Detailed Flora/ Vegetation Survey & Basic Fauna Survey Goldfields Highway and Railway Realignment Prepared For Bardoc Gold Limited

October 2020
FINAL

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Glossary

Acronym	Description
ANCA	Australian Nature Conservation Agency.
BA	Birdlife Australia.
BAM Act	*Biosecurity and Agriculture Management Act 2007*, WA Government.
BC Act	*Biodiversity Conservation Act 2016*, WA Government.
Botanica	Botanica Consulting.
BoM	Bureau of Meteorology.
CAMBA	*China Australia Migratory Bird Agreement 1998.*
DAFWA	Department of Agriculture and Food Western Australia (now known as DPIRD), WA Government.
DAWE	Department of Agriculture, Water and Environment, Australian Government.
DBCA	Department of Biodiversity, Conservation and Attractions, WA Government.
DMIRS	Department of Mines, Industry Regulation and Safety, WA Government
DotEE	Department of the Environment and Energy (now known as DAWE), Australian Government.
DPIRD	Department of Primary Industries and Regional Development, WA Government
DWER	Department of Water and Environmental Regulation, WA Government
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*, Australian Government.
ESA	Environmentally Sensitive Area.
Ha	Hectare (10,000 square meters).
IBRA	Interim Biogeographic Regionalisation for Australia.
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
JAMBA	*Japan Australia Migratory Bird Agreement 1981.*
Km	Kilometer (1,000 meters).
MVG	Major Vegetation Groups.
Norton	Norton Gold Fields Pty Ltd.
NVIS	National Vegetation Information System.
PEC	Priority Ecological Community.
ROKAMBA	*Republic of Korea-Australia Migratory Bird Agreement 2007.*
SRE	Short Range Endemic.
SSC	Species Survival Commission, International.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.

Executive Summary

Botanica Consulting Pty Ltd (Botanica) was commissioned by Bardoc Gold Limited (Bardoc) to undertake a detailed flora/ vegetation survey and basic fauna survey of the Goldfields Highway and Railway realignment (referred to as the 'survey area'). The survey area is located adjacent to the Kalgoorlie North Gold (KNG) Project along the Goldfields Highway approximately 47km north of Kalgoorlie-Boulder, Western Australia. The survey area covers an approximate area of 498 ha, encompassing 50 ha of the proposed highway and railway realignment footprint (referred to as the 'target survey area') and a 500m radius of the target survey area. The surveys were conducted between the 1st and the 9th September 2020.

Six floristic groups were identified within the survey area. These vegetation units were located within two different landform types and comprised of three major vegetation groups, which were represented by a total of 114 Taxa. The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plains and greenstone rocky hillslopes.

Results of the literature review identified 32 mammals (including 11 bat species), 108 birds, 75 reptiles and 5 frog species that have previously been recorded in the general area, some of which have the potential to occur, subject to the identified habitats being suitable.

No Threatened Flora, Migratory Fauna or Threatened Ecological Communities (TEC) as listed under the Western Australian *Biodiversity Conservation (BC) Act 2016* or Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* were identified within the survey area. No evidence of Malleefowl activity (active or inactive mounds, tracks, feathers or bird observations etc.) were observed within the survey area.

No Priority Ecological Communities (PEC) as listed by the Department of Biodiversity, Conservation and Attractions (DBCA) were identified within the survey area. No Priority Flora or Fauna taxa as listed by the DBCA were identified within the survey area.

A review of the EPBC Act threatened fauna list, DBCA's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified a number of specially protected, migratory or priority fauna species as having been previously recorded or as being potentially present in the general vicinity of the survey area. However, no fauna of conservation significance is likely to be significantly impacted on by the proposed development. This conclusion is primarily based on the lack of suitable habitats, the known local extinction of some species, the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on fauna and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

The survey area does not contain any world or national heritage places and does not occur within a Bush Forever site. There are no wetlands of international importance (Ramsar Wetlands), national importance (Australian Nature Conservation Agency (ANCA) Wetlands) or conservation category wetlands within the survey area.

The survey area does not contain any Environmentally Sensitive Areas (ESA) listed under the *Environmental Protection (EP) Act 1986*. The survey is not located within DBCA managed land. The closest proposed and gazetted conservation reserves are the ex. Goongarrie Station UCL (LR3068/801) and Goongarrie National Park, which are located approximately 25km north/ north-east of the survey area.

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 vegetation ranged from ‘good’ to ‘very good’. Two introduced flora have been previously identified within the survey area, neither of which are listed as a Declared Plant under the *Biosecurity and Agriculture Management Act 2007.* No additional introduced flora were identified during the current survey.

1 Introduction

1.1 Project Description

Botanica Consulting Pty Ltd (Botanica) was commissioned by Bardoc Gold Limited (Bardoc) to undertake a detailed flora/ vegetation survey and basic fauna survey of the Goldfields Highway and Railway realignment (referred to as the 'survey area'). The survey area is located adjacent to the Kalgoorlie North Gold (KNG) Project along the Goldfields Highway approximately 47km north of Kalgoorlie-Boulder, Western Australia (Figure 1-1). The survey area covers an approximate area of 498 ha, encompassing 50 ha of the proposed highway and railway realignment footprint (referred to as the 'target survey area') and a 500m radius of the target survey area (Figure 1-2). The surveys were conducted between the 1st and the 9th September 2020.

1.2 Objectives

The flora assessment was conducted in accordance with *Technical Guide - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016). The objectives of the assessment were to:

- Conduct a desktop review of available technical reports, relevant databases and spatial data to identify the potential flora and vegetation that may be present;
- Identify significant flora, vegetation/ecological communities potentially occurring in the area;
- Conduct a detailed flora and vegetation survey and targeted searches for populations of significant flora;
- Undertake floristic community mapping to a scale appropriate for the bioregion and described according to the National Vegetation Information System (NVIS) structure and floristics;
- Undertake vegetation condition mapping;
- Review the local and regional significance of flora and vegetation within the survey area;
- Assess the survey area's plant species diversity, density, composition, structure and weed cover, using NVIS classification system for vegetation description; and
- Assess Matters of National Environmental Significance (MNES) and indicate whether potential impacts on MNES as protected under the EPBC Act are likely to require referral to the Commonwealth Department of Agriculture, Water and the Environment (DAWE).

The fauna assessment was conducted in accordance with the requirements of a basic terrestrial fauna survey as defined in *Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment – June 2020* (EPA, 2020). The objectives of the assessment were to:

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

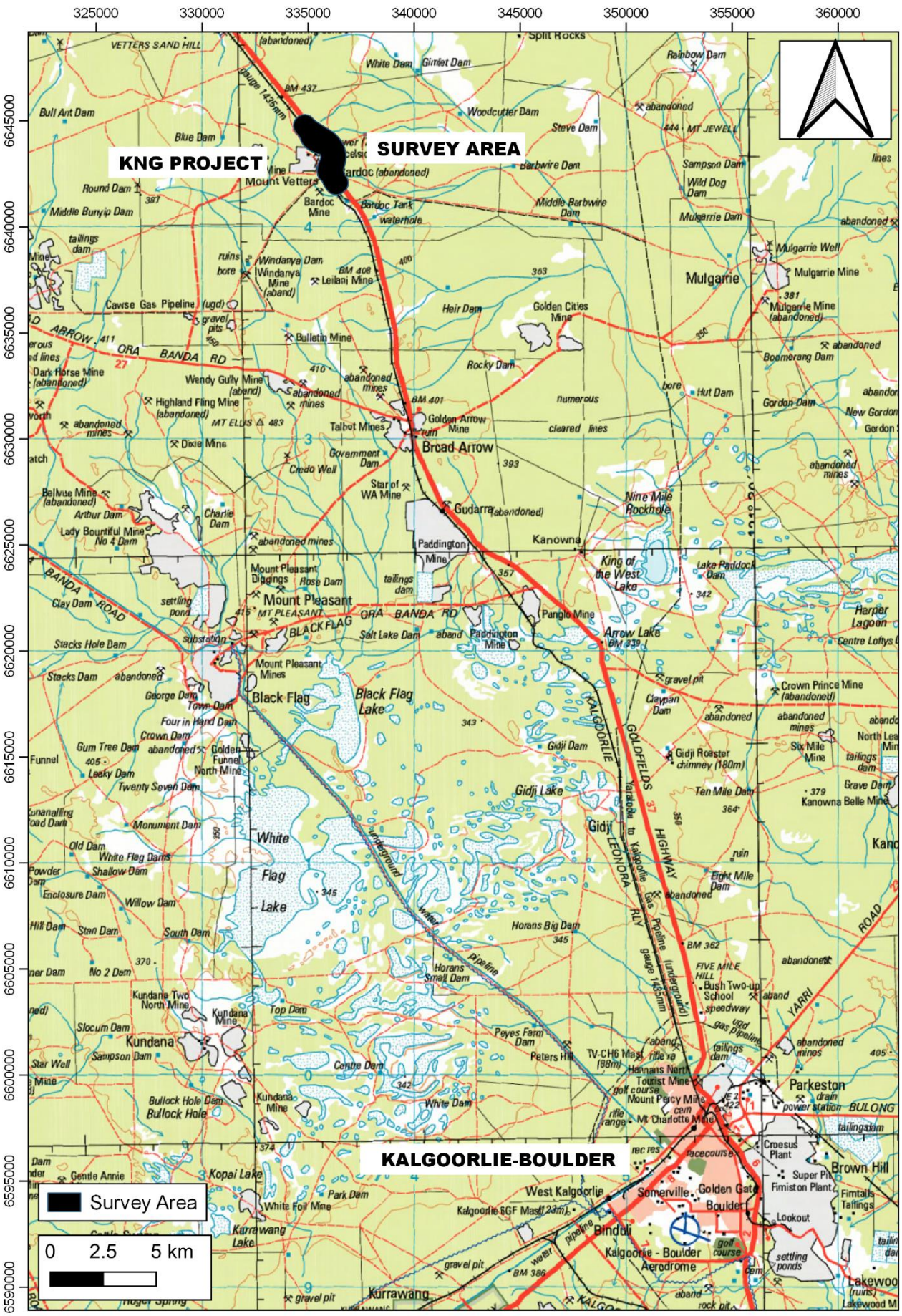


Figure 1-1: Regional map of the survey area

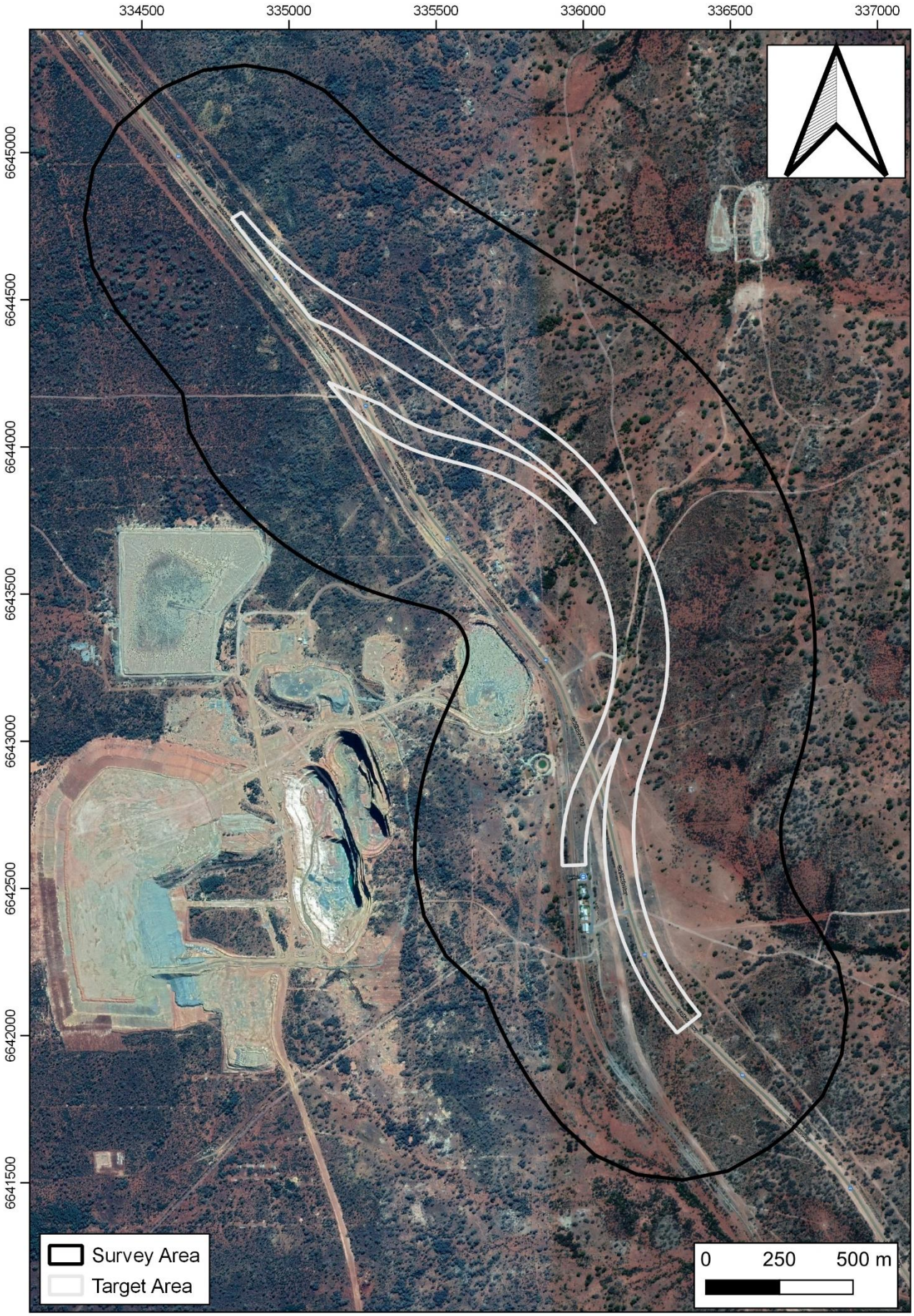


Figure 1-2: Survey Area

2 Regional Biophysical Environment

2.1 Regional Environment

The survey area is located near the boundary of the Coolgardie Bioregion of the South-West Interzone and the Murchison Bioregion of the Eremaean Province. The Coolgardie and Murchison Bioregions are further divided into subregions, based on the Interim Biogeographic Regionalisation of Australia (IBRA), with the survey area located within the Eastern Murchison (MUR1) subregion and approximately 12km north of the Eastern Goldfields (COO3) subregion as shown in Figure 2-1.

The Coolgardie Bioregion is within the Yilgarn Craton. Its granite basement includes Archaean Greenstone intrusions in parallel belts. Drainage is occluded. The climate is arid to semi-arid warm Mediterranean with 250-300mm of mainly winter rainfall (McKenzie, May & McKenna, 2002). Diverse woodlands, rich in endemic eucalypts, occur on low greenstone hills, on alluvial soils on the valley floors, around the saline playas of the region's occluded drainage system, and on broad plains of calcareous earths (McKenzie, May & McKenna, 2002).

The Eastern Goldfields subregion comprises gently undulating plains interrupted in the west by low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying strata are eroded flat and covered with Tertiary sand and gravel soils, scattered exposures of bedrock, and plains of calcareous earths (Cowan, 2001a).

The landscape of the Murchison Bioregion comprises low hills, mesas of duricrust separated by flat colluvium and alluvial plains (Commonwealth Government, 2008). It is dominated by the Archaean (over 2500 million years ago) granite greenstone terrain of the Yilgarn Craton (Commonwealth Government, 2008). Alluvial soils and sands mantle the granitic and greenstone units of the Yilgarn Craton. These soils are shallow, sandy and infertile. Underlying the soils in low areas is a red-brown siliceous hard pan (Curry et al. 1994). The soils in the eastern half of the bioregion are typically red sands, calcareous red earth soil, duplex soil and clays. There are 41 vegetation associations (hummock grasslands, succulent steppe or low woodlands) that have at least 85 per cent of their total area in the bioregion. The bioregion is rich and diverse in both its flora and fauna but most species are wide ranging and usually occur in adjoining regions (McKenzie, May and McKenna, 2002).

The Eastern Murchison subregion comprises the northern parts of the craton's Southern Cross and Eastern Goldfields Terrains and is characterised by 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 breakaways complexes as well as red sandplains are widespread. Vegetation is dominated by Mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and Samphire shrublands (McKenzie *et. al.,* 2002). The Eastern Murchison subregion comprises diverse Mulga woodlands, which occur on low greenstone belts.

Figure 2-1: Map of Interim Biogeographic Regionalisation of Australia (IBRA)

2.2 Soils and Landscape Systems

The survey area lies within the Kalgoorlie Province of Western Australia. The Kalgoorlie Province is located on the central eastern portion of the Yilgarn Craton, mostly overlying Archaean rocks of the Southern Cross Domain and the Eastern Goldfields Superterrane. To the north-west is the Murchison Domain. The basement rocks are a mix of granite, gneiss and greenstone. Even-grained porphyritic granitic rocks (intruded by quartz veins and dolerite dykes) are most common across the north as well as in the western half and the north-east. The largest areas of migmatite and gneiss are found in the south-west (Tille, 2006).

The Kalgoorlie Province is further divided into soil-landscape zones, with the survey area located within the Kambalda Zone (265). This zone is characterised by flat to undulating plains (with hills, ranges and some salt lakes and stony plains) on greenstone and granitic rocks of the Yilgarn Craton. Soils include calcareous loamy earths and red loamy earths with salt lake soils and some red-brown hardpan shallow loams and red sandy duplexes. Vegetation includes red mallee blackbutt- salmon gum-gimlet woodlands with mulga and halophytic shrublands (and some spinifex grasslands). This zone is located in the south-eastern Goldfields between Menzies, Norseman and the Fraser Range (Tille, 2006). The Kambalda Zone is further divided into soil landscape systems, with the survey area located within the soil landscape systems described in
Table 2-1 and shown in Figure 2-2 below.

Table 2-1: Soil Landscape Systems within the survey area

Soil Landscape System	Description
Bevon System	Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.
Campsite System	Alluvial plains supporting eucalypt woodlands with halophytic understoreys and acacia shrublands.
Gundockerta System	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.
Illaara System	Plains with ironstone gravel or calcrete mantles supporting eucalypt woodlands and mulga-casuarina shrublands.
Lawrence System	Low greenstone hills with ironstone ridges supporting pearl bluebush shrublands and eucalypt woodlands with halophytic undershrubs.
Moriarty System	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.

