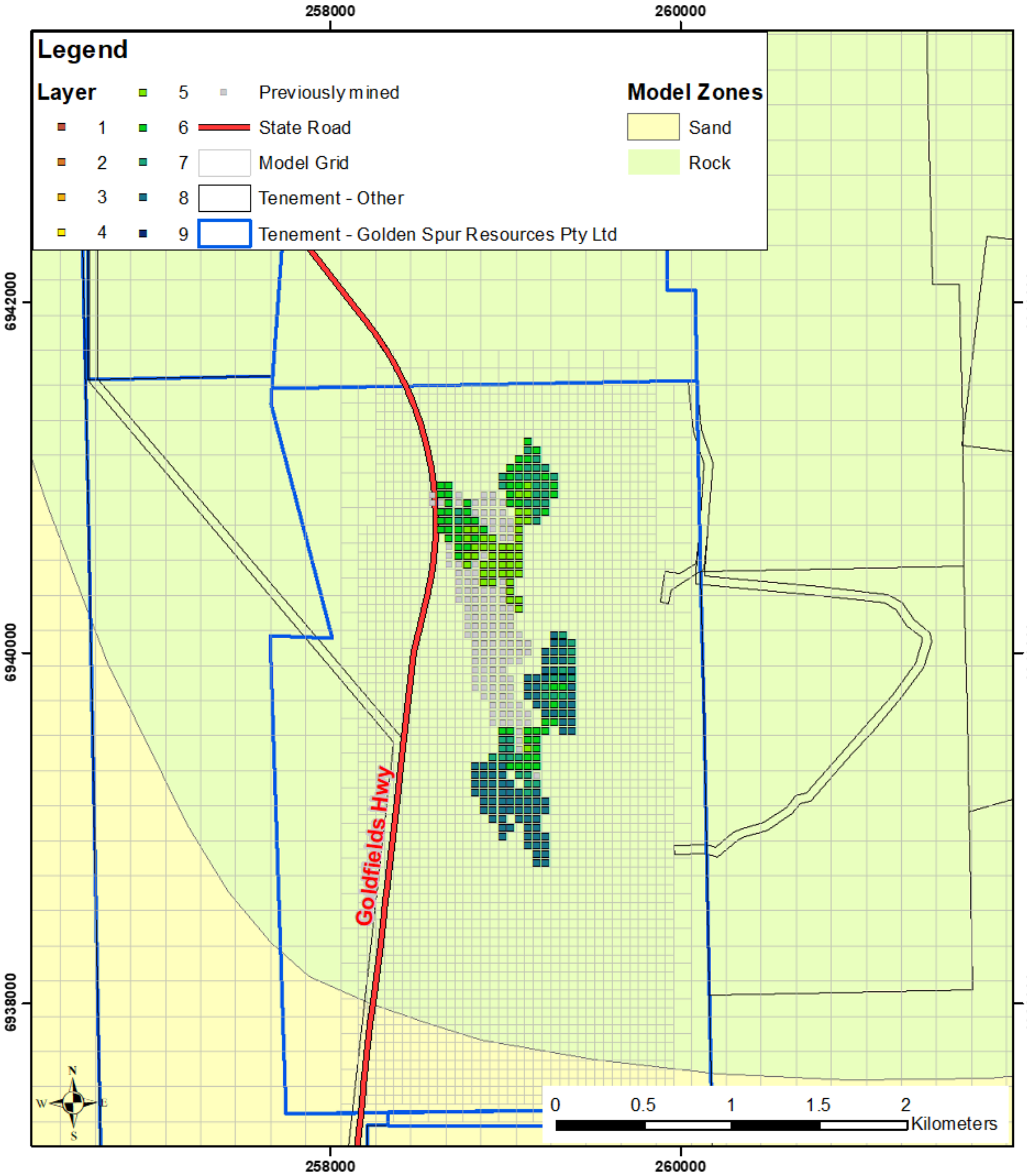
Appendix B – Progression of underground workings