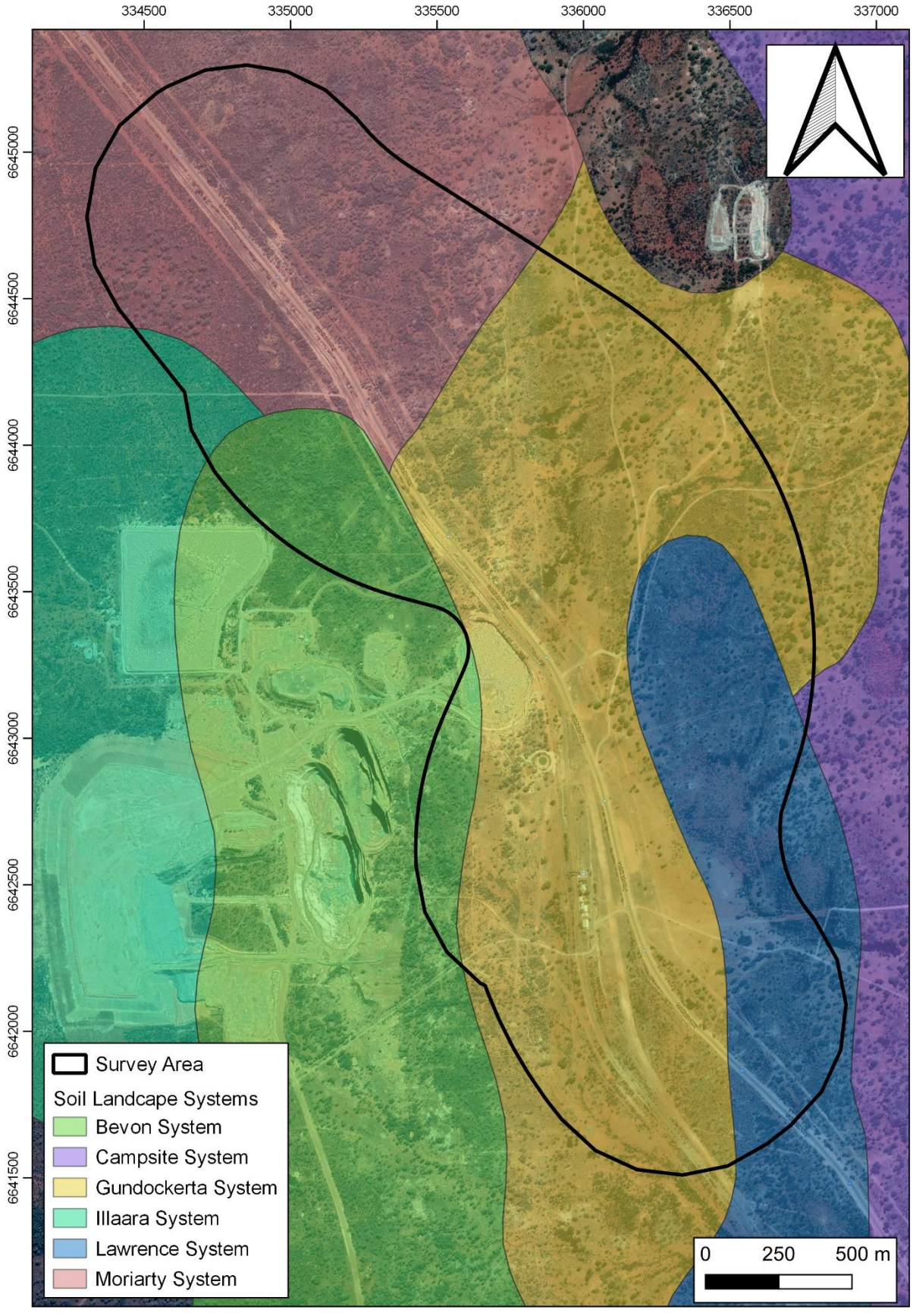


Figure 2-2: Map of Soil Landscape Systems within the survey area

2.3 Remnant Vegetation

The Department of Primary Industries and Regional Development GIS file (DPIRD, 2018) indicates that the survey area is located within the Barlee 2903 vegetation association (Figure 2-3). The remaining extent of this vegetation association as reported in the *2018 Statewide Vegetation Statistics* (DBCA, 2019) is provided in Table 2-2.

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered "endangered" (EPA, 2000). Vegetation within the survey area retains >96% of its pre-European extent within Western Australia.

Table 2-2: Remaining Beard Vegetation Associations within the survey area (DBCA, 2019)

Region	Pre-European Extent (Ha)	Current Extent (Ha)	Pre-European extent remaining (%)	% of Current extent within DBCA managed lands
Barlee 2903: Medium woodland; Salmon gum, goldfield blackbutt, gimlet & *Casuarina pauper*				
Eastern Goldfields	14	14	100.0	0
Eastern Murchison	28,295	27,317	96.5	0
Western Australia	28.309	27,331	96.5	0

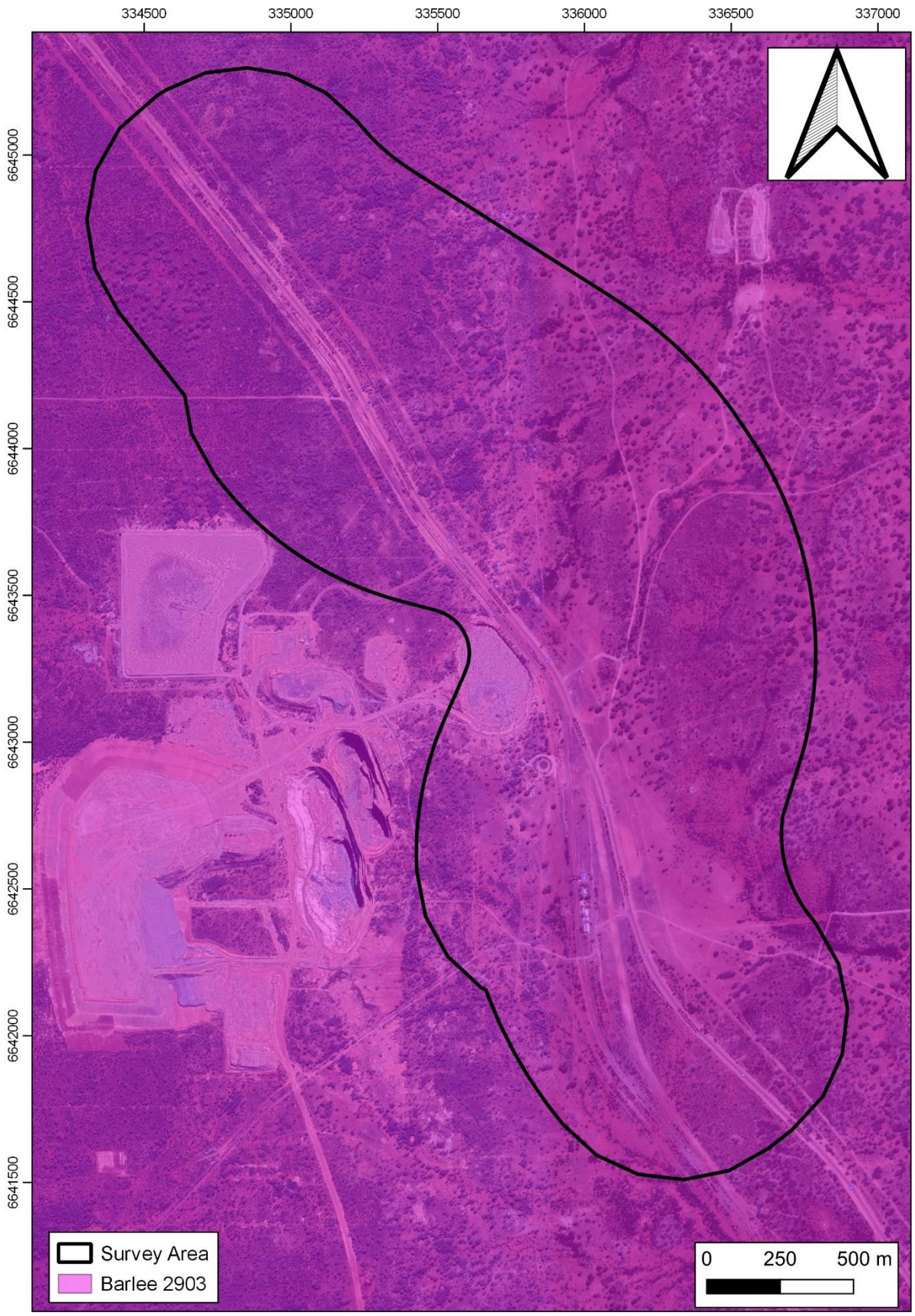
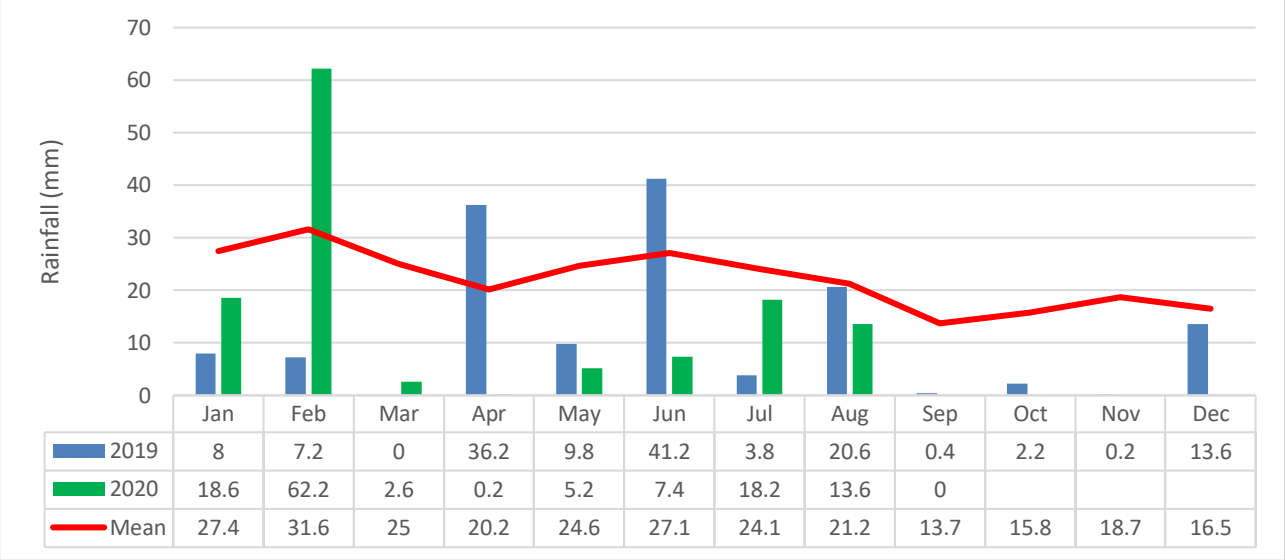


Figure 2-3: Pre-European Vegetation Associations within the survey area

2.4 Climate

The climate of the Eastern Goldfields subregion is characterised as an arid to semi-arid climate with annual rainfall of approximately 200-300 mm (Beard, 1990; Cowan, 2001a). The climate of the Eastern Murchison subregion is characterised as an arid climate (Beard, 1990; Cowan, 2001b). Rainfall data for the Kalgoorlie airport weather station (#12038) located approximately 47km south of the survey area is shown in Figure 2-4 (BoM, 2020a). Mean monthly rainfall ranges from 31.2 mm in February to 13.7 mm in September, whilst the mean annual rainfall is 266.1 mm. Rainfall has been below average since February 2020.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	8	7.2	0	36.2	9.8	41.2	3.8	20.6	0.4	2.2	0.2	13.6
2020	18.6	62.2	2.6	0.2	5.2	7.4	18.2	13.6	0			
Mean	27.4	31.6	25	20.2	24.6	27.1	24.1	21.2	13.7	15.8	18.7	16.5

Figure 2-4: Monthly rainfall for the Kalgoorlie airport weather station #12038 (BoM, 2020a)

2.5 Hydrology

According to the Geoscience Australia database (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however one minor ephemeral drainage line intersects the survey area (Figure 2-5).

Groundwater Dependent Ecosystems (GDE) includes biological assemblages of species such as wetlands or woodlands that use groundwater either opportunistically or as their primary water source. For the purposes of this report, a GDE is defined as any vegetation community that derives part of its water budget from groundwater and must be assumed to have some degree of groundwater dependency. According to the BoM *Atlas of Groundwater Dependent Ecosystems* (BoM, 2020b) database, there are four potential terrestrial GDEs which intersect the survey area, described below in Table 2-3 and spatially in Figure 2-5. Given the proposed developments subject to this survey relates to realignment of the Goldfields Highway and Railway, no impacts to groundwater dependent vegetation are anticipated.

Table 2-3: Potential Terrestrial Groundwater Dependent Ecosystems (BoM, 2020b)

GDE Description	Potential GDE (according to BoM, 2020b)
Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.	Low potential GDE
Low greenstone hills with ironstone ridges supporting pearl bluebush shrublands with mixed eucalypt overstories. In the south west.	Low potential GDE
Plains with ironstone gravel or calcrete mantles supporting eucalypt woodlands and mulga-casuarina shrublands.	Low potential GDE
Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.	High potential GDE

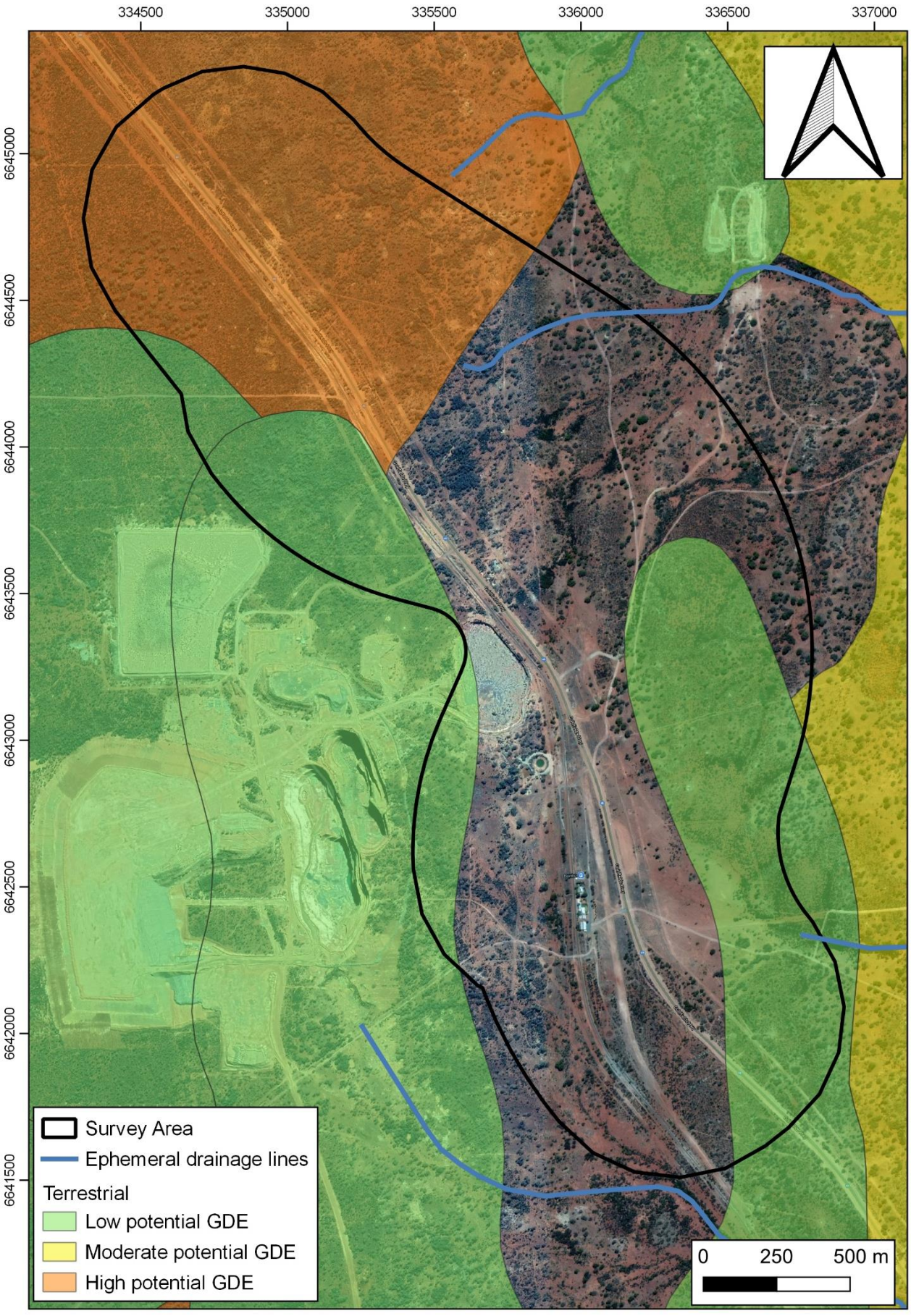


Figure 2-5: Hydrology of the survey area

2.6 Land Use

The dominant land uses of the Eastern Goldfields subregion include Unallocated Crown Land and Crown Reserves, grazing-native pastures-leasehold, freehold, conservation and mining leases (Cowan, 2001). The dominant land uses of the Eastern Murchison subregion include grazing native pastures (85.5%), unallocated crown reserves (11.3%), conservation (1.4%) and mining (1.8%) (Cowan, 2001). The survey area is located within the Mt Vetters Station Pastoral Lease.

3 Survey Methodology

3.1 Desktop Assessment

3.1.1 Literature Review

Prior to the field assessment a literature review was undertaken of previous flora and fauna assessments conducted within the local region. Documents reviewed included:

- Alexander Holm & Associates (2012). Environmental Assessment: Kalgoorlie North Gold Project.
- Alexander Holm & Associates (2020a). Environmental Assessment: Goldfields Road and Rail Diversion.
- Alexander Holm & Associates (2020b). Environmental Assessment: Aphrodite to Bardoc Haul Road.
- Alexander Holm & Associates (2020c). Environmental Assessment: Kalgoorlie North Gold Project.
- Bamford Consulting Ecologists (2012). Fauna Assessment of the Excelsior Gold Bardoc Project.
- Botanica Consulting (2011). Lignum Dam Tenement E24/146 Level 1 Flora and Vegetation Survey.
- Botanica Consulting (2012). Mt Jewel Haul road Level 2 Flora and Vegetation Survey.
- Botanica Consulting (2016). Level 1 Flora & Vegetation Survey of the Carbine Mining Area.
- Botanica Consulting (2020a), Reconnaissance Flora/ Vegetation & Fauna Survey Mulgarrie Project
- Botanica Consulting (2020b), Reconnaissance Flora & Fauna Survey Ora Banda Region.
- McKenzie, N.L. and Hall, N.J. (1992). The Biological Survey of the Eastern Goldfields of WA - Pt 8: Kurnalpi – Kalgoorlie study area. Records of the WAM, Supplement 41: 1 – 125.
- Woodman Environmental (2017). Aphrodite Gold Deposit Level 2 Flora and Vegetation Assessment.

3.1.2 Database Searches

Searches of the following databases were undertaken to aid in the compilation of a list of flora taxa within the survey area:

- DBCA Priority/ Threatened Flora Database Search (DBCA, 2019a)
- DBCA Priority/ Threatened Ecological Communities Database Search (DBCA, 2019b)
- DBCA NatureMap Database (DBCA, 2020a)
- DAWE Protected Matters search tool (DAWE, 2020a).

The DBCA Priority/ Threatened Flora Database Search and Priority/ Threatened Ecological Communities Database Search were conducted within a 50km radius of the survey area (DBCA, 2019a; DBCA, 2019b).

The NatureMap and Protected Matters Search were conducted for an area encompassing a 40km radius of the centre coordinates -30.2414S 121.2219E. It should be noted that these lists are based on observations from a broader area than the assessment area (40km radius) and therefore may include taxa not present. The databases also often include very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

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

- *Environment Protection and Biodiversity and Conservation* (EPBC) *Act 1999*. Administered by the Australian Government (DAWE);
- *Biodiversity Conservation* (BC) *Act 2016*. Administered by the WA Government (DBCA);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- Priority Flora/ Fauna list. A non-legislative list maintained by DBCA for management purposes (fauna list released January 2019; flora list released December 2018).

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

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

Most but not all migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as Matters of National Environmental Significance (MNES) under the EPBC Act. Descriptions of conservation significant species and communities are provided in Appendix 1.

[1] Most but not all species listed under JAMBA are also specially protected under Specially Protected Species of the BC Act.

3.2 Flora Field Assessment

Botanica conducted a detailed flora/ vegetation survey of the 498 ha survey area and targeted flora survey of the proposed highway and railway realignment footprint (approximately 50 ha) between the 1st and 9th September 2020.

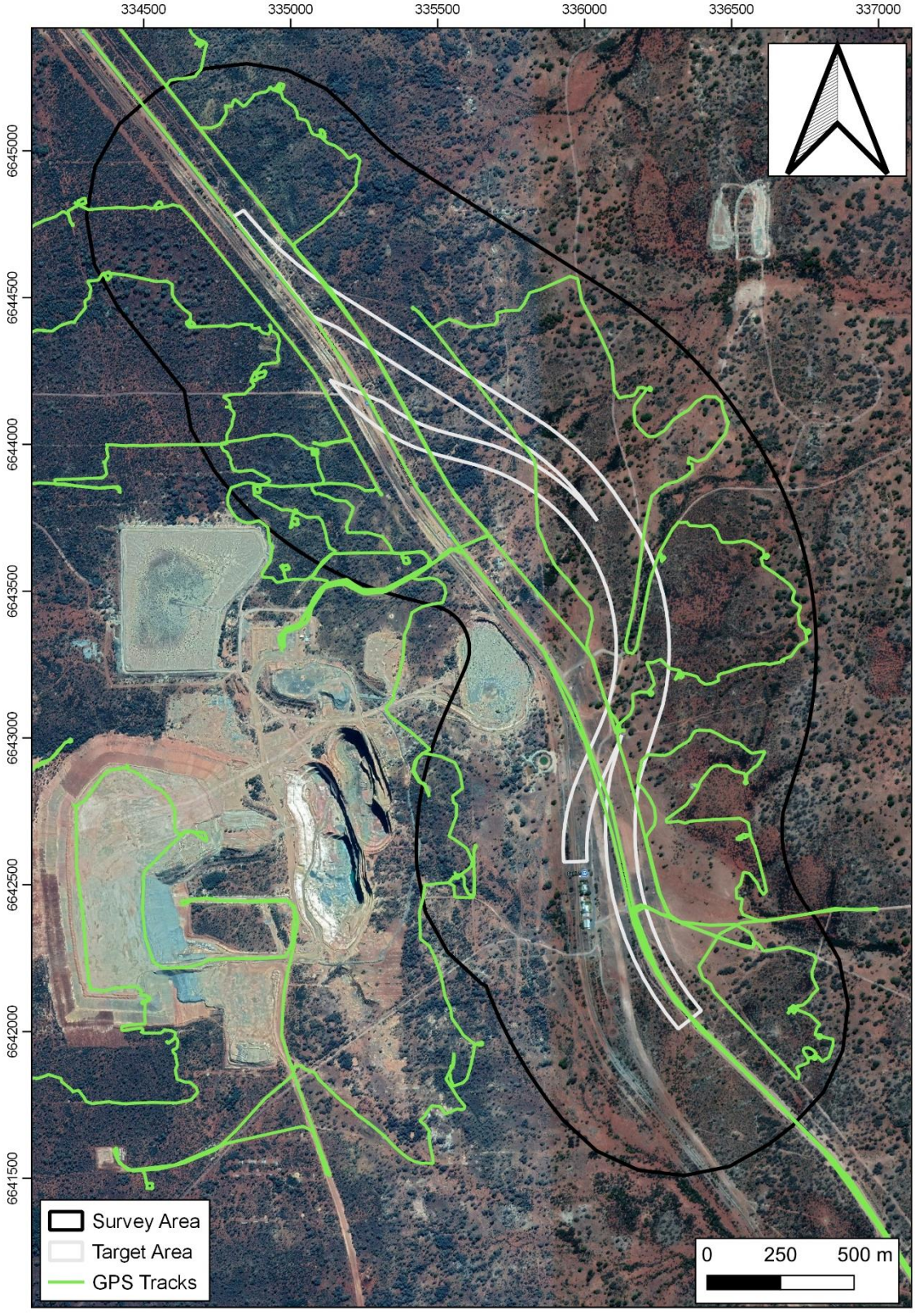


Figure 3-1: Survey area boundary and GPS tracks traversed throughout the survey area

3.2.1 Vegetation Mapping

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

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum (including height and percentage cover of dominant taxa);
- All vascular taxa (including annual taxa);
- Landform classification;
- Vegetation condition rating;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of significance if encountered.

Vegetation was mapped in accordance with existing vegetation mapping conducted by Alexander Hold & Associates (2020a), with vegetation types classified by floristic group in accordance with NVIS classifications.

3.2.2 Flora Identification

Unknown specimens collected during the survey were identified by Jim Williams with the aid of samples housed at the Botanica Herbarium and WA Herbarium.

3.2.3 Sampling Quadrats

A total of 66 quadrats (20m X 20m) were established within both the survey area and local area. A map of all quadrats included in the statistical analysis (including 23 quadrats located within the boundary of the survey area and 43 quadrats located outside of the survey area) is provided in Figure 3-1.

The quadrats were established by inserting metal pickets in each corner, and measuring the length of the resultant boundaries to verify the quadrats were 20 m x 20 m (square quadrats). Following their establishment and boundary verification, the location of each quadrat was recorded by GPS (Appendix 4) and photographed from the north-west corner of the quadrat (Appendix 7). All vascular plants within the quadrat were recorded (Appendix 6).

This included recording of dominant taxa from the upper, middle and lower stratum, and sampling of all unknown taxa. Unknown taxa were identified using Botanica's own reference herbarium and relevant taxonomical keys. Data on level of disturbance, presence of coarse fragments on surface, topographical position, elevation, aspect, percentage litter, percentage bare ground, percentage surface rock (bedrock and surface deposits), soil types (colour, profile, field texture and surface type), and vegetation structure were collected from each quadrat (Appendix 6). Methods of recording data from these quadrats largely follow those outlined in CSIRO's *Australian Soil and Land Survey Field Handbook* (McDonald *et al.* 1998) and in accordance with current EPA Guidelines (2016).

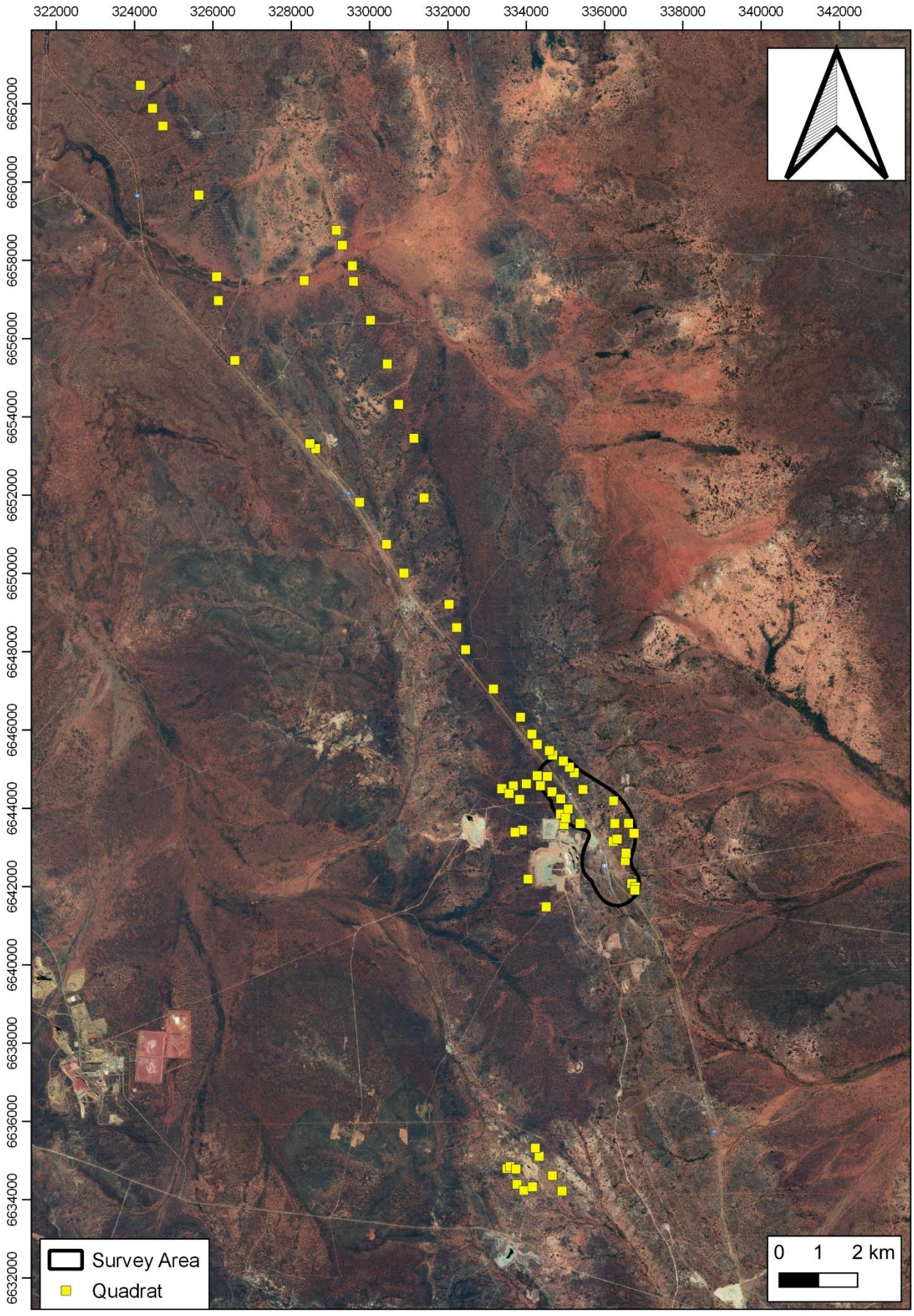


Figure 3-2: Location of quadrats in relation to the survey area

3.2.4 Targeted Searches

A targeted search for significant flora was conducted within the proposed highway and railway realignment footprint covering an area of approximately 50 ha. Suitable habitats were systematically searched by Botanica staff members to identify and record the locations of Threatened and Priority Flora. Any locations of Threatened and Priority Flora were recorded using a hand-held GPS and a simple plant count (not differentiated between juvenile/mature plants, flowering or non-flowering plants) was conducted.

3.3 Data Analysis Tools

At the completion of the survey effort, the data obtained was analysed to generate a vegetation map (Figure 4-1) and complete list of flora species (Appendix 3). The statistical program PATN was used to assess species composition of the quadrats (Appendix 8).

3.3.1 PATN Analysis

The PATN software package was used to assess the similarities/ dissimilarities between quadrats based on presence/ absence of species.

Annual taxa were removed from the data prior to analysis (total of 4 annual taxa). Species reconciliation eliminated those sterile taxa that could not be fully identified from the analysis (4 taxa), and reconciled subsp. and/or variant taxa (2 taxa). Singleton taxa were included in the analysis. 100 perennial taxa were included in the final analysis.

The analysis produced a quantitative estimate of the relationship between species composition of each quadrat. The classifications were based upon a Bray-Curtis association matrix using a flexible Unweighted Pair Group Arithmetic Mean (UPGMA) method (with a beta value of -0.1) which standardises the data enabling the analysis to be completed. Semi-strong hybrid (SSH) ordination of the quadrat is then undertaken to show spatial relationships between groups and to elucidate possible environmental correlates with the classification.

The analysis also produced a stress value which is a measure of the 'strength' of the analysis (i.e. how well the quadrats are grouped together into the appropriate floristic groups). The lower the stress value the greater the strength of the analysis with a value of less than 0.3 showing that the analysis appropriately grouped quadrats. A stress value greater than 0.3 suggests that the analysis was unable to group quadrats appropriately due to extraneous variables (i.e. other factors influencing differences in floristic groups other than species composition e.g. fire, clearing disturbance etc.).

3.3.2 EstimateS

EstimateS software was used to estimate species richness present using the Chao2 richness estimator. For any number of samples, the estimator uses the existing pattern of species accumulation to estimate the true number of species at a site. The estimators tend to under-estimate species number when sample size is small, hence the estimated number of true species can be seen to increase with sample size. This software was also used to compute Coleman rarefaction curves estimates which were used to calculate species accumulation curves.

3.4 Fauna Field Assessment

Vegetation and landform units identified during the flora assessment have been used to define broad fauna habitat types across the site. This information has been supplemented with observations made during the fauna assessment.

The main aim of the fauna habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that maybe impacted on as a consequence of development at the site. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the desktop literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey, the habitats within the study area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

Opportunistic observations of fauna species were made during all field survey work which involved a series of transects across the study area during the day including observations of bird species with binoculars. Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

3.4.1 Targeted Fauna Survey

Suitable Malleefowl habitat within the proposed highway and railway realignment footprint (approximately 50 ha) was systematically searched on foot and by ATV by two Botanica staff members to identify and record the locations of any Malleefowl activity (i.e. mounds, footprints and feathers). Any locations/ observations of Malleefowl activity were recorded using a hand-held GPS. Locations of existing Malleefowl mounds in the local area were also visited and motion sensor cameras were installed to assess any Malleefowl activity at existing mounds in the local area.

3.5 Personnel involved

Jim Williams	- Environmental Consultant/ Director (Diploma of Horticulture)
Greg Harewood	- Zoologist (BSc Zoology)
Lauren Pick	- Senior Environmental Consultant (BSc Zoology & Conservation Biology)
April Slater	- Graduate Environmental Consultant (BSc Conservation)

3.5.1 Scientific licences

Table 3-1: Scientific Licences of Botanica Staff coordinating the survey

Licensed staff	Permit Number	Valid
Jim Williams	FB62000108 (Licence to flora for scientific purposes)	27/05/2019 - 27/05/2022

3.6 Survey limitations and constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 3-2.

The conclusions presented in this report are based upon field data and environmental assessments and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. Also, it should be recognised that site conditions can change with time. Information not available at the time of this assessment which may subsequently become available may alter the conclusions presented.

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

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

Table 3-2: Limitations and constraints associated with the survey

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD and on foot. Numerous tracks were located within the survey area, providing ease of access.
Competency/ Experience	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Botanist/ Zoologist:** Jim Williams **Data Interpretation:** Jim Williams, Greg Harewood and Lauren Pick
Timing of survey, weather & season	Minor constraint	Fieldwork was not undertaken within EPA's recommended primary survey time period for the Eremaean Province (i.e., 6-8 weeks following winter rainfall) but was conducted during the EPA recommended timing for the South-West Interzone (i.e. September to November) and during optimal flowering period for Eucalypt Woodland vegetation. Rainfall for the Kalgoorlie-Boulder region has been below average since February 2020.
Area disturbance	Not a constraint	The area has been disturbed from pastoral land use, exploration, mining, road and rail development; however, vegetation was mostly intact and comprised of native vegetation.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/ significance of the area with a detailed flora/ vegetation survey and basic fauna survey completed to identify vegetation types/fauna habitats and conservation significant species/communities over the survey area.
Availability of contextual information at a regional and local scale	Not a constraint	Threatened flora database searches provided by the DBCA were used to identify any potential locations of Threatened/Priority taxa. BoM, DWER, DPIRD, DBCA and DAWE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Botanica was able to obtain information about the area from previous flora/fauna assessments conducted within the region which provided context on the local environment.
Completeness	Minor constraint	In the opinion of Botanica, the survey area was covered sufficiently in order to identify vegetation assemblages and fauna habitats. Limited annual species were present during the survey and many of the plants were not in flower; However, previous species identification from previous surveys conducted supplemented the current assessment. It is estimated that approximately 90% of the flora within the survey area were able to be fully identified. The vegetation types for this study were based on visual descriptions of locations in the field. Vegetation types identified were categorised via comparison to vegetation distributions throughout WA specified in the NVIS Major Vegetation Groups (DotEE, 2017b).

4 Results

4.1 Desktop Assessment

4.1.1 Flora and Vegetation

According to the results of the NatureMap search (DBCA, 2020a), a total of 597 flora taxa have been recorded within a 40 km radius of the survey area. Dominant genera include *Acacia, Eremophila* and *Eucalyptus.*

Results of database searches/ literature review identified twenty-one introduced taxa as potentially occurring within a 40 km radius of the survey area (Table 4-1). According to the Department of Primary Industries and Regional Development Western Australian Organism List (DPIRD, 2020) two taxa are listed as a Declared Pest under the *Biosecurity and Agriculture Management* (BAM) *Act 2007.* One taxon is listed as a Weed of National Significance (WoNS) by the DAWE (DAWE, 2020b).

Table 4-1: Introduced flora potentially occurring within the survey area

Introduced Taxon	Common Name	WAOL Status	WoNS
Agave americana	Century Plant	Permitted - s11	
Carrichtera annua	Wards Weed	Permitted - s11	
Carthamus lanatus	Saffron Thistle	Permitted - s11	
Cenchrus ciliaris	Buffel Grass	Permitted - s11	
Conyza bonariensis	Flaxleaf Fleabane	Permitted - s11	
Cucumis myriocarpus	Prickly Paddy Melon	Permitted - s11	
Dittrichia graveolens	Stinkwort	Permitted - s11	
Echium plantagineum	Paterson's Curse	Declared Pest - s22(2)	
Erodium aureum		Permitted - s11	
Erodium cicutarium	Common Storksbill	Permitted - s11	
Hypochaeris glabra	Smooth Catsear	Permitted - s11	
Malva parviflora	Marshmallow	Permitted - s11	
Oligocarpus calendulaceus		Permitted - s11	
Opuntia elata	Prickly Pear	Declared Pest - s22(2)	Yes
Ricinus communis	Castor Oil Plant	Permitted - s11	
Rostraria pumila		Permitted - s11	
Rumex hypogaeus		Permitted - s11	
Salvia verbenaca	Wild Sage	Permitted - s11	
Schismus arabicus	Araby Grass	Permitted - s11	
Solanum nigrum	Black Berry Nightshade	Permitted - s11	
Sonchus oleraceus	Common Sowthistle	Permitted - s11	

The results of the literature review, combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2019a), NatureMap search (DBCA, 2020a) and DAWE protected matters search (DAWE, 2020a) recorded no Threatened Flora or Priority Flora species within the survey area. Three Threatened flora and twenty-four Priority Flora were listed in the databases/ literature review as occurring within a 50 km radius of the survey area (map of flora locations provided in Appendix 2). These taxa were assessed and ranked for their likelihood of occurrence[2] within the survey area (Table 4-2). The rankings and criteria used were:

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

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

- Known to Occur: The species in question was positively identified as being present during current or previous field surveys.