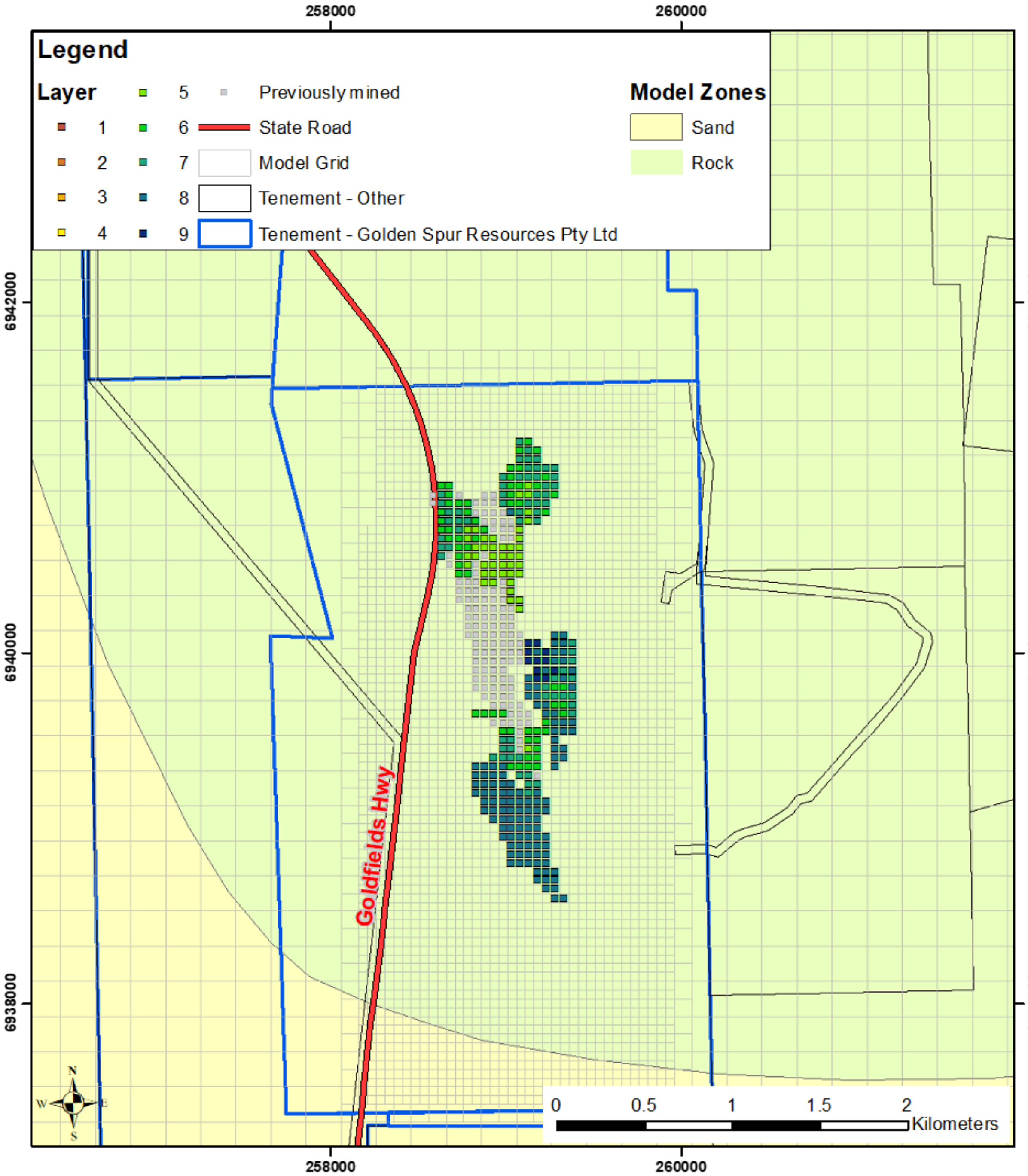
Existing workings



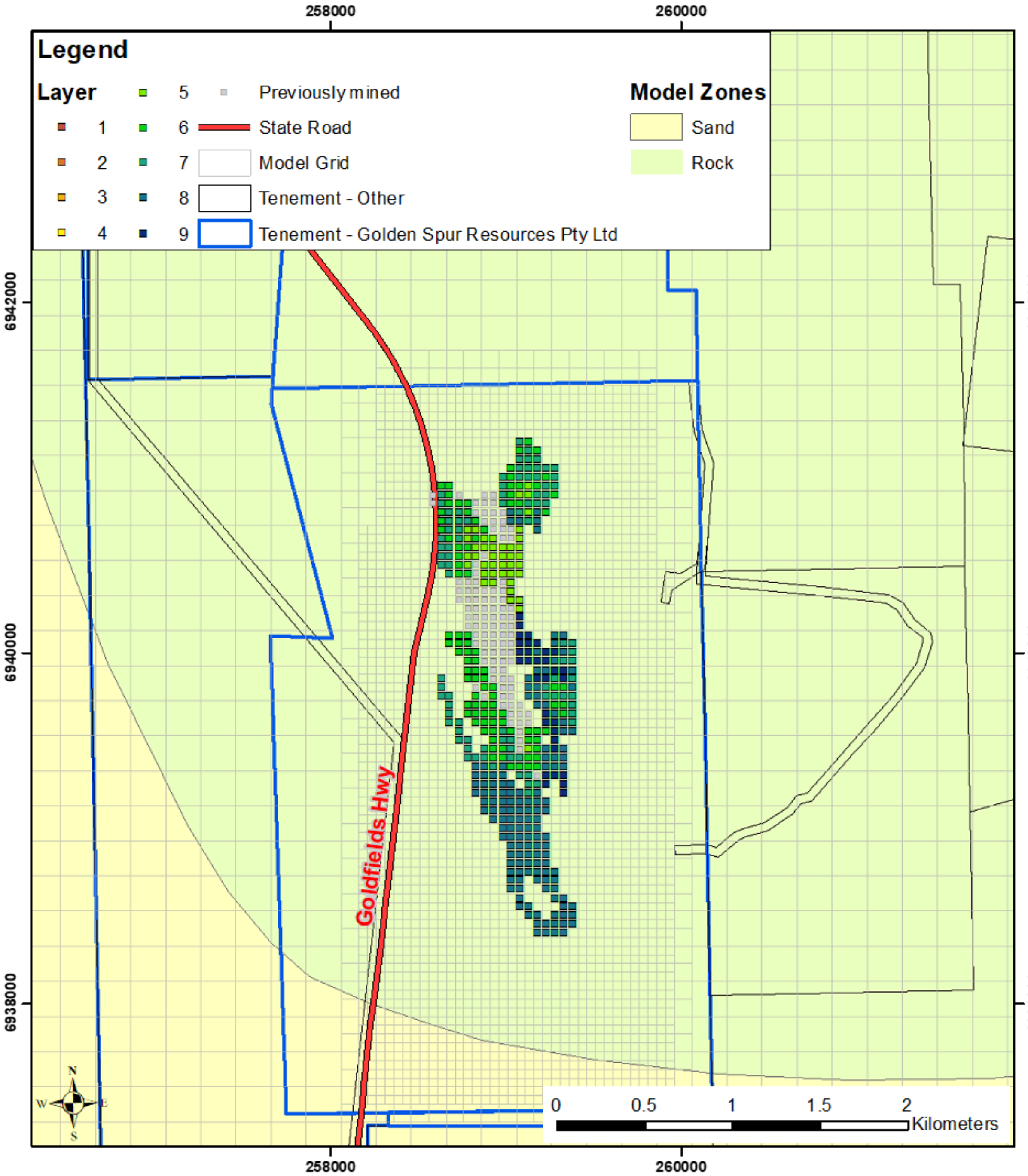