[2] Based on habitat descriptions provided by the WA Herbarium (Florabase) and habitat descriptions provided in previous records listed on the DBCA Threatened Flora Database (DBCA, 2019a)

Table 4-2: Threatened and Priority Flora within 50km of the survey area

Taxon	EPBC Act	BC Act	Priority Rating	Habitat Description-Florabase (WAHERB, 2020)	Habitat Description-DBCA Record (DBCA, 2019a)	Likelihood of Occurrence
Acacia epedunculata	-	-	P1	Yellow sand. Sandplains	No description available	Unlikely
Acacia eremophila var. *variabilis*	-	-	P3	Sandy or sandy loam.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
Alyxia tetanifolia	-	-	P3	Sandy clay, loam, concretionary gravel. Drainage lines, near lakes.	Brown sandy clay, between lake edge and gum belt.	Unlikely
Angianthus prostratus	-	-	P3	Red clay or loamy soils. Saline depressions.	Red loamy soil.	Unlikely
Calandrinia quartzitica	-	-	P1	No description available.	Lower slopes of hummocky quartz strewn hills and adjoining flats on lake edge. Scattered quartz stones-rocks. Brown silty-sandy clay	Unlikely
Chrysocephalum apiculatum subsp. *norsemanense*	-	-	P3	No description available.	N/A. No records on DBCA database search within 50km of survey area.	Not determined. No habitat description available
Conostylis lepidospermoides	EN	VU	-	Grey or yellow-brown sand over laterite.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely[3]
Elatine macrocalyx	-	-	P3	Shallow sands over clay. Margins of playa lakes and clay pans.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
Eleocharis papillosa	VU	-	P3	Red clay over granite, open clay flats. Claypans.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
Eremophila praecox	-	-	P1	Red/brown sandy loam. Undulating plains.	Low plain. Moist red/brown loam.	Possible
Eucalyptus educta	-	-	P2	Shallow soils. Granite rocks.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely

[3] Potential incorrect listing. Listed on NatureMap database but only known to occur within Mallee and Esperance IBRA bioregions (within Frank Hann National Park)

Taxon	EPBC Act	BC Act	Priority Rating	Habitat Description-Florabase (WAHERB, 2020)	Habitat Description-DBCA Record (DBCA, 2019a)	Likelihood of Occurrence
Eucalyptus jutsonii subsp. *jutsonii*	-	-	P4	Red to pale orange deep sands. Undulating areas and on dunes.	Red sandy soil.	Unlikely
Eutaxia rubricarina	-	-	P3	Gravelly sand, grey to pinkish-white sandy clay, red loam. Flats, slopes, valley floors, road verges.	N/A. No records on DBCA database search within 50km of survey area.	Possible
Homalocalyx grandiflorus	-	-	P3	Yellow sand. Sandplains.	Orange sand dune.	Unlikely
Hysterobaeckea ochropetala subsp. cometes	-	-	P3	No description available.	N/A. No records on DBCA database search within 50km of survey area.	Not determined. No habitat description available
Newcastelia insignis	-	-	P2	Red or yellow sandy soils.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
Notisia intonsa	-	-	P3	No description available.	Lake shore, moist red sand.	Unlikely
Persoonia leucopogon	-	-	P1	Yellow sand or sandy clay.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
Philotheca coateana	-	-	P3	Red sand.	Breakaway.	Unlikely
Ptilotus chortophytus	-	-	P1	No description available.	Small quartz outcrop which is surrounded by a salt claypan.	Unlikely
Ptilotus rigidus	-	-	P1	No description available.	No description available	Not determined. No habitat description available
Rhodanthe uniflora	-	-	P1	Brown earth. Open eucalyptus woodland.	No description available	Possible
Ricinocarpos brevis	EN	EN	-	Rocky hillslopes, rock outcrops.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely[4]
Ricinocarpos digynus	-	-	P1	No description available.	Rocky hillslope. Rocky surface. Red-brown sand-loam over felsic and mafic volcanics.	Possible

[4] Currently only known from Diemals, Perrinnvale and Windarling Range

Taxon	EPBC Act	BC Act	Priority Rating	Habitat Description-Florabase (WAHERB, 2020)	Habitat Description-DBCA Record (DBCA, 2019a)	Likelihood of Occurrence
Sowerbaea multicaulis	-	-	P4	Yellow-brown sand.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
Thryptomene eremaea	-	-	P2	Red or yellow sand. Sandplains.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely

4.1.2 Fauna

According to the results of the NatureMap search (DBCA, 2020a) a total of 225 vertebrate fauna taxa have been recorded within a 40 km radius of the survey area including 4 amphibians, 122 bird species, 26 mammals and 73 reptiles. Combined results of database searches (DBCA, 2020a and DAWE, 2020a) identified thirteen introduced taxa as potentially occurring within a 40 km radius of the survey area (Table 4-3).

Table 4-3: Introduced fauna potentially occurring within the survey area

Introduced Taxon	Common Name
Camelus dromedarius	Camel
Canis lupus familiaris	Dog
Capra hircus	Goat
Colubia livia	Rock Pigeon
Equus asinus	Donkey
Equus caballus	Horse
Felis catus	Cat
Hemidactylus frenatus	Asian House Gecko
Mus musculus	House Mouse
Oryctolagus cuniculus	Rabbit
Streptopelia chinensis	Spotted Turtle-Dove
Streptopelia senegalensis	Laughing Turtle-Dove
Vulpes vulpes	Red Fox

The results of the literature review, NatureMap search (DBCA, 2020a) and DAWE protected matters search (DAWE, 2020a) recorded six Threatened fauna, one other specially protected fauna, four Priority Flora and various migratory birds as occurring within a 50 km radius of the survey area. These taxa were assessed and ranked for their likelihood of occurrence within the survey area. The rankings and criteria used were:

- Would Not Occur: There is no suitable habitat for the species in the survey area and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
    - Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20km of the survey area. Populations do however persist outside of this area.
    - Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the Goldfields region. Populations do however persist outside of this area.
- Unlikely to Occur: The survey area is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the site itself would not support a population or part population of the species.
- Possibly Occurs: Survey area is within the known distribution of the species in question and habitat of at least marginal quality was identified as likely to be present during the field survey and literature review, supported in some cases by recent records being documented in literature from within or near the survey area. In some cases, while a species may be classified as

possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

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

Table 4-4: Threatened and Priority Fauna within 50km of the survey area

Species	Conservation Status			Habitat Description	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA Priority		
Malleefowl *Leipoa ocellata*	VU	VU	-	Scrublands and woodlands dominated by mallee and wattle species ((DAWE, 2020c).	Possibly occurs however habitat appears very marginal/or unsuitable for breeding supported by lack of observations during survey and no previous mounds recorded. Occasional transients only.
Migratory Shorebirds (Various species)	MI	IA	-	Migratory shorebirds generally prefer muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland ((DAWE, 2020c).	Would not occur. No suitable habitat.
Peregrine Falcon *Falco peregrinus*	-	OS	-	Diverse from rainforest to arid shrublands, from coastal heath to alpine Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Birdlife Australia, 2020).	Possibly occurs however generally uncommon. Area may represent part of a larger home range used by individuals of this species.
Grey Falcon *Falco hypoleucos*	VU		-	The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter ((DAWE, 2020c).	Unlikely to occur. Outside of current documented distribution.
Grey Wagtail *Motacilla cinerea*	MI	IA	-	Running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields (Morecombe 2004).	Would not occur. Never recorded in goldfields region.
Hooded Plover *Thinornis rubricollis*	-	-	P4	Densities are lowest on narrow, steep beaches, where there are few or no dunes, and where human activities are most intensive. In the south-west, they also occur on inland salt lakes (Birdlife Australia, 2020).	Would not occur. No suitable habitat.
Blue Billed Duck *Oxyura australis*	-	-	P4	Well vegetated freshwater swamps, large dams and lakes, winters on more open water. Occasionally salt lakes and estuaries freshened by floodwaters.	Would not occur. No suitable habitat. Outside of current documented distribution.
Princess Parrot *Polytelis alexandrae*	VU	-	P4	Inhabits sand dunes and sand flats in the arid zone of western and central Australia. It occurs in open savanna woodlands and shrublands that usually consist of scattered stands of *Eucalyptus* (including *E. gongylocarpa*, *E. chippendalei* and mallee species), *Casuarina* or *Allocasuarina* trees; an understorey of shrubs such as *Acacia* (especially *A. aneura*), *Cassia*, *Eremophila*, *Grevillea*, *Hakea* and *Senna*; and a ground cover dominated by *Triodia* species ((DAWE, 2020c).	Would not occur. Preferred habitat absent. No records in central/southern goldfields region.
Night Parrot *Pezoporus occidentalis*	EN	CR	-	Broad habitat requirements include areas of old-growth spinifex (*Triodia*) for roosting and nesting, together with foraging habitats that are likely to include various native grasses and herbs, and may or may not contain shrubs or low trees. (DPaW, 2017).	Would not occur. Preferred habitat absent. No records in central/southern goldfields region.

Species	Conservation Status			Habitat Description	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA Priority		
Chuditch *Dasyurus geoffroii*	VU	VU	-	Occurring in a variety of habitats including deserts, woodlands and shrublands ((DAWE, 2020c).	Would not occur. No recent records nearby and very likely to be locally extinct.
Central Long-eared Bat *Nyctophilus major tor*	-	-	P3	*Nyctophilus major* occurs in the high rainfall southwest region of Western Australia. The trees of the upperstory of its habitat are the large to very tall eucalypt species, karri *Eucalyptus diversicolor*, jarrah *E. marginata*, tuart E. *gomphocephala*, and marri *Corymbia calophylla*. Other woodland types inhabited by the bat include stands of melaleuca, banksia and sheoak tees of genus *Allocasuarina*, and include a dense understory.	Possibly occurs however this species is generally uncommon with very few records north of Kalgoorlie.
Arid Bronze Azure Butterfly *Ogyris subterrestris petrina*	CR	CR	-	At the two known extant locations within the Wheatbelt Region, vegetation is mature mixed *Eucalyptus salubris* / *E. salmonophloia* woodlands on red-brown loam soils, with an open understorey. In addition to gimlet and salmon gum, other smooth-barked eucalyptus at these sites which have basal ant colonies include *E. capillosa* subsp*. wandoo, E. loxophleba* subsp*. lissophloia* and *E. sheathiana*. The habitat at the locally extinct Lake Douglas site located within the Goldfields Region differs from the other sites but is also dominated by mature smooth-barked eucalypt woodland, particularly *E. concinna*. The most critical factor for habitat occupancy by the butterfly is the presence of large colonies of the host ant; *Camponotus sp. nr. terebrans* (DBCA, 2020b).	Unlikely to occur. Only known to be extant at two locations within the Wheatbelt Region and is presumed extinct at another location within the Goldfields Region (Lake Douglas approximately 57 km south of the survey area). Suitable habitat for host ant unlikely to be present. Survey area has been subject to previous disturbance (mining/ exploration, road-rail development and pastoral disturbance) and is unlikely to provide floristically diverse habitat. The survey area has been subject to soil disturbance which adversely affects the host ant (DotEE, 2015).

4.2 Field Assessment

4.2.1 Vegetation Communities

Six floristic groups were identified within the survey area which were located within two different landform types and comprised of three major vegetation groups, which were represented by a total of 114 Taxa (Appendix 3). A map showing the floristic groups present in the survey area is located in Figure 4-1 and a summary of floristic groups is presented in Table 4-5.

Table 4-5: Summary of floristic groups within the survey area

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Clay-Loam Plain	Casuarina Forest and Woodlands (MVG 8)	Low woodland of *Casuarina pauper* over mid shrubland of *Acacia* spp. and low mixed shrubland on clay-loam plain	CLP-CFW1	28	5.6	
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of *Eucalyptus oleosa/ E. salmonophloia* over mid shrubland of *Acacia* spp. and low mixed shrubland on clay-loam plain	CLP-EW1	63	12.7	

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of *Eucalyptus moderata/ E. salmonophloia* over mid shrubland of *Acacia/ Eremophila* spp. and low chenopod shrubland on clay-loam plain	CLP-EW2	95	19.1	
Rocky Hillslope	Acacia Forest and Woodlands (MVG 6)	Low woodland of *Acacia acuminata/ A. caesaneura* over mid shrubland of *Acacia / Melaleuca* spp. and low mixed shrubland on rocky hillslope	RS-AFW1	106	21.3	

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Rocky Hillslope	Casuarina Forest and Woodlands (MVG 8)	Low open woodland of *Casuarina pauper* over mid shrubland of *Acacia/ Senna* spp. and low open shrubland of *Ptilotus obovatus* on rocky hillslope	RS-CFW1	84	16.9	
Rocky Hillslope	Eucalypt Woodlands (MVG 5)	Low open woodland of *Eucalyptus clelandiorum/ E. griffithsii* over tall open shrubland of *Acacia* spp. and low mixed shrubland on rocky hillslope	RS-EW1	113	22.7	
N/A	N/A	Cleared Vegetation (mining only)	CV	9	1.8	N/A
Total				**498**	**100**	

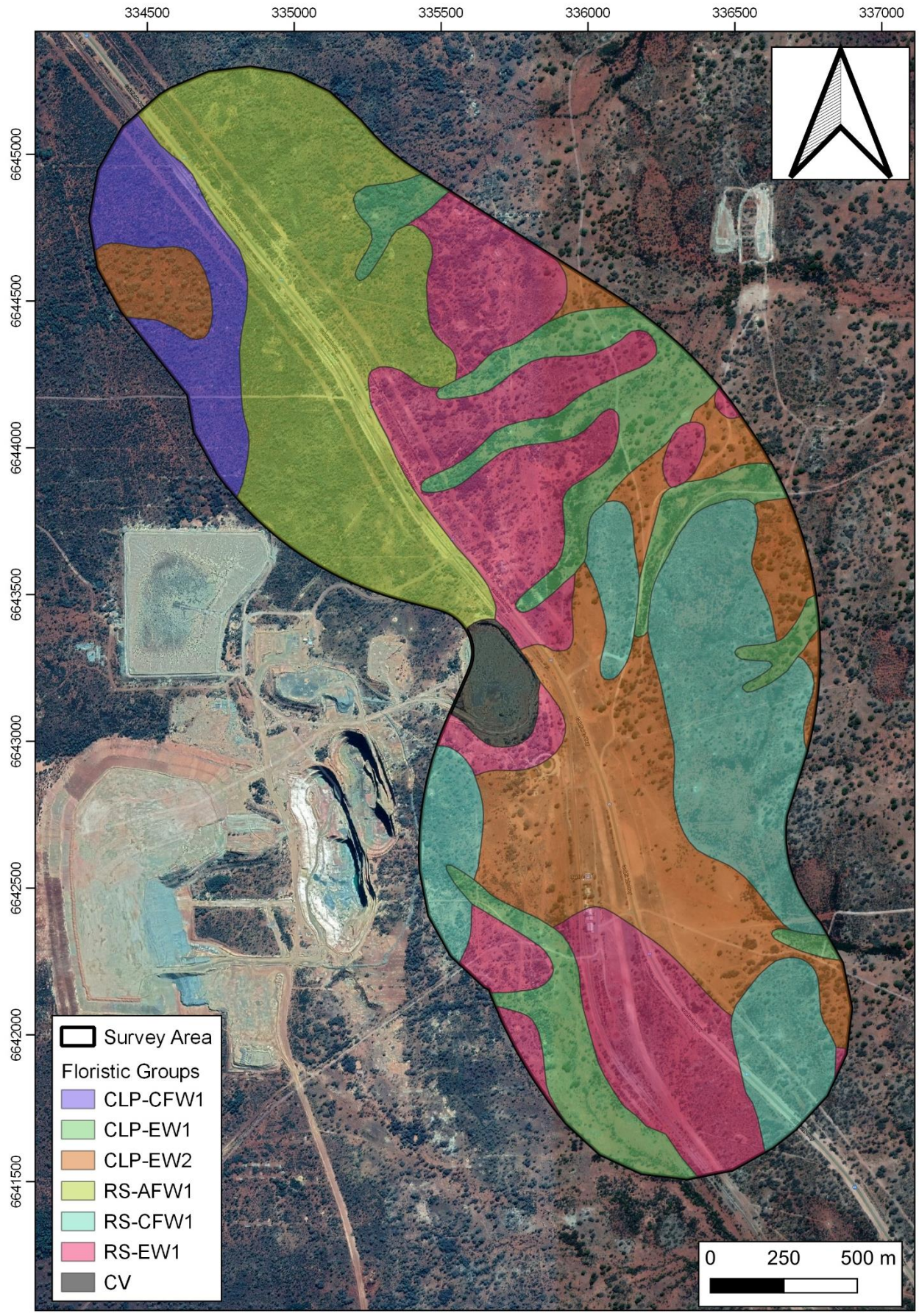


Figure 4-1: Floristic Groups within the survey area

4.2.2 Floristic Composition

PATN analysis was used to determine the similarities or differences between vegetation types identified within the survey area. Appendix 8 provides the dendrogram, two way-table (specifying species group) and ordination graph for all generated from the PATN statistical analysis. A list of the 66 quadrats and their respective vegetation communities are provided in Table 4-6 below. The PATN analysis produced a stress value of 0.2089.

Table 4-6: Floristic Groups identified within the survey area and corresponding quadrats

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Quadrat
Clay-Loam Plain	Casuarina Forest and Woodlands (MVG 8)	Low woodland of *Casuarina pauper* over mid shrubland of *Acacia* spp. and low mixed shrubland on clay-loam plain	CLP-CFW1	AH4 AH8 AH10 KNGP3 KNGP13 KNGP15 KNGP16 SB11 SB14 SB17
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of *Eucalyptus oleosa/ E. salmonophloia* over mid shrubland of *Acacia* spp. and low mixed shrubland on clay-loam plain	CLP-EW1	AH2 AH6 KNGP4 KNGP5 KNGP9 SB16
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of *Eucalyptus moderata/ E. salmonophloia* over mid shrubland of *Acacia/ Eremophila* spp. and low chenopod shrubland on clay-loam plain	CLP-EW2	AH11 AH12 KNGP10 KNGP11 KNGP14 SB3 SB4 SB6 SB8 SB12 B1 B4 B5
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of *Eucalyptus salubris* over mid shrubland of *Eremophila/ Senna* spp. and low chenopod shrubland on clay-loam plain	CLP-EW3	AH13 AH14 AH15 AH16 AH17 AH18 AH22 KNGP6 KNGP7 KNGP8
Rocky Hillslope	Acacia Forest and Woodlands (MVG 6)	Low woodland of *Acacia acuminata/ A. caesaneura* over mid shrubland of *Acacia / Melaleuca* spp. and low mixed shrubland on rocky hillslope	RS-AFW1	KNGP1 KNGP12 KNGP19 SB10 B7 B8 B9

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Quadrat
				GHR3 GHR4 GHR5
Rocky Hillslope	Casuarina Forest and Woodlands (MVG 8)	Low open woodland of *Casuarina pauper* over mid shrubland of *Acacia/ Senna* spp. and low open shrubland of *Ptilotus obovatus* on rocky hillslope	RS-CFW1	SB2 SB5 SB9 GHR1
Rocky Hillslope	Eucalypt Woodlands (MVG 5)	Low open woodland of *Eucalyptus clelandiorum/ E. griffithsii* over tall open shrubland of *Acacia* spp. and low mixed shrubland on rocky hillslope	RS-EW1	AH1 AH3 AH5 KNGP2 KNGP17 KNGP18 SB1 SB7 B2 B6 B10 GHR2

Two 'supergroups' were identified in the PATN analysis:

1. Clay-Loam Plain (Casuarina woodlands and *Eucalyptus oleosa/ E. salmonophloia* woodland) and rocky hillslopes (Acacia woodlands/ Casuarina woodlands and *Eucalyptus clelandiorum/ E. griffithsii* woodlands); and
2. Clay-Loam Plain (Casuarina woodlands, *Eucalyptus moderata/ E. salmonophloia* woodland and *Eucalyptus salubris* woodland).

The first supergroup was divided into five floristic groups, comprising of quadrats from two different landform types (clay-loam plain and rocky hillslope) and three major vegetation groups (Acacia woodlands, Casuarina woodlands and Eucalypt woodlands). The first floristic group was intermixed including majority of the Clay-Loam Plain Casuarina woodland quadrats, all Rocky Hillslope Casuarina woodland quadrats and individual quadrats from the Rocky Hillslope Eucalypt Woodlands (*Eucalyptus clelandiorum/ E. griffithsii)* and Clay-Loam Plain Eucalypt Woodlands (*Eucalyptus oleosa/ E. salmonophloia* and *Eucalyptus moderata/ E. salmonophloia)*. The second floristic group comprised of the majority of Rocky Hillslope Acacia Woodland quadrats. The third floristic group comprised of the majority of Rocky Hillslope Eucalypt Woodlands (*Eucalyptus clelandiorum/ E. griffithsii)* quadrats. Floristic group 4 and 5 each comprised of a single quadrat; Rocky Hillslope *Eucalyptus clelandiorum/ E. griffithsii* woodland (SB1) and Rocky Hillslope Acacia woodland (KNGP1) respectively.