Active workings - Year 1



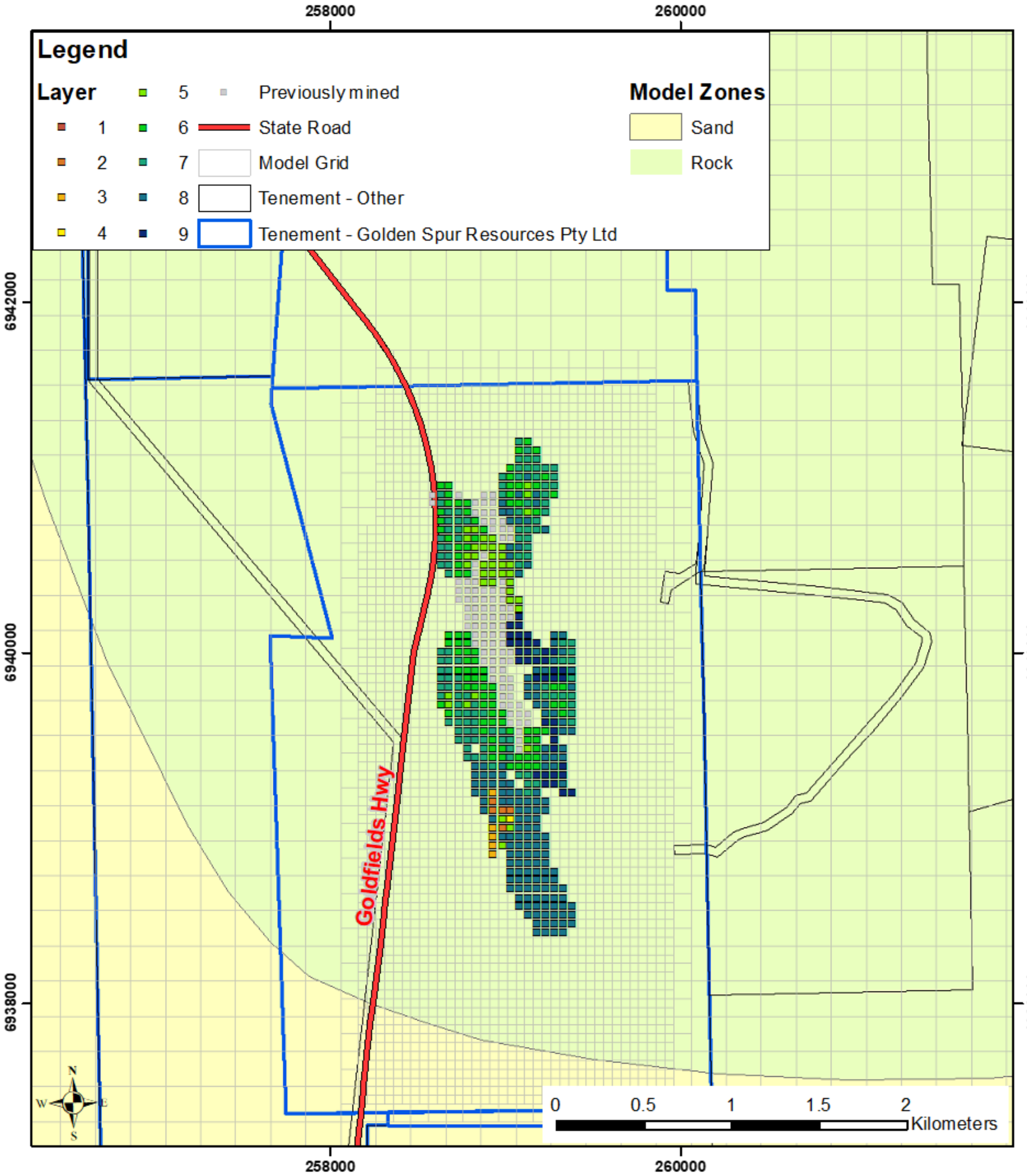
Active Workings - Year 2



Active Workings – Year 3