All five floristic groups within this supergroup were mostly characterised by species group A (see two-way table in Appendix 8). As shown in the ordination graph (Appendix 8), floristic groups 1-3 were closely associated with each other. The most distinct floristic groups were group 4 and 5 which each included an individual quadrat. Compared to the other quadrats within their respective vegetation units, floristic group 4 and 5 had low species composition.

The second supergroup was divided into two floristic groups (6 and 7), which were mostly characterised by species group D. Floristic group 8 comprised of mostly Clay-Loam Plain *Eucalyptus moderata/ E. salmonophloia* woodland and *E. salubris* woodland quadrats. The remaining three *E. salubris* woodland quadrats were all grouped together as a separate floristic group. Species composition of understorey taxa was lower in floristic group 7 that floristic group 6.

Based on the results of the PATN analysis, there was minimal heterogeneity in species composition within the clay-loam plain and rocky hillslope vegetation units intermixed into floristic groups despite differences in both dominant stratum taxa and landform. The first super group was highly mixed with this super group including quadrats from each of the different landforms and major vegetation groups. The second supergroup comprised mostly of two Clay-Loam Plain Eucalypt woodland floristic groups (*Eucalyptus moderata/ E. salmonophloia* woodland and *E. salubris* woodland).

4.2.2.1 Species Richness and accumulation estimates

The Chaos 2 richness estimator provided an estimated species richness of 115 species in 100 sample sites (quadrats). Species richness recorded for the 66 quadrats was 110 species (including annuals) which indicates survey intensity was adequate.

A species accumulation curve was created to display the rate of species accumulation. The R^2 value (0.98) suggests that the data "fits" the species accumulation curve shown in Figure 4-2. The rate of species accumulation for the first 20 quadrats ranged from seven to two species per quadrat. The rate of species accumulation between 21-50 quadrats was one species per quadrat. Species accumulation reduced to ≤1 species per quadrat as quadrat number increased above 50. Botanica has determined that according to this data a sufficient number of quadrats were established in the survey area to adequately assess the floristic composition of the area.

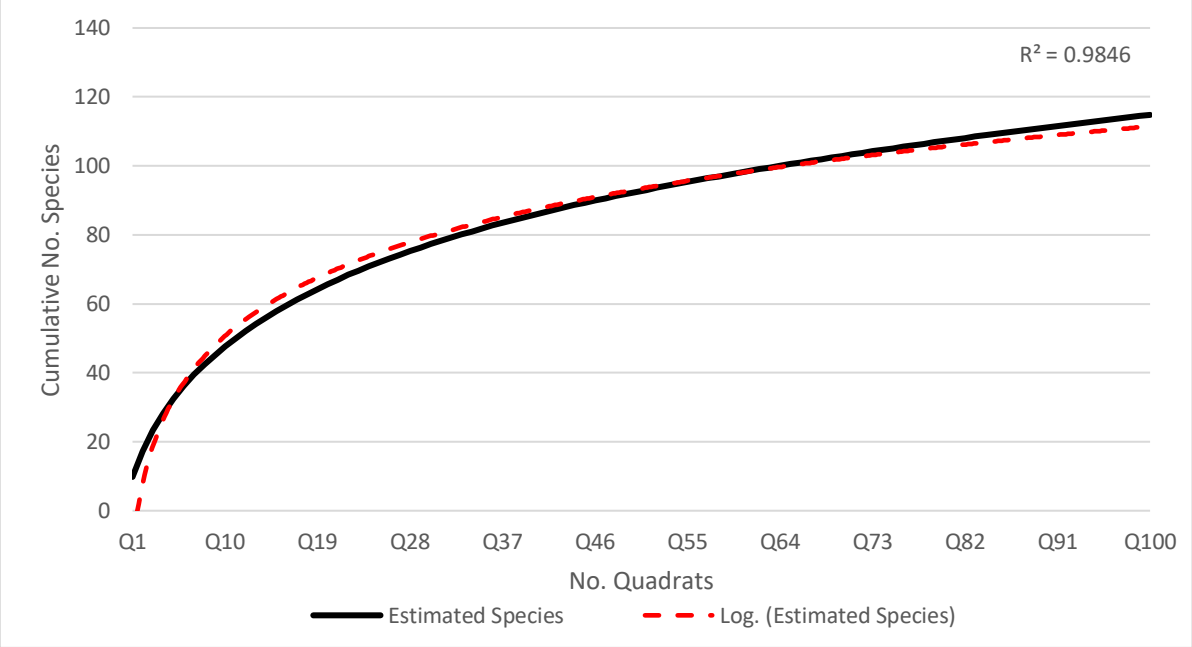


Figure 4-2: Species accumulation curve

4.2.3 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 5), vegetation condition ranged from 'good' to 'very good' (Table 4-7). A map of the vegetation condition within the survey area is provided in Figure 4-3.

'Good' condition depicts that vegetation has been impacted by 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.

'Very Good' condition depicts that vegetation has 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.

Table 4-7: Vegetation Condition Rating of the survey area

Condition Rating	Area (ha)	Area (%)
Cleared Vegetation	9	1.8
Good	365	73.3
Good-Very Good	110	22.1
Very Good	14	2.8

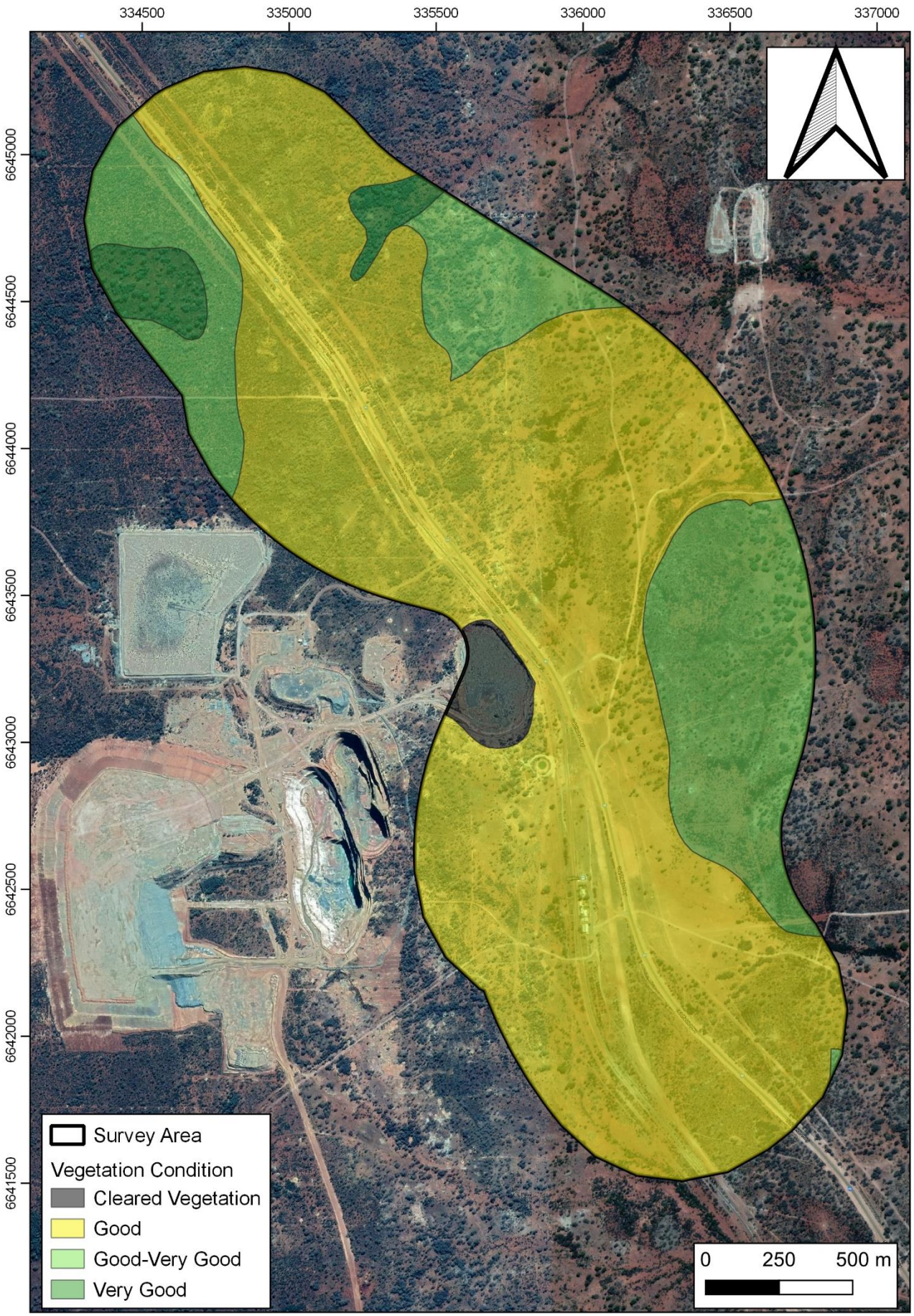


Figure 4-3: Vegetation Condition Rating of the survey area

4.2.4 Fauna Habitat

The broad scale terrestrial fauna habitats within the survey area presented below are based on vegetation and associated landforms identified during the flora and vegetation assessment. A total of two fauna habitat communities have been mapped for the survey area. The extent of the identified fauna habitats and a summary description of each are provided in Table 4-8 below.

Table 4-8: Main Terrestrial Fauna Habitats within the survey area

Fauna Habitat Description	Example Image
Clay-Loam Plain Eucalypt Woodland/ Casuarina Woodland (approximate area = 186 ha; 37.3%).	
Rocky Hillslope Acacia Woodland/ Casuarina Woodland/ Eucalypt Woodland (approximate area = 303 ha; 60.8%).	

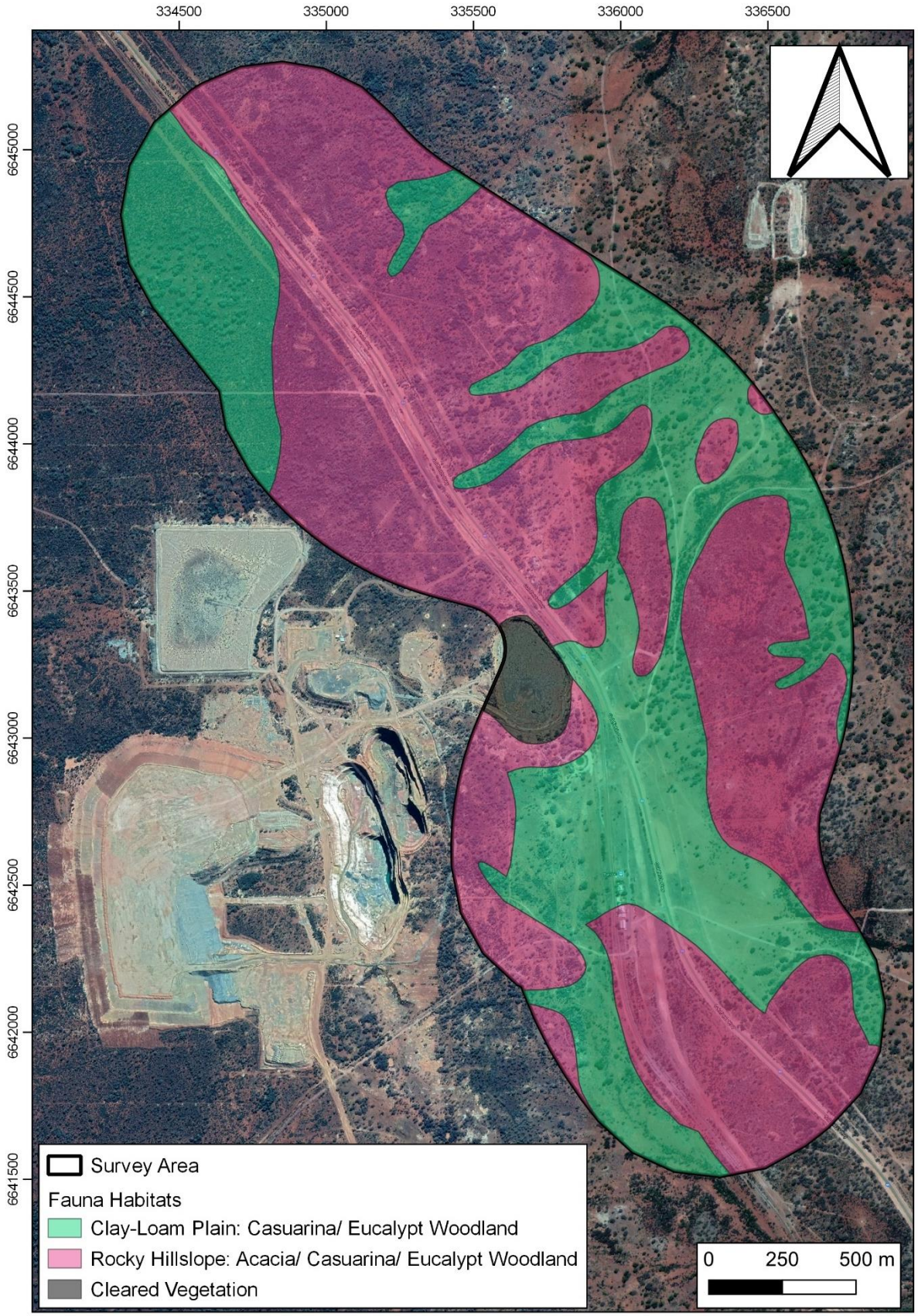


Figure 4-4: Main Terrestrial Fauna Habitats within the survey area

Based on the habitats present within the survey area, a list of expected vertebrate fauna species likely to occur in the survey area was compiled from information obtained during the literature review and is presented in Appendix 9. The results of some previous fauna surveys carried out in the general area are also summarised in this species listing as are the DBCA NatureMap database search results.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. *EPBC Act* Threatened Fauna and Migratory species lists, DBCA NatureMap Fauna Database and various publications) are considered likely to be present within the survey area. The list of potential fauna takes into consideration known occurrence locally/regionally extinct and secondly suitability of habitat for each species, as identified during the habitat assessment, is present within the survey area, though compiling an accurate list has limitations (see **Section 3.3 Survey limitations and constraints**).

Table 4-9 summarises the numbers of potential species based on vertebrate class considered likely to be present in the general vicinity of the survey area based on the complete list held Appendix 9. This list has been developed based on the complete list provided in Appendix 9 and using a precautionary approach adopted for the assessment. At any one time, only a subset of the listed potential species is likely to be present within the bounds of the survey area.

Table 4-9: Summary of Potential Vertebrate Fauna Species

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species
Amphibians	5	0	0	0
Reptiles	75	0	0	0
Birds	108	2	0	0
Non-Volant Mammals	21[8]	0	0	0
Volant Mammals (Bats)	11	0	0	1
Total	**220[8]**	**2**	**0**	**1**

Superscript = number of introduced species included in the total. Note: Where a species state and federal conservation status is different, the highest category is used.

4.2.5 Introduced Species

Two introduced flora have been previously identified by Alexander Holm & Associates (2020a) within the survey area (Figure 4-5); *Carrichtera annua* (Wards Weed) and *Salvia verbenaca* (Wild Sage). Neither species is listed as a Declared Plant under the *Biosecurity and Agriculture Management Act 2007;* No additional introduced flora were identified during the current survey. Evidence of introduced fauna species (rabbits, goats and cattle) were identified in the survey area in the form of droppings and grazing.

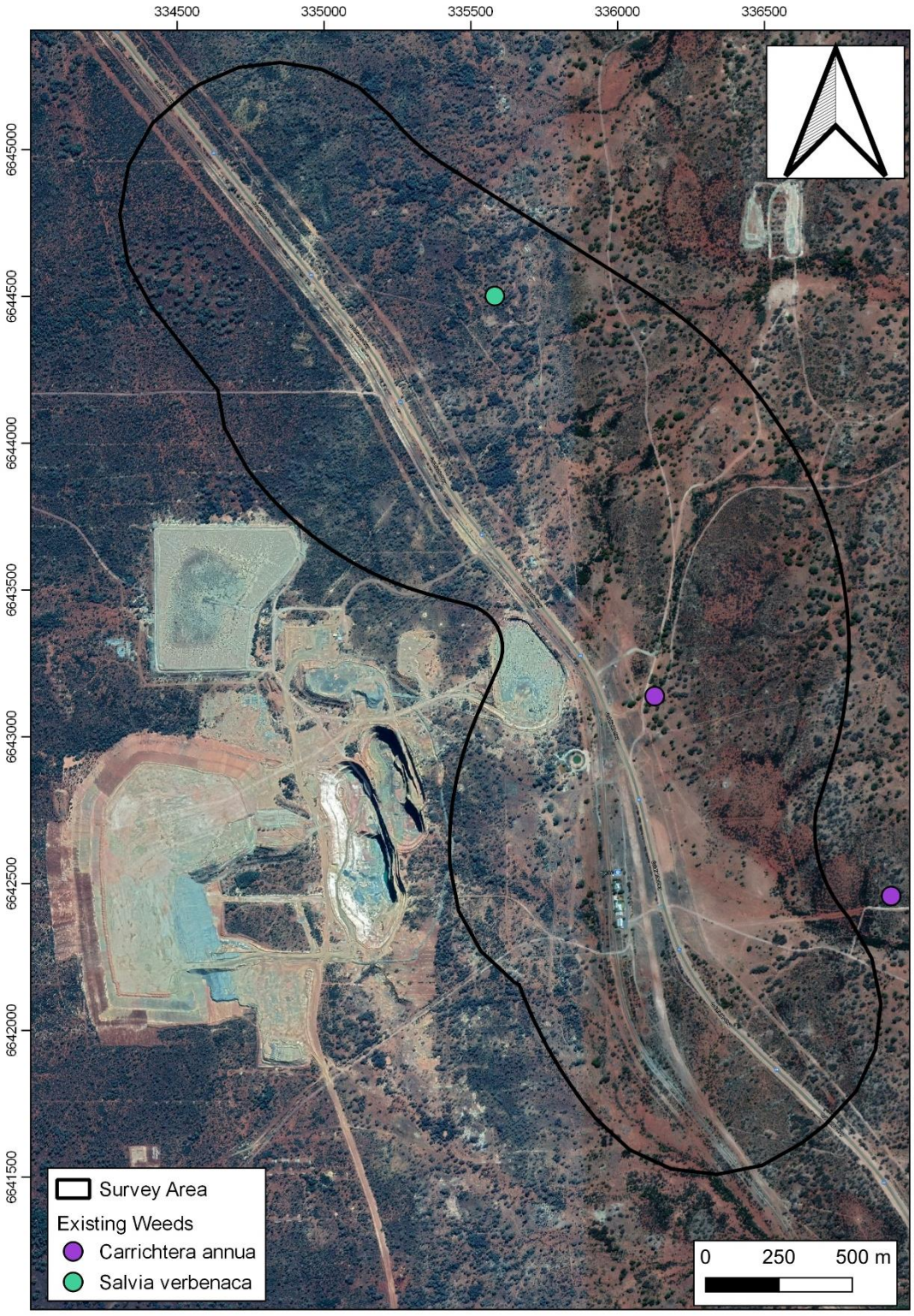


Figure 4-5: Introduced Flora identified within the survey area

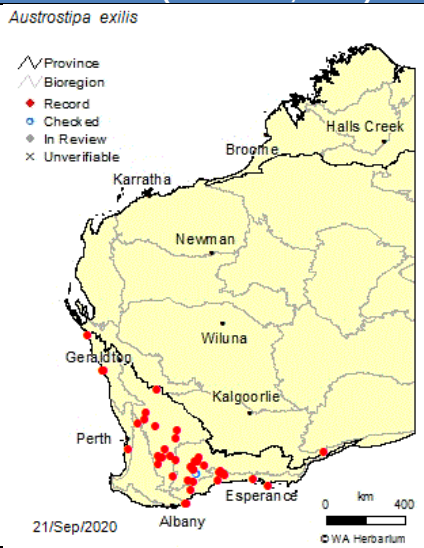
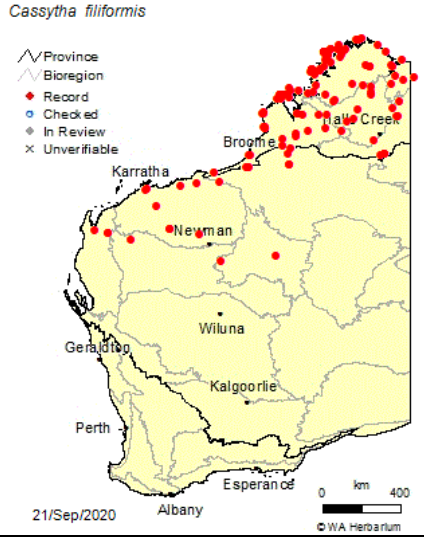
4.2.6 Significant Flora

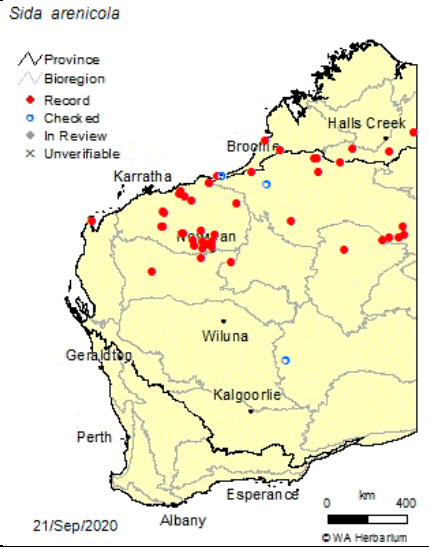
According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016a) significant flora includes:

- flora being identified as threatened or priority species;
- locally endemic flora or flora associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- flora representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- flora with relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

No Threatened Flora taxa listed under Commonwealth or State legislation were identified within the survey area. No Priority Flora listed by DBCA were recorded within the survey area. A map showing DBCA records of Threatened/ Priority Flora in relation to the survey area is provided in Appendix 2. Three range extension taxa have been previously identified by Alexander Holm & Associates (2020a) within the survey area; *Austrostipa exilis, Cassytha filiformis* and *Sida arenicola* (Table 4-10; Figure 4-6). No other significant flora were identified within the survey area.