Active Workings – Year 4



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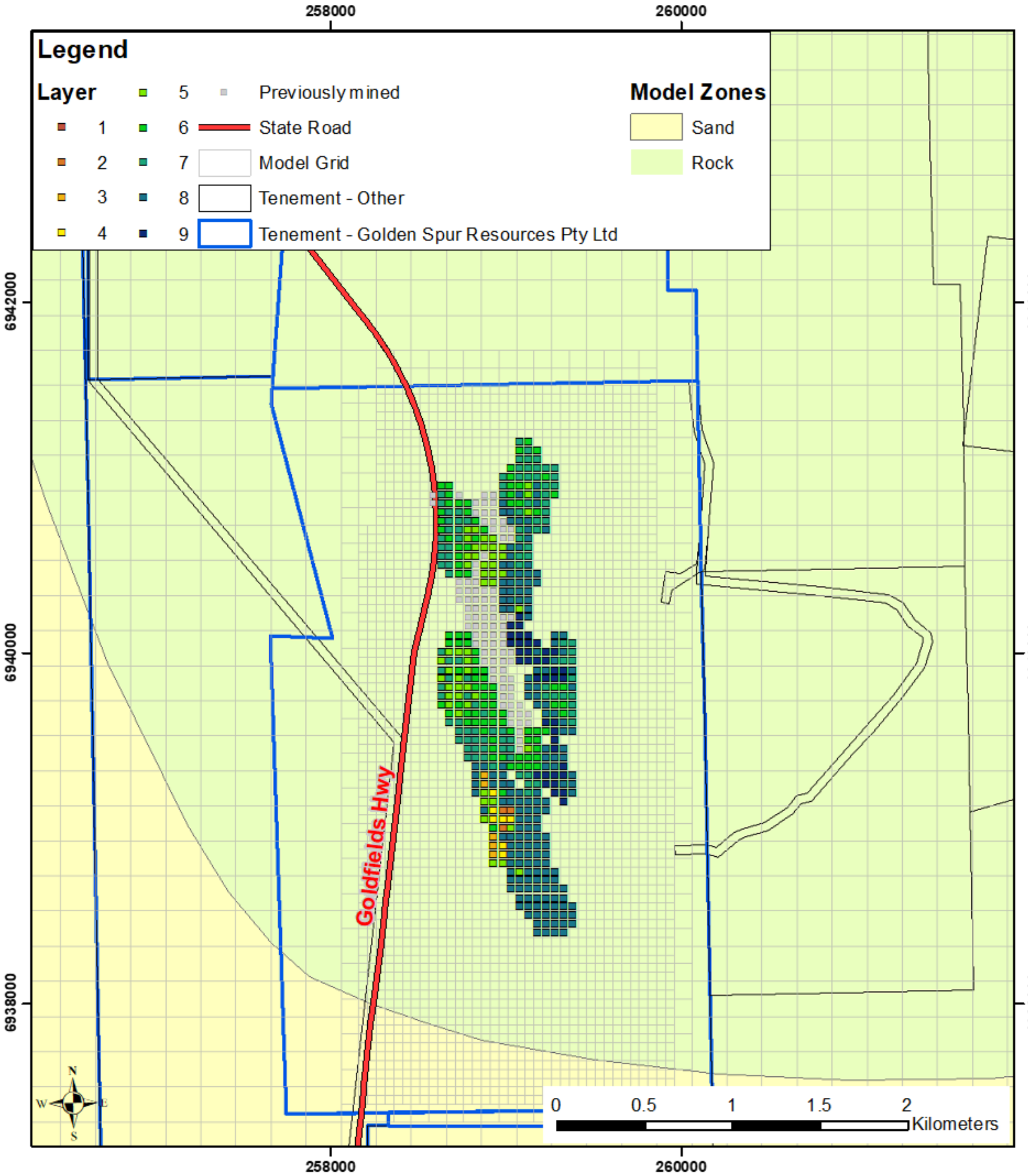

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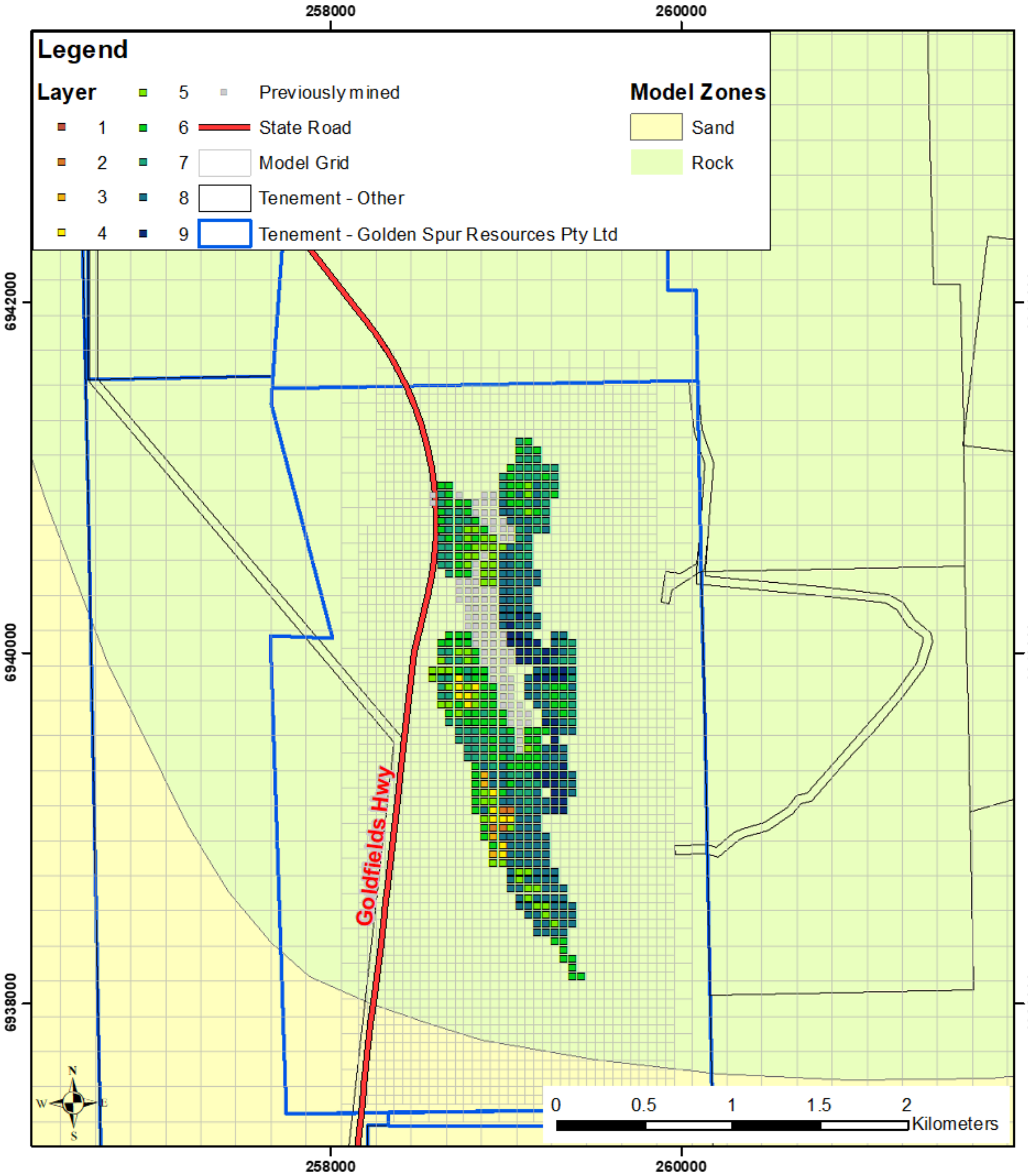