Table 4-10: Range Extension Flora identified within the survey area

Taxon	Distribution (WAHERB, 2020)	Associated Vegetation
Austrostipa exilis		Two locations recorded within the survey area. Identified within two floristic groups: 1. Low open woodland of *Casuarina pauper* over mid shrubland of *Acacia/ Senna* spp. and low open shrubland of *Ptilotus obovatus* on rocky hillslope (RS-CFW1); and 2. Low open woodland of *Eucalyptus clelandiorum/ E. griffithsii* over tall open shrubland of *Acacia* spp. and low mixed shrubland on rocky hillslope (RS-EW1).
Cassytha filiformis		One location recorded within the survey area, identified within one floristic group; Low woodland of *Acacia acuminata/ A. caesaneura* over mid shrubland of *Acacia / Melaleuca* spp. and low mixed shrubland on rocky hillslope (RS-AFW1).

Taxon	Distribution (WAHERB, 2020)	Associated Vegetation
Sida arenicola		One location recorded within the survey area, identified within one floristic group; Low woodland of *Eucalyptus oleosa/ E.salmonophloia* over mid shrubland of *Acacia* spp. and low mixed shrubland on clay-loam plain (CLP-EW1).

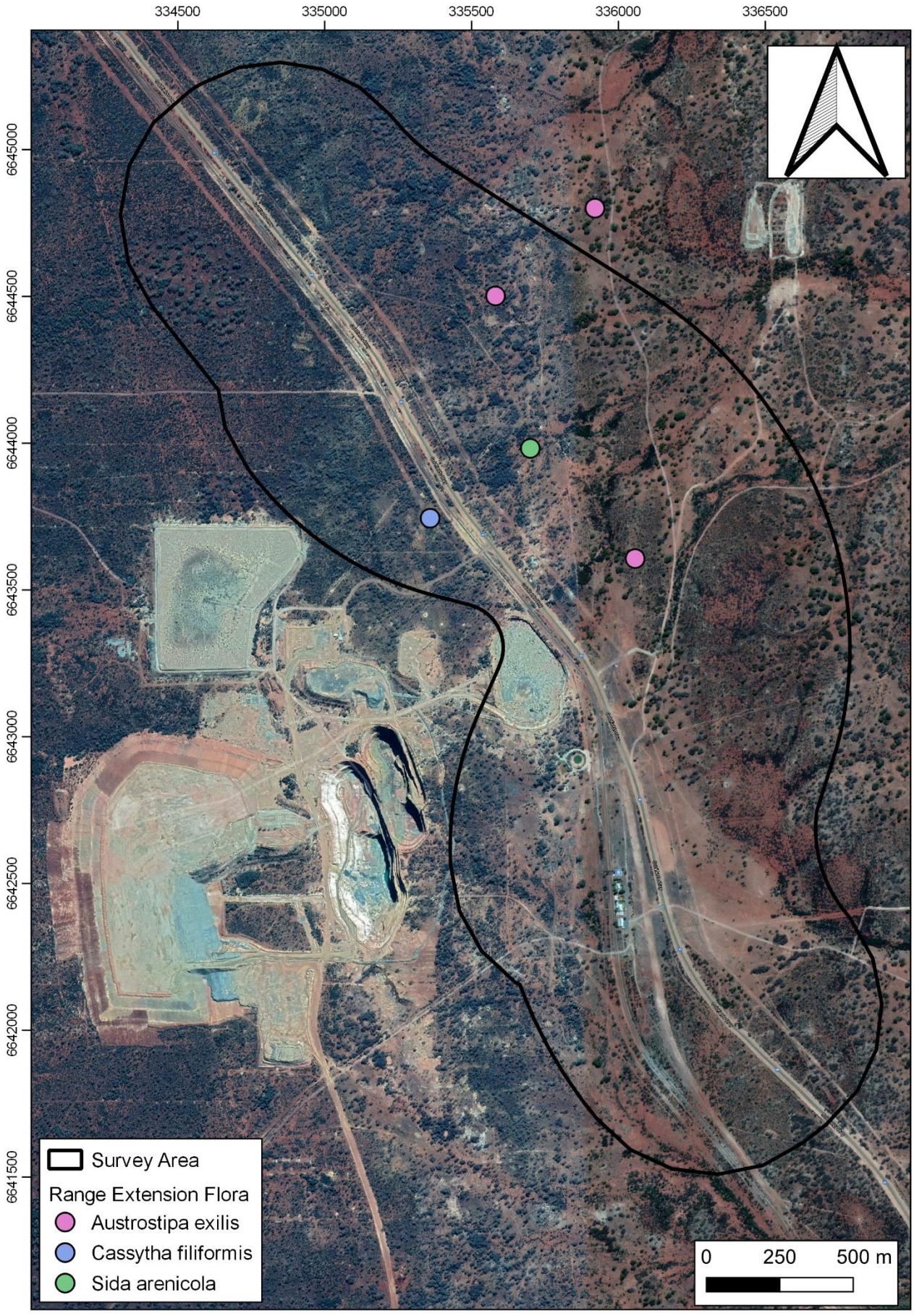


Figure 4-6: Range Extension Flora identified within the survey area

4.2.7 Significant Vegetation

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant vegetation includes:

- vegetation being identified as threatened or priority ecological communities;
- vegetation with restricted distribution;
- vegetation subject to a high degree of historical impact from threatening processes;
- vegetation which provides a role as a refuge; and
- vegetation providing an important function required to maintain ecological integrity of a significant ecosystem.

No Threatened Ecological Communities (TEC) listed under State or Commonwealth legislation were recorded within the survey area. No Priority Ecological Communities (PEC) as listed by DBCA were identified within the survey area. The closest PEC is the Emu Land System Priority 3 Ecological Community which is located approximately 16km north-west of the survey area. A map showing DBCA records of Priority Ecological Communities in relation to the survey area is provided in Appendix 2. No other significant vegetation was identified within the survey area.

4.2.8 Significant Fauna

According to the EPA *Environmental Factor Guideline for Terrestrial Fauna* (EPA, 2016d) significant fauna includes:

- Fauna being identified as a threatened or priority species;
- Fauna species with restricted distribution;
- Fauna subject to a high degree of historical impact from threatening processes; and
- Fauna providing an important function required to maintain the ecological integrity of a significant ecosystem.

No significant fauna were observed during the survey. The current status of some species on site and/or in the general area is difficult to determine, however, based on the habitats present and, in some cases, direct observations or recent nearby records, the following species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

- **Malleefowl *Leipoa ocellata* – Vulnerable (EPBC Act and BC Act)**
  This species is occasionally recorded in the general area, however habitat within the survey area appears very marginal/or unsuitable for breeding; however, occasional transients could potentially occur. No evidence of malleefowl activity (inactive or active mounds, tracks, feathers or bird observations etc.) were observed within the survey area. Significant impact unlikely.

- **Peregrine Falcon *Falco peregrinus* – OS (*BC Act*)**
  This species potentially utilises some sections of the survey area as part of a much larger home range, though records in this area are uncommon. It is considered unlikely to breed within the survey area. Significant impact unlikely.

- **Central Long-eared Bat *Nyctophilus major tor* – P3 (DBCA Priority Species)**
  Listed as a potential species however it is generally uncommon and rarely recorded north of Kalgoorlie. Significant impact unlikely.

It should be noted that while habitats onsite for one or more of the species listed above are considered possibly suitable, some or all may be marginal in extent/quality and therefore the fauna species considered as possibly occurring may in fact only visit the area for short periods as infrequent vagrants.

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

4.3 Matters of National Environmental Significance

4.3.1 *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC Act protects matters of national environmental significance, and is used by the Commonwealth DAWE to list threatened taxa and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance. Matters of national environmental significance as defined by the Commonwealth EPBC Act include:

- Nationally threatened flora species;
- World heritage properties;
- National heritage places;
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- Nationally threatened ecological communities;
- Commonwealth marine area;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mining) a water resource, in relation to coal seam gas development and large coal mining development.

No matters of national environmental significance as defined by the Commonwealth EPBC Act were identified within the survey area.

4.4 Matters of State Environmental Significance

4.4.1 *Environmental Protection Act WA 1986*

The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The Act is administered by the Department of Water and Environment Regulation (DWER), which is the State Government's environmental regulatory agency.

Under Section 51C of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations (Regulations) WA 2004* any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the *EP Act 1986* or under the Regulations 2004 requires a clearing permit from the DWER or DMIRS. Under Section 51A of the *EP Act 1986* native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the *EP Act 1986* defines clearing as "the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above".

Exemptions under Schedule 6 of the EP Act and the EP Regulations do not apply in ESAs as declared under Section 51B of the EP Act or TEC listed under State and Commonwealth legislation.

No evidence of the survey area containing any TEC or Threatened Flora or Fauna was identified during the survey. The survey area is not located within an ESA.

4.4.2 *Biodiversity Conservation Act 2016*

This Act is used by the Western Australian DBCA for the conservation and protection of biodiversity and biodiversity components in Western Australia and to promote the ecologically sustainable use of biodiversity components in the State. Taxa are classified as 'Threatened' when their populations are geographically restricted or are threatened by local processes (see following sections for Threatened definitions). Under this Act all native flora and fauna are protected throughout the State. Financial penalties are enforced under this Act if threatened species are collected without an appropriate licence.

Under Section 54(1) of the BC Act, habitat is eligible for listing as critical habitat if:
(a) it is critical to the survival of a threatened species or a threatened ecological community; and
(b) its listing is otherwise in accordance with the ministerial guidelines.

No threatened species or critical habitat listed under the BC Act were recorded within the survey area.

4.4.3 Conservation Reserves

The survey area is not located within a proposed or gazetted conservation reserve. The closest proposed and gazetted conservation reserves are the ex. Goongarrie Station UCL (LR3068/801) and Goongarrie National Park, which are located approximately 25km north/ north-east of the survey area. A map showing areas of proposed and gazetted Conservation Reserves in relation to the survey area is provided in Appendix 2.

4.5 Native Vegetation Clearing Principles

Based on the outcomes from the survey, as presented in this report, Botanica provides the following comments regarding the native vegetation clearing principles listed under Schedule 5 of the EP Act (Table 4-11). The assessment has identified clearing may be at variance with one principle; clearing principle (f).

Table 4-11: Assessment of development within the survey area against native vegetation clearing principles

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
(a)	comprises a high level of biological diversity.	Vegetation identified within the survey area is not considered to be of high biological diversity and is well represented in the local area.	Clearing is unlikely to be at variance to this principle
(b)	comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	No significant fauna were observed within the survey area. The survey area comprises of broad fauna habitats that are typical of those in the wider region. No unique fauna habitats (caves, rocky outcrops/ pools etc.) occur within the survey area. No water bodies (both perennial/ non-perennial) occur within the survey area.	Clearing is unlikely to be at variance to this principle
(c)	includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to the BC Act and the EPBC Act were identified within the survey area (none listed as occurring on DBCA database and none identified during survey).	Clearing is not at variance to this principle
(d)	comprises the whole or part of or is necessary for the maintenance of a threatened ecological community (TEC).	No TEC listed under the EPBC Act or by the BC Act occur within the survey area (none listed as occurring on DBCA database and none identified during survey).	Clearing is not at variance to this principle
(e)	is significant as a remnant of native vegetation in an area that has been extensively cleared	The survey area occurs within the pre-European Beard vegetation association Barlee 2903 which retains >96% of the original pre-European vegetation extent.	Clearing is unlikely to be at variance to this principle
(f)	is growing, in, or in association with, an environment associated with a watercourse or wetland	According to the Geoscience Australia database (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however one minor ephemeral drainage line intersects the survey area, associated with floristic group CLP-EW1 which accounts for 12.7% of the total survey area.	Clearing may be at variance to this principle
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The survey area occurs within the pre-European Beard vegetation association Barlee 2903 which retains >96% of the original pre-European vegetation extent. Clearing within this vegetation association is not likely to lead to land degradation issues such as salinity, water logging or acidic soils.	Clearing is unlikely to be at variance to this principle
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The survey area is not located within a proposed or gazetted conservation reserve. The closest proposed and gazetted conservation reserves are the ex. Goongarrie Station UCL (LR3068/801) and Goongarrie National Park, which are located approximately 25km north/ north-east of the survey area. Given the distance of the survey area from these proposed or gazetted conservation areas, clearing within the survey area is unlikely to impact the environmental values of these reserves.	Clearing is unlikely to be at variance to this principle
(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.	According to the Geoscience Australia database (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however one minor ephemeral drainage line intersects the survey area, associated within CLP-EW1 which accounts for 12.7% of the total survey	Clearing is unlikely to be at variance to this principle

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
		area, and covers approximately 6 ha of the target survey area. Most rainfall is lost by evaporation or surface runoff. Only a small portion infiltrates the soil and recharges the groundwater.	
(j)	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	Rainfall is unreliable and highly variable with an average rainfall for Kalgoorlie-Boulder of 266.1mm and an evaporation rate of 2400mm. The region is not prone to flooding and does not contain perennial water sources.	Clearing is unlikely to be at variance to this principle

4.6 Conclusions and Recommendations

4.6.1 Conclusions

No Threatened Flora, Migratory Fauna or TECs as listed under State or Commonwealth legislation were identified within the survey area. No evidence of Malleefowl activity (active or inactive mounds, tracks, feathers or bird observations etc.) were observed within the survey area.

No Priority Flora, Priority Fauna or PECs as listed by the DBCA were identified within the survey area.

The survey area does not contain any world or national heritage places, wetlands of international importance (Ramsar Wetlands), national importance (ANCA Wetlands) or conservation category wetlands. The survey area does not contain any ESAs, proposed or gazetted conservation reserves.

The assessment identified clearing may be at variance with one Native Vegetation Clearing Principle; (f) *vegetation is growing, in, or in association with, an environment associated with a watercourse or wetland.* According to the Geoscience Australia database (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however one minor ephemeral drainage line intersects the survey area, associated with floristic group CLP-EW1 which accounts for 12.7% of the total survey area.

4.6.2 Recommendations

- Clearing within ephemeral drainage lines be avoided or minimised where possible.
- Vehicle hygiene/ weed management measures be implemented prior to any clearing to prevent introduction or spread of introduced species.
- Clearing of mature Eucalypts be avoided/ minimised where possible.

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Appendix 1: Significant Flora and Communities Conservation Categories

Definitions of Conservation Significant Species

Code	Category
State categories of threatened and priority species	
Threatened Species (T) 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).	
CR	**Critically Endangered** 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** 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** 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 Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	**Extinct** 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 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.	
IA	**International Agreement/ Migratory** 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*

Code	Category
	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** 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 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.
Commonwealth categories of threatened species	
EX	**Extinct** Taxa where there is no reasonable doubt that the last member of the species has died.