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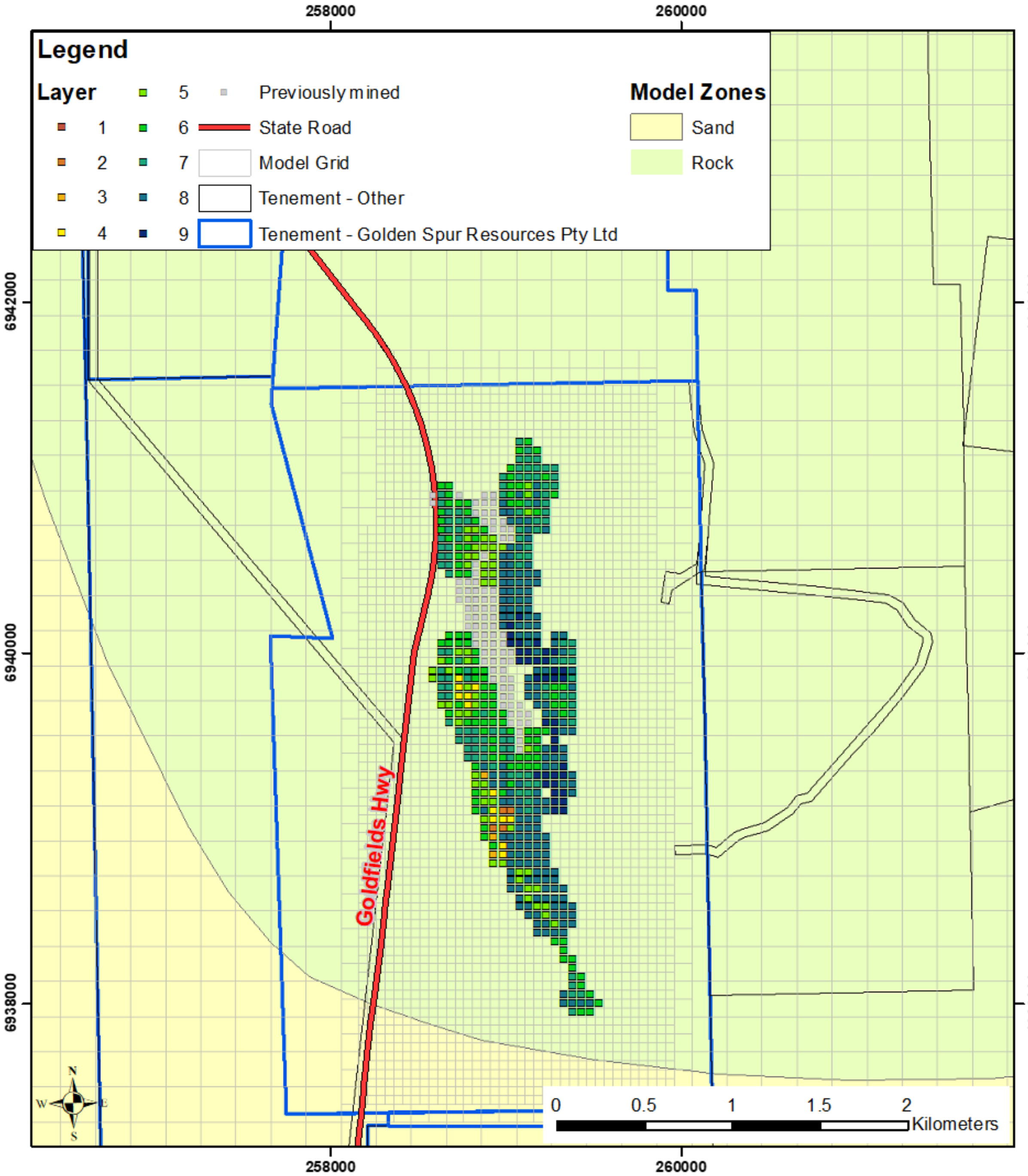
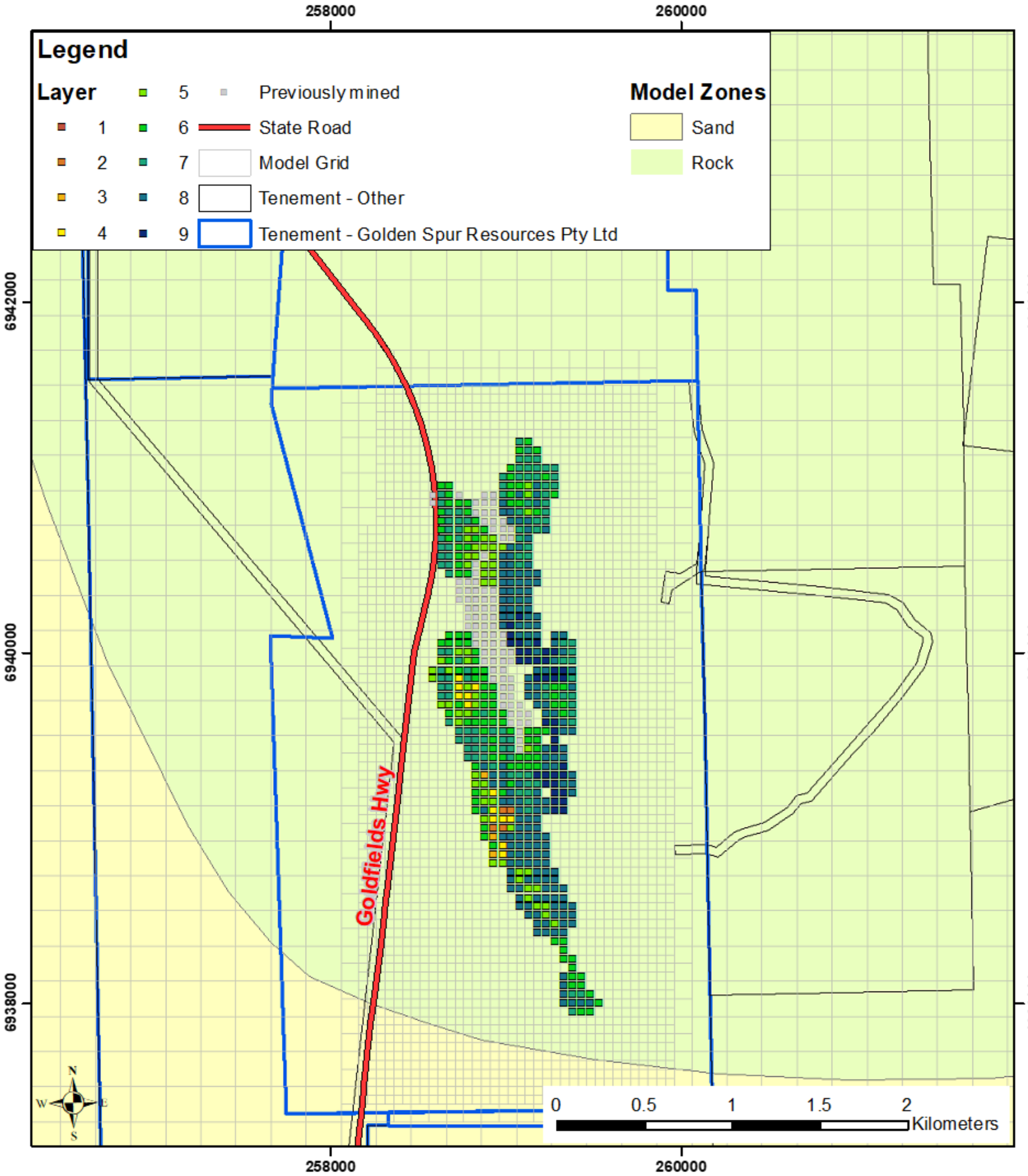
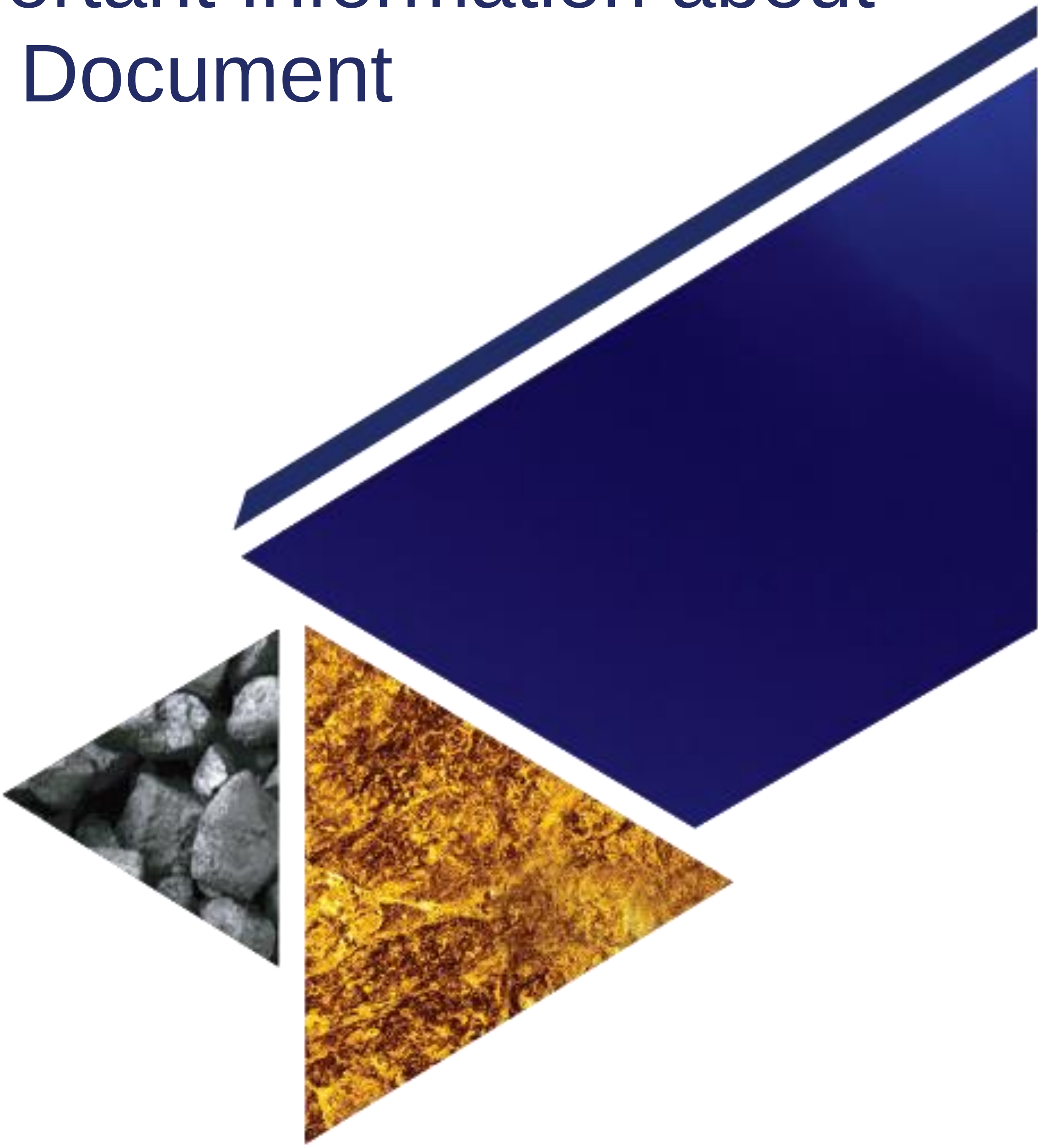