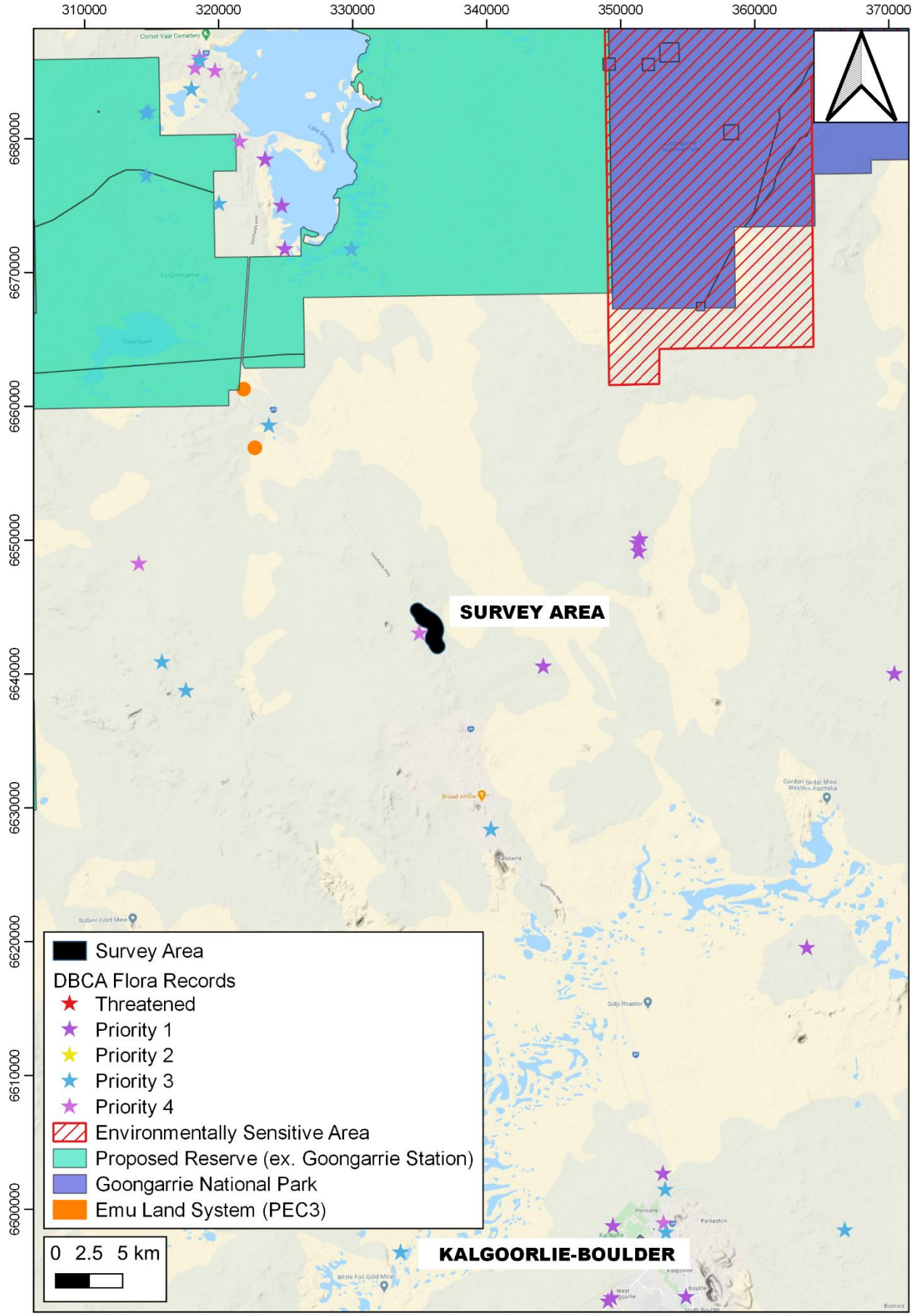
Code	Category
EW	**Extinct in the Wild** Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CR	**Critically Endangered** Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
EN	**Endangered** Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
VU	**Vulnerable** Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Definition of conservation significant communities

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

Category Code	Category
	The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the short-term future.
VU	**Vulnerable** An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	**Critically Endangered** If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
EN	**Endangered** If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
VU	**Vulnerable** If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).
Priority Ecological Communities (PEC)	
P1	**Poorly-known ecological communities** Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities** Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Ecological communities that are adequately known, rare but not threatened** or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 2: Regional map of the survey area in relation to areas of conservation significance



Appendix 3: Species List

(A) Blue text Denotes Annual species; (W) Green text Introduced Flora; (RE) Purple text Denotes Range Extension Flora

Family	Taxon	CLP-CFW1	CLP-EW1	CLP-EW2	RS-AFW1	RS-CFW1	RS-EW1
Amaranthaceae	*Ptilotus exaltatus (A)*	*		*			
	Ptilotus helichrysoides						*
	Ptilotus obovatus	*	*	*	*	*	*
	Ptilotus schwartzii						*
Apocynaceae	*Alyxia buxifolia*		*		*		*
	Marsdenia australis	*	*				*
Asteraceae	*Cratystylis subspinescens*			*	*		
	Olearia muelleri	*	*	*		*	*
	Vittadinia eremaea (A)			*			
Brassicaceae	*Carrichtera annua (W)*			*			
Boraginaceae	*Halgania andromedifolia*						*
Casuarinaceae	*Allocasuarina campestris*				*		*
	Casuarina pauper	*	*	*	*	*	*
Chenopodiaceae	*Atriplex bunburyana*			*		*	
	Atriplex codonocarpa (A)		*	*			
	Atriplex nummularia subsp. *spathulata*		*	*		*	*
	Atriplex stipitata						*
	Atriplex vesicaria			*			*
	Chenopodium curvispicatum	*					
	Chenopodium sp. (sterile)	*					
	Enchylaena tomentosa			*			
	Maireana georgei	*	*	*	*	*	
	Maireana oppositifolia			*			
	Maireana planifolia					*	
	Maireana platycarpa			*			
	Maireana pyramidata	*		*			
	Maireana sedifolia	*	*	*			*
	Maireana trichoptera	*		*		*	
	Maireana triptera		*	*			*
	Rhagodia eremaea	*		*		*	*
	Sclerolaena diacantha	*	*	*	*	*	*
	Sclerolaena eurotioides	*					
	Sclerolaena uniflora			*			

Family	Taxon	CLP-CFW1	CLP-EW1	CLP-EW2	RS-AFW1	RS-CFW1	RS-EW1
	Tecticornia disarticulata			*			
Fabaceae	*Acacia acuminata*	*	*		*		*
	Acacia burkittii	*					
	Acacia caesaneura	*	*		*		
	Acacia collegialis	*	*				
	Acacia colletioides	*		*			
	Acacia erinacea	*	*	*	*	*	*
	Acacia hemiteles	*	*	*			*
	Acacia incurvaneura		*		*		
	Acacia jennerae	*		*		*	*
	Acacia kempeana	*			*		
	Acacia ligulata					*	
	Acacia murrayana						*
	Acacia oswaldii	*					
	Acacia quadrimarginea	*	*				*
	Acacia ramulosa var. *ramulosa*	*	*				
	Acacia tetragonophylla	*	*	*	*	*	*
	Hovea acanthoclada						*
	Senna artemisioides subsp. *filifolia*	*	*	*		*	*
	Senna cardiosperma		*	*		*	*
	Templetonia incrassata			*			
Frankeniaceae	*Frankenia setosa*			*			*
Goodeniaceae	*Dampiera* sp. (sterile)				*		
	Scaevola spinescens	*	*	*	*	*	*
Gyrostemonaceae	*Codonocarpus cotinifolius*	*					*
Lamiaceae	*Prostanthera albiflora*				*		
	Prostanthera althoferi subsp. *althoferi*		*		*		
	Prostanthera campbellii		*		*		
	Salvia verbenaca (W)						*
	Westringia cephalantha						*
	Westringia rigida	*	*		*		*
Lauraceae	*Cassytha filiformis (RE)*				*		
Loranthaceae	*Amyema preissii*	*	*				
Malvaceae	*Sida arenicola (RE)*		*				
	Sida calyxhymenia			*		*	

Family	Taxon	CLP-CFW1	CLP-EW1	CLP-EW2	RS-AFW1	RS-CFW1	RS-EW1
Myrtaceae	*Cryptandra aridicola*						*
	Eucalyptus celastroides subsp. *celastroides*		*				*
	Eucalyptus clelandiorum			*			*
	Eucalyptus concinna		*				*
	Eucalyptus flavida				*		
	Eucalyptus griffithsii	*	*	*			*
	Eucalyptus moderata		*	*			
	Eucalyptus oleosa	*	*		*		
	Eucalyptus ravida			*			*
	Eucalyptus salmonophloia		*	*			
	Melaleuca hamata				*		
	Melaleuca lateriflora						*
Pittosporaceae	*Pittosporum angustifolium*			*		*	*
Poaceae	*Austrostipa elegantissima*			*			
	Austrostipa exilis (RE)					*	*
	Eragrostis eriopoda				*		
	Triodia sp. (sterile)						*
Proteaceae	*Grevillea acuaria*	*		*	*		*
	Grevillea juncifolia subsp. *juncifolia*				*		
	Grevillea nematophylla subsp. *nematophylla*		*				
	Grevillea sp. (sterile)		*				
Rutaceae	*Philotheca brucei*		*		*		
Santalaceae	*Exocarpos aphyllus*	*	*	*			*
	Santalum acuminatum			*			
	Santalum spicatum	*	*	*	*		*
Sapindaceae	*Alectryon oleifolius*			*			
	Dodonaea lobulata	*	*	*	*	*	*
	Dodonaea rigida	*	*		*		*
	Dodonaea viscosa subsp. *angustissima*	*			*		*
Scrophulariaceae	*Eremophila alternifolia*		*		*		*
	Eremophila clarkei	*	*				*
	Eremophila dempsteri			*			
	Eremophila gibbosa		*				*
	Eremophila glabra			*	*		*
	Eremophila interstans	*	*				*

Family	Taxon	CLP-CFW1	CLP-EW1	CLP-EW2	RS-AFW1	RS-CFW1	RS-EW1
	Eremophila oldfieldii	*	*	*	*	*	*
	Eremophila oppositifolia subsp. *angustifolia*						*
	Eremophila parvifolia subsp. *auricampi*		*	*			
	Eremophila pustulata						*
	Eremophila scoparia	*	*	*			*
	Eremophila sp. (sterile)				*		
	Eremophila sp. Mt Jackson (G.J. Keighery 4372)	*					*
Solanaceae	*Solanum lasiophyllum*	*		*			
	Solanum nummularium	*					
Thymelaeaceae	*Pimelea microcephala*	*		*			
Zygophyllaceae	*Roepera eremaea (A)*					*	
Total Taxa		**48**	**48**	**54**	**35**	**23**	**58**

Appendix 4: GPS coordinates of Flora Quadrat locations (GDA94)

Quadrat ID	Zone	Easting	Northing
AH1	51 J	335448	6644482
AH2	51 J	335226	6644910
AH3	51 J	335102	6645050
AH4	51 J	334946	6645209
AH5	51 J	334676	6645361
AH6	51 J	334591	6645474
AH8	51 J	334143	6645896
AH10	51 J	333163	6647050
AH11	51 J	332450	6648053
AH12	51 J	332222	6648619
AH13	51 J	332030	6649213
AH14	51 J	331390	6651930
AH15	51 J	331129	6653454
AH16	51 J	330742	6654321
AH17	51 J	330453	6655352
AH18	51 J	330022	6656472
AH22	51 J	329151	6658769
KNGP1	51 J	334966	6643585
KNGP2	51 J	334875	6643856
KNGP3	51 J	334541	6644816
KNGP4	51 J	334280	6644833
KNGP5	51 J	334004	6644626
KNGP6	51 J	333670	6644575
KNGP7	51 J	333375	6644502
KNGP8	51 J	333566	6644379
KNGP9	51 J	333833	6644228
KNGP10	51 J	334364	6644577
KNGP11	51 J	334659	6644420
KNGP12	51 J	334881	6644243
KNGP13	51 J	333900	6643442
KNGP14	51 J	333714	6643389
KNGP15	51 J	334045	6642194
KNGP16	51 J	334510	6641482
KNGP17	51 J	335379	6643613
KNGP18	51 J	335071	6643985
KNGP19	51 J	335005	6643750
B1	51 J	333766	6634394
B2	51 J	333940	6634238
B3	51 J	334159	6634329
B4	51 J	334665	6634617
B5	51 J	334914	6634223
B6	51 J	334331	6635108
B7	51 J	333511	6634797
B8	51 J	333587	6634847
B9	51 J	333739	6634784
B10	51 J	334232	6635319

Quadrat ID	Zone	Easting	Northing
GHR1	51 J	336695	6642080
GHR2	51 J	336791	6641986
GHR3	51 J	336773	6641911
GHR4	51 J	336527	6642666
GHR5	51 J	336548	6642854
SB1	51 J	336218	6643156
SB2	51 J	336323	6643215
SB3	51 J	336752	6643363
SB4	51 J	336612	6643618
SB5	51 J	336261	6643613
SB6	51 J	336229	6644189
SB7	51 J	330877	6650008
SB8	51 J	330431	6650747
SB9	51 J	329744	6651818
SB10	51 J	328624	6653189
SB11	51 J	328474	6653317
SB12	51 J	326560	6655444
SB14	51 J	324458	6661886
SB16	51 J	325642	6659668
SB17	51 J	326093	6657582

Appendix 5: Vegetation Condition Rating

Vegetation Condition Rating	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
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.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or ‘parkland cleared’ with their flora comprising weed or crop species with isolated native trees or shrubs.

Appendix 6: Quadrat Datasheets

Project Name: Highway and Railway		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 200-202
Quadrat No: GHR1	**Quadrat size/shape:** 20x20m	**Elevation (m):** 426
Coordinates (GDA94): 51 J 336695 6642080		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Very Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 50-90%/ 20-60mm/ angular		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Light brown/ Uniform/ Silty loam/ Firm		
%Cover leaf litter: 20		
%Cover bare ground: 40		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 30-70	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Dodonaea lobulata*	*Ptilotus obovatus*

ALL TAXA
Acacia erinacea
Acacia tetragonophylla
Casuarina pauper
Dodonaea lobulata
Eremophila interstans
Eremophila oldfieldii
Olearia muelleri
Ptilotus obovatus
Sclerolaena diacantha
Senna artemisioides subsp. *filifolia*

Project Name: Highway and Railway		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 203-205
Quadrat No: GHR2	**Quadrat size/shape:** 20x20m	**Elevation (m):** 424
Coordinates (GDA94): 51 J 336791 6641986		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 20-50%/ 20-60mm/ angular		
Rock outcrop (abundance/runoff): Nil/ Moderately Rapid		
Soil (profile/field texture/soil surface): Light brown/ Uniform/ Light Medium Clay/ Firm		
%Cover leaf litter: 20		
%Cover bare ground: 80		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus clelandiorum	*Senna artemisioides* subsp. *filifolia*	*Olearia muelleri*

ALL TAXA
Acacia erinacea
Acacia tetragonophylla
Eremophila parvifolia subsp. *auricampa*
Eucalyptus clelandiorum
Maireana sedifolia
Olearia muelleri
Scaevola spinescens
Sclerolaena uniflora
Senna artemisioides subsp. *filifolia*

Project Name: Highway and Railway		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 206-208
Quadrat No: GHR3	**Quadrat size/shape:** 20x20m	**Elevation (m):** 426
Coordinates (GDA94): 51 J 336773 6641911		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 50-90%/ 60-200mm/ angular tabular		
Rock outcrop (abundance/runoff): Nil/ moderately rapid		
Soil (profile/field texture/soil surface): Red/uniform/silty clay loam/firm		
%Cover leaf litter: 20		
%Cover bare ground: 30		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 30-70	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia acuminata	*Scaevola spinescens*	*Dampiera* sp. (sterile)

ALL TAXA
Acacia acuminata
Acacia tetragonophylla
Casuarina pauper
Dampiera sp. (sterile)
Dodonaea lobulata
Scaevola spinescens

Project Name: Highway and Railway		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 210-212
Quadrat No: GHR4	**Quadrat size/shape:** 20x20m	**Elevation (m):** 424
Coordinates (GDA94): 51 J 336527 6642666		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 20-50%/ 60-200mm/ angular tabular		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/Uniform/Silty Loam/Firm		
%Cover leaf litter: 20		
%Cover bare ground: 30		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 30-70	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia acuminata	*Eremophila clarkei*	*Ptilotus obovatus*

ALL TAXA
Acacia acuminata
Acacia tetragonophylla
Eremophila clarkei
Marsdenia australis
Ptilotus obovatus
Senna artemisioides subsp. x *artemisioides*

Project Name: Highway and Railway		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 213-215
Quadrat No: GHR5	**Quadrat size/shape:** 20x20m	**Elevation (m):** 431
Coordinates (GDA94): 51 J 336548 6642854		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 50-90%/ 20-60mm/ subrounded		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Silty clay loam/ firm		
%Cover leaf litter: 20		
%Cover bare ground: 30		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia acuminata	*Dodonaea lobulata*	*Ptilotus obovatus*

ALL TAXA
Acacia acuminata
Acacia quadrimarginea
Dodonaea lobulata
Prostanthera campbellii
Ptilotus obovatus
Scaevola spinescens

Project Name: Aphrodite Haul Road		
Date: 1/9/2020	**Botanist:** JW	**Photo:** 28,29,30
Quadrat No: AH1	**Quadrat size/shape:** 20x20	**Elevation (m):** 420
Coordinates (GDA94): 51 J 335448 6644482		**Accuracy:** 1 metre
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Very abundant, medium gravel pebbles		
Rock outcrop (abundance/runoff): No bed rock exposed, slow runoff		
Soil (profile/field texture/soil surface): Uniform, firm, red brown, heavy clay		
%Cover leaf litter: 10		
%Cover bare ground: 30		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6 metres	**Height:** 1-3 metres	**Height:** <1 metre
Crown cover %: 10-30%	**Crown cover %:** 10-30%	**Crown cover %:** >10%
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus clelandiorum	*Senna artemisioides* subsp. *filifolia*	*Ptilotus obovatus*

ALL TAXA
Acacia erinacea
Acacia hemiteles
Atriplex nummularia subsp. *spatulata*
Casuarina pauper
Dodonaea lobulata
Eremophila interstans
Eremophila oppositifolia subsp. *angustifolia*
Eucalyptus clelandiorum
Maireana sedifolia
Ptilotus obovatus
Scaevola spinescens
Sclerolaena diacantha
Senna artemisioides subsp. *filifolia*

Project Name: Aphrodite Haul Road		
Date: 1/9/2020	**Botanist:** JW	**Photo:** 31,32,33
Quadrat No: AH2	**Quadrat size/shape:** 20x20	**Elevation (m):** 422
Coordinates (GDA94): 51 J 335226 6644910		**Accuracy:** 1 metre
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Very abundant, medium gravel pebbles		
Rock outcrop (abundance/runoff): No bedrock exposed, moderately rapid runoff		
Soil (profile/field texture/soil surface): Red brown, heavy clay, firm		
%Cover leaf litter: 40		
%Cover bare ground: 60		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6 metres	**Height:** 1-3 metres	**Height:** <1 metre
Crown cover %: 10-30%	**Crown cover %:** >1	**Crown cover %:** >10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus moderata	*Eremophila scoparia*	*Ptilotus obovatus*

ALL TAXA
Acacia erinacea
Acacia tetragonophylla
Atriplex codonocarpa (A)
Atriplex nummularia subsp. *spatulata*
Eremophila interstans
Eremophila scoparia
Eucalyptus moderata
Maireana georgei
Maireana triptera
Ptilotus obovatus
Sclerolaena diacantha
Senna cardiosperma

Project Name: Aphrodite Haul Road		
Date: 2/9/2020	**Botanist:** JW	**Photo:** 34,35,36
Quadrat No: AH3	**Quadrat size/shape:** 20x20	**Elevation (m):** 425
Coordinates (GDA94): 51 J 335102 6645050		**Accuracy:** 1 metre
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Very good
Landform: Hillslope		
Coarse fragments on the surface: Very abundant, coarse gravelly pebbles		
Rock outcrop (abundance/runoff): Moderately rapid, runoff, no bedrock exposed.		
Soil (profile/field texture/soil surface): Firm, medium clay, red brown		
%Cover leaf litter: 40%		
%Cover bare ground: 10%		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6 metres	**Height:** 1-3 metres	**Height:** <1 metre
Crown cover %: 10-30%	**Crown cover %:** 10-30%	**Crown cover %:** 30-70
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus griffithsii	*Eremophila interstans*	*Acacia erinacea*

ALL TAXA
Acacia erinacea
Acacia hemiteles
Acacia tetragonophylla
Alyxia buxifolia
Atriplex stipitata
Casuarina pauper
Eremophila interstans
Eremophila oldfieldii
Eremophila sp. Mt Jackson (G.J. Keighery 4372)
Eucalyptus griffithsii
Olearia muelleri
Ptilotus obovatus
Santalum spicatum
Scaevola spinescens
Senna artemisioides subsp. *filifolia*

Project Name: Aphrodite Haul Road		
Date: 2/9/2020	**Botanist:** JW	**Photo:** 37,38,39
Quadrat No: AH4	**Quadrat size/shape:** 20x20	**Elevation (m):** 430
Coordinates (GDA94): 51 J 334946 6645209		**Accuracy:** 1 metre
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Very good
Landform: Hillslope		
Coarse fragments on the surface: Very abundant, medium gravel pebbles		
Rock outcrop (abundance/runoff): No bedrock exposed, moderately rapid runoff		
Soil (profile/field texture/soil surface): Red brown, uniform, firm, medium heavy clay.		
%Cover leaf litter: 30%		
%Cover bare ground: 70%		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6 metre	**Height:** 1-3 metre	**Height:** <1 metre
Crown cover %: <10	**Crown cover %:** >10	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Dodonaea lobulata*	*Ptilotus obovatus*