Active Workings – Year 8



Active Workings – Year 9

Appendix D. Important Information about this Document



IMPORTANT INFORMATION ABOUT THIS DOCUMENT

1. Our Client

This report has been produced by or on behalf of RPM Advisory Services Pty Ltd ("RPM") solely for Golden Spur Resources Pty Ltd (the "Client").

2. Client Use

The Client's use and disclosure of this report is subject to the terms and conditions of the engaging Agreement under which RPM prepared the report.

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4. Independence

RPM provides advisory services to the mining and finance sectors. Within its core expertise it provides independent technical reviews, resource evaluation, mining engineering, environmental assessments and mine valuation services to the resources and financial services industries.

RPM have independently assessed the subject of the report (the "Project") by reviewing pertinent data, which may include Resources, Reserves, existing approvals, licences and permits, manpower requirements and the life of mine plans relating to productivity, production, operating costs and capital expenditures. All opinions, findings and conclusions expressed in this report are those of RPM and specialist advisors.

Drafts of this report were provided to the Client, but only for the purpose of confirming the accuracy of factual material and the reasonableness of assumptions relied upon in this report.

RPM has been paid, and has agreed to be paid, professional fees for the preparation of this report. The remuneration for this report is not dependent upon the findings of this report. RPM does not have any economic or beneficial interest (present or contingent), in the Project, in securities of the companies associated with the Project or the Client

5. Inputs, subsequent changes and no duty to update

RPM has created this report using data and information provided by or on behalf of the Client. Unless specifically stated otherwise, RPM has not independently verified that data and information. RPM accepts no liability for the accuracy or completeness of that data and information, even if that data and information has been incorporated into or relied upon in creating this report (or parts of it).

The conclusions and opinions contained in this report apply as at the date of the report. Events (including changes to any of the data and information that RPM used in preparing the report) may have occurred since that date which may impact on those conclusions and opinions and make them unreliable. RPM is under no duty to update the report upon the occurrence of any such event, though it reserves the right to do so.

6. Inherent Mining Risks

Mining is carried out in an environment where not all events are predictable.

Whilst an effective management team can identify the known risks and take measures to manage and mitigate those risks, there is still the possibility for unexpected and unpredictable events to occur. It is not possible therefore to totally remove all risks or state with certainty that an event that may have a material impact on the operation of a mine, will not occur.

The ability of any person to achieve forward-looking production and economic targets is dependent on numerous factors that are beyond RPM's control and that RPM cannot anticipate. These factors include, but are not limited to, site-specific mining and geological conditions, management and personnel capabilities, availability of funding to properly operate and capitalize the operation, variations in cost elements and market conditions, developing and operating the mine in an efficient manner, unforeseen changes in legislation and new industry developments. Any of these factors may substantially alter the performance of any mining operation.

7. Limitations and Exclusions

RPM 's report is based on data, information reports, plans and tabulations, as applicable, provided by Client or on behalf of the Client. The Client has not advised RPM of any material change, or event likely to cause material change, to the operations or forecasts since the date of assets inspections.

The work undertaken for this report is that required for a technical review of the information, coupled with such inspections as RPM considered appropriate to prepare this report.

Unless otherwise stated specifically in writing, the report specifically excludes all aspects of legal issues, commercial and financing matters, land titles and agreements, except such aspects as may directly influence technical, operational or cost issues and where applicable to the JORC Code guidelines.

RPM has specifically excluded making any comments on the competitive position of the relevant assets compared with other similar and competing producers around the world. RPM strongly advises that any potential investors make their own comprehensive assessment of the competitive position of the relevant assets in the market.

8. Indemnification

The Client has indemnified and held harmless RPM and its subcontractors, consultants, agents, officers, directors and employees from and against any and all claims, liabilities, damages, losses and expenses (including lawyers' fees and other costs of litigation, arbitration or mediation) arising out of or in any way related to:

- *RPM 's reliance on any information provided by Client; or*
- *RPM 's services or materials; or*
- *Any use of or reliance on these services or materials by any third party not expressly authorised by RPM,*

save and except in cases of death or personnel injury, property damage, claims by third parties for breach of intellectual property rights, gross negligence, wilful misconduct, fraud, fraudulent misrepresentation or the tort of deceit, or any other matter which be so limited or excluded as a matter of applicable law (including as a Competent Person under the Listing Rules) and regardless of any breach of contract or strict liability by RPM.

– END OF REPORT –

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