ALL TAXA
Acacia erinacea
Casuarina pauper
Dodonaea lobulata
Eremophila oppositifolia subsp. *angustifolia*
Olearia muelleri
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp. *filifolia*
Solanum nummularium

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 105-107
Quadrat No: KNGP2	**Quadrat size/shape:** 20x20m	**Elevation (m):** 436
Coordinates (GDA94): 51 J 334875 6643856		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Ironstone/ 50-90%/ 2-6mm/ subrounded		
Rock outcrop (abundance/runoff): nil/ moderately rapid		
Soil (profile/field texture/soil surface): light brown/ uniform/ medium heavy clay/ firm		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus moderata	*Senna artemisioides* subsp. *filifolia*	*Dodonaea rigida*

ALL TAXA
Acacia erinacea
Casuarina pauper
Dodonaea rigida
Eremophila oldfieldii
Eucalyptus clelandiorum
Eucalyptus griffithsii
Eucalyptus moderata
Grevillea acuaria
Santalum spicatum
Scaevola spinescens
Senna artemisioides subsp. *filifolia*
Westringia rigida

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 108-110
Quadrat No: KNGP3	**Quadrat size/shape:** 20x20m	**Elevation (m):** 431
Coordinates (GDA94): 51 J 334541 6644816		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Ironstone/ 50-90%/ 2-6mm/angular & subrounded		
Rock outcrop (abundance/runoff): nil/ moderately rapid		
Soil (profile/field texture/soil surface): Red brown/ uniform/ heavy clay/ firm		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Acacia tetragonophylla*	*Scaevola spinescens*

ALL TAXA
Acacia erinacea
Acacia tetragonophylla
Casuarina pauper
Dodonaea lobulata
Eremophila clarkei
Exocarpos aphyllus
Olearia muelleri
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp. *filifolia*

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 130-132
Quadrat No: KNGP10	**Quadrat size/shape:** 20x20m	**Elevation (m):** 427
Coordinates (GDA94): 51 J 334364 6644577		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Ironstone/ >90%/2-6mm/subrounded		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Heavy Clay/ Firm		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Chenopod Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salmonophloia	*Acacia hemiteles*	*Maireana triptera*

ALL TAXA
Acacia hemiteles
Eremophila scoparia
Eucalyptus salmonophloia
Exocarpos aphyllus
Maireana georgei
Maireana trichoptera
Maireana triptera
Ptilotus obovatus
Scaevola spinescens

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 133-135
Quadrat No: KNGP11	**Quadrat size/shape:** 20x20m	**Elevation (m):** 432
Coordinates (GDA94): 51 J 334659 6644420		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Ironstone/ 50-90%/ 2-6mm/ rounded		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Heavy Clay/ Firm		
%Cover leaf litter: 40		
%Cover bare ground: 60		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salmonophloia	*Eremophila scoparia*	*Acacia erinacea*

ALL TAXA
Acacia erinacea
Acacia hemiteles
Acacia tetragonophylla
Atriplex bunburyana
Austrostipa elegantissima
Eremophila dempsteri
Eremophila oldfieldii
Eremophila scoparia
Eucalyptus salmonophloia
Exocarpos aphyllus
Maireana georgei
Maireana platycarpa
Olearia muelleri
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp. *filifolia*

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 136-138
Quadrat No: KNGP12	**Quadrat size/shape:** 20x20m	**Elevation (m):** 434
Coordinates (GDA94): 51 J 334881 6644243		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Ironstone/ 20-50%/ 6-20mm/ subrounded		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Heavy Clay/ Firm		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia caesaneura	*Dodonaea rigida*	*Scaevola spinescens*

ALL TAXA
Acacia acuminata
Acacia caesaneura
Dodonaea lobulata
Dodonaea rigida
Eragrostis eriopoda
Eucalyptus oleosa
Prostanthera althoferi subsp. *althoferi*
Prostanthera campbellii
Scaevola spinescens
Westringia rigida

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 158-160
Quadrat No: KNGP17	**Quadrat size/shape:** 20x20m	**Elevation (m):** 439
Coordinates (GDA94): 51 J 335379 6643613		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Gravel/ 20-50%/ 20-60mm/ subrounded		
Rock outcrop (abundance/runoff): Nil/ moderately rapid		
Soil (profile/field texture/soil surface): Brown/ Uniform/ Silty Loam/ Firm		
%Cover leaf litter: 40		
%Cover bare ground: 60		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus clelandiorum	*Eremophila pustulata*	*Scaevola spinescens*

ALL TAXA
Cryptandra aridicola
Dodonaea rigida
Eremophila pustulata
Eremophila sp. Mt Jackson (G.J. Keighery 4372)
Eucalyptus celastroides subsp. *celastroides*
Eucalyptus clelandiorum
Grevillea acuaria
Hovea acanthoclada
Maireana triptera
Melaleuca lateriflora
Ptilotus obovatus
Scaevola spinescens
Westringia rigida

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 161-163
Quadrat No: KNGP18	**Quadrat size/shape:** 20x20m	**Elevation (m):** 437
Coordinates (GDA94): 51 J 335071 6643985		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Ironstone/ 50-90%/ 6-20mm/ subrounded		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Heavy Clay/ Firm		
%Cover leaf litter: 20		
%Cover bare ground: 80		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus clelandiorum	*Dodonaea viscosa* subsp. *angustissima*	*Scaevola spinescens*
ALL TAXA		
Acacia erinacea		
Dodonaea viscosa subsp. *angustissima*		
Eremophila oldfieldii		
Eucalyptus celastroides subsp. *celastroides*		
Eucalyptus clelandiorum		
Scaevola spinescens		
Westringia rigida		

Project Name: KNGP		
Date: 03/09/2020	**Botanist:** JW	**Photos:** 164-166
Quadrat No: KNGP19	**Quadrat size/shape:** 20x20m	**Elevation (m):** 435
Coordinates (GDA94): 51 J 335005 6643750		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 20-50%/ 20-60mm/ subrounded		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Light brown/ Uniform/ Silty Clay Loam/ Firm		
%Cover leaf litter: 20		
%Cover bare ground: 80		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %**: <10	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Eremophila oldfieldii*	*Scaevola spinescens*

ALL TAXA
Acacia erinacea
Alyxia buxifolia
Casuarina pauper
Dodonaea viscosa subsp. *angustissima*
Eremophila oldfieldii
Grevillea acuaria
Maireana georgei
Santalum spicatum
Scaevola spinescens
Westringia rigida

Project Name: Scotia Borefield		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 216-218
Quadrat No: SB1	**Quadrat size/shape:** 20x20m	**Elevation (m):** 421
Coordinates (GDA94): 51 J 336218 6643156		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: 20-50%/ 20-60mm/ angular		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red brown/ Uniform/ Heavy Clay		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus clelandiorum	*Senna ?cardiosperma*	*Ptilotus obovatus*

ALL TAXA
Atriplex nummularia subsp. *spathulata*
Eremophila oldfieldii
Eremophila parvifolia subsp. *auricampa*
Eucalyptus clelandiorum
Maireana trichoptera
Pittosporum angustifolium
Ptilotus obovatus
Rhagodia eremaea
Senna ?cardiosperma

Project Name: Scotia Borefield		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 219-221
Quadrat No: SB2	**Quadrat size/shape:** 20x20m	**Elevation (m):** 430
Coordinates (GDA94): 51 J 336323 6643215		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 20-50%/ 20-60mm/ angular		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Light brown/ Uniform/ Medium Clay/ Firm		
%Cover leaf litter: 20		
%Cover bare ground: 80		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Senna cardiosperma*	*Ptilotus obovatus*

ALL TAXA
Acacia erinacea
Acacia jennerae
Acacia tetragonophylla
Casuarina pauper
Dodonaea lobulata
Eremophila oldfieldii
Maireana georgei
Maireana trichoptera
Ptilotus obovatus
Rhagodia eremaea
Scaevola spinescens
Sclerolaena diacantha
Senna artemisioides subsp. *filifolia*
Senna cardiosperma

Project Name: Scotia Borefield		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 222-224
Quadrat No: SB3	**Quadrat size/shape:** 20x20m	**Elevation (m):** 416
Coordinates (GDA94): 51 J 336752 6643363		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Greenstone/ 10-20%/ 6-20mm/ subangular		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Heavy Clay/ Firm		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Chenopod Shrub	**Growth form:** Chenopod Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salmonophloia	*Atriplex nummularia* subsp. *spathulata*	*Atriplex bunburyana*

ALL TAXA
Atriplex bunburyana
Atriplex nummularia subsp. *spathulata*
Enchylaena tomentosa
Eremophila glabra
Eucalyptus salmonophloia
Maireana georgei
Maireana trichoptera
Maireana triptera
Senna artemisioides subsp. *filifolia*
Senna cardiosperma

Project Name: Scotia Borefield		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 225-227
Quadrat No: SB4	**Quadrat size/shape:** 20x20m	**Elevation (m):** 413
Coordinates (GDA94): 51 J 336612 6643618		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Greenstone/ 10-20%/ 6-20mm/ angular tabular		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Heavy Clay/ Firm		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Chenopod Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salmonophloia	*Atriplex nummularia* subsp. *spathulata*	*Senna artemisioides* subsp. *filifolia*

ALL TAXA
Acacia hemiteles
Acacia tetragonophylla
Atriplex bunburyana
Atriplex nummularia subsp. *spathulata*
Dodonaea lobulata
Enchylaena tomentosa
Eucalyptus salmonophloia
Exocarpos aphyllus
Maireana georgei
Olearia muelleri
Ptilotus obovatus
Scaevola spinescens
Sclerolaena diacantha
Senna artemisioides subsp. *filifolia*
Senna cardiosperma

Project Name: Scotia Borefield		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 228-230
Quadrat No: SB5	**Quadrat size/shape:** 20x20m	**Elevation (m):** 420
Coordinates (GDA94): 51 J 336261 6643613		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Very Good
Landform: Hillslope		
Coarse fragments on the surface: Greenstone/ 50-90%/ 20-60mm/ subangular		
Rock outcrop (abundance/runoff): Nil/ Moderately rapid		
Soil (profile/field texture/soil surface): Grey Brown/ Clay-Loam/ Hard setting		
%Cover leaf litter: 20		
%Cover bare ground: 80		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Casuarina pauper	*Senna artemisioides* subsp. *filifolia*	*Ptilotus obovatus*

ALL TAXA
Acacia jennerae
Casuarina pauper
Dodonaea lobulata
Pittosporum angustifolium
Ptilotus obovatus
Rhagodia eremaea
Scaevola spinescens
Sclerolaena diacantha
Senna artemisioides subsp. *filifolia*
Sida calyxhymenia

Project Name: Scotia Borefield		
Date: 06/09/2020	**Botanist:** JW	**Photos:** 231-233
Quadrat No: SB6	**Quadrat size/shape:** 20x20m	**Elevation (m):** 414
Coordinates (GDA94): 51 J 336229 6644189		**Accuracy:** 1m
Aspect: SE	**Fire (yrs):** >40	**Condition rating:** Good
Landform: Flat Plain		
Coarse fragments on the surface: Greenstone/ 20-50%/ 6-20mm/ subrounded		
Rock outcrop (abundance/runoff): Nil/ moderately rapid		
Soil (profile/field texture/soil surface): Red/ Uniform/ Firm		
%Cover leaf litter: 30		
%Cover bare ground: 70		
Upper stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree	**Growth form:** Chenopod Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** <1m
Crown cover %: 10-30	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus salmonophloia	*Atriplex nummularia* subsp. *spathulata*	*Ptilotus obovatus*

ALL TAXA
Atriplex bunburyana
Atriplex nummularia subsp. *spathulata*
Eremophila scoparia
Eucalyptus salmonophloia
Maireana georgei
Maireana triptera
Olearia muelleri
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp. *filifolia*
Senna cardiosperma
Sida calyxhymenia
Vittadinia eremaea (A)

Appendix 7: Quadrat Photographs

KNGP1			
Direction	East	South-East	South
KNGP2			
Direction	East	South-East	South
KNGP3			
Direction	East	South-East	South

KNGP4			
Direction	East	South-East	South
KNGP5			
Direction	East	South-East	South
KNGP6			
Direction	East	South-East	South

KNGP7			
Direction	East	South-East	South
KNGP8			
Direction	East	South-East	South
KNGP9			
Direction	East	South-East	South

KNGP10			
Direction	East	South-East	South
KNGP11			
Direction	East	South-East	South
KNGP12			
Direction	East	South-East	South

KNGP13			
Direction	East	South-East	South
KNGP14			
Direction	East	South-East	South
KNGP15			
Direction	East	South-East	South

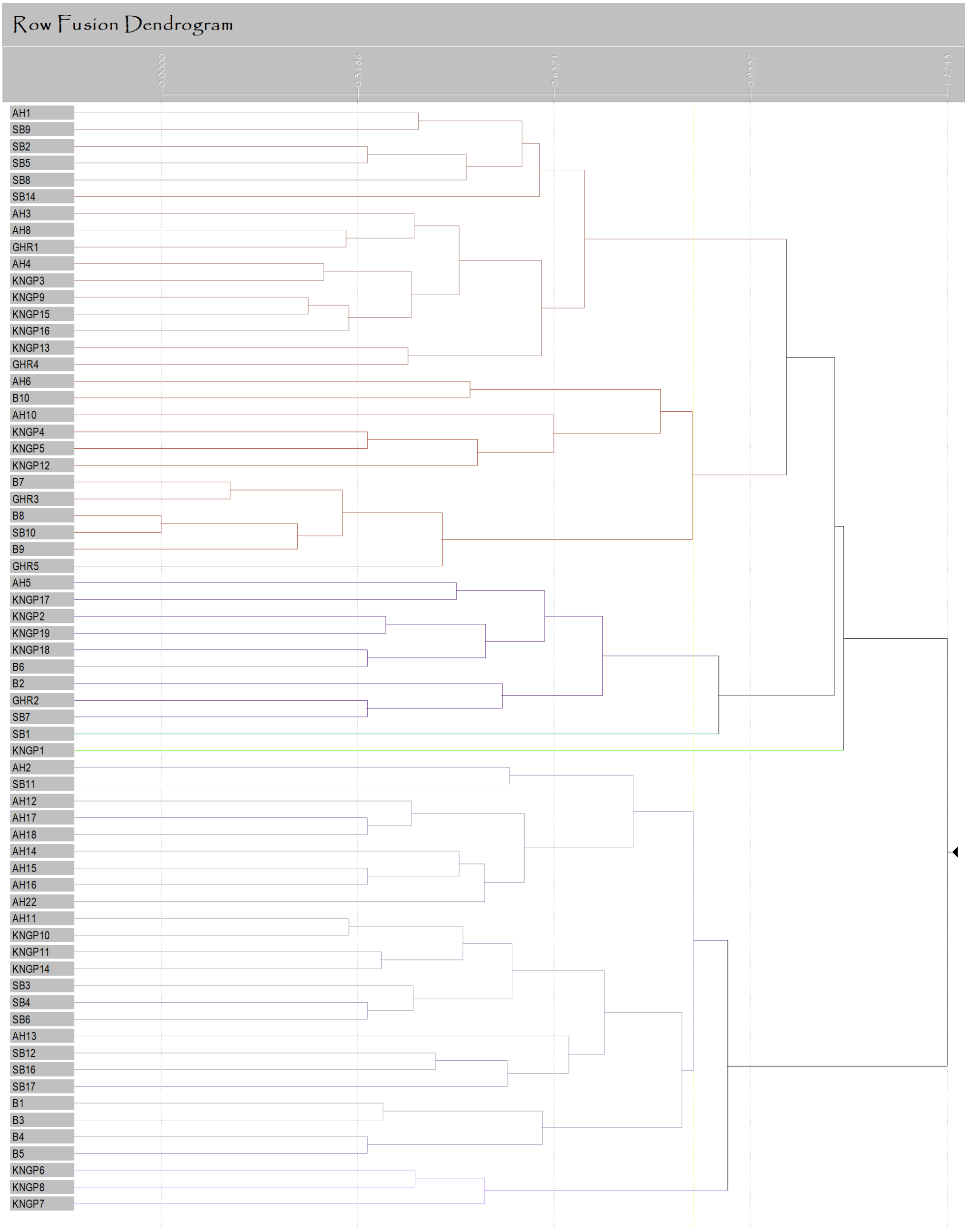
KNGP16			
Direction	East	South-East	South
KNGP17			
Direction	East	South-East	South
KNGP18			
Direction	East	South-East	South

KNGP19			
Direction	East	South-East	South
SB1			
Direction	East	South-East	South
SB2			
Direction	East	South-East	South

SB3			
Direction	East	South-East	South
SB4			
Direction	East	South-East	South
SB5			
Direction	East	South-East	South

SB6			
Direction	East	South-East	South

Appendix 8: PATN Analysis



AH1 SB9 SB2 SB5 SB8 SB14 AH3 AH8 GHR1 AH4 KNGP8 KNGP9 KNGP15 KNGP16 KNGP13 GHR4 AH6 B10 AH10 KNGP4 KNGP5 KNGP12 B7 GHR3 B8 SB10 B9 GHR5 AH6 KNGP17 KNGP2 KNGP19 KNGP18 B6 B2 GHR2 SB7 SB1 KNGP1 AH2 SB11 AH12 AH17 AH16 AH14 AH15 AH16 AH22 AH11 KNGP10 KNGP11 KNGP14 SB3 SB4 SB5 AH13 SB12 SB16 SB17 B1 B3 B4 B5 KNGP5 KNGP6 KNGP7

A

Acacia acuminata
Eremophila clarkei
Marsdenia australis
Solanum lasiophyllum
Acacia erinacea
Eremophila oldfieldii
Eremophila interstans
Acacia hemiteles
Olearia muelleri
Dodonaea lobulata
Scaevola spinescens
Acacia tetragonophylla
Casuarina pauper
Ptilotus obovatus
Senna artemisioides
Acacia quadrimarginea
Amyema preissii
Dodonaea rigida
Westringia rigida
Grevillea acuaria
Eucalyptus grillithsii
Santalum spicatum
Eremophila pustulata
Eucalyptus clelandiorum
Eucalyptus celastroides subsp. celastroides
Eucalyptus moderata
Halgania andromedifolia
Eremophila oppositifolia subsp. angustifolia
Solanum nummularium

B

Atriplex stipitata
Eremophila sp. Mt Jackson (G.J. Keighery 4372)
Cryptandra aridicola
Hovea acanthoclada
Melaleuca lateritia

C

Acacia burkitii
Acacia colletioides
Dodonaea viscosa subsp. angustissima
Acacia ligulata
Maireana planifolia
Acacia ramulosa var. ramulosa
Chenopodium curvispicatum

D

Acacia jennerae
Sclerolaena diacantha
Pittosporum angustifolium
Rhagodia eremaea
Sida calyxhymenia
Atriplex vesicaria
Eremophila glabra
Frankenia serpa
Tecticornia disarticulata
Eremophila parvifolia subsp. auricampi
Sclerolaena uniflora
Atriplex bunburyana
Eremophila scoparia
Eucalyptus salmonophloia
Maireana georgei
Maireana triptera
Exocarpos aphyllus
Maireana trichoptera
Atriplex nummularia subsp. spathulata
Senna cardiosperma
Enchylaena tomentosa
Cratystylis subspinescens
Maireana oppositifolia
Templetonia incrassata
Eucalyptus salubris
Maireana pyramidata
Maireana sedifolia
Alectryon oleifolius
Ptilotus holosericeus
Eremophila decipiens
Santalum acuminatum
Austrostipa elegantissima
Maireana platycarpa
Eremophila dempsteri
Maireana glomerifolia
Eucalyptus ravida
Sclerolaena parviflora
Pterocaulon sphacelatum
Templetonia sulcata
Sclerolaena cuneata

E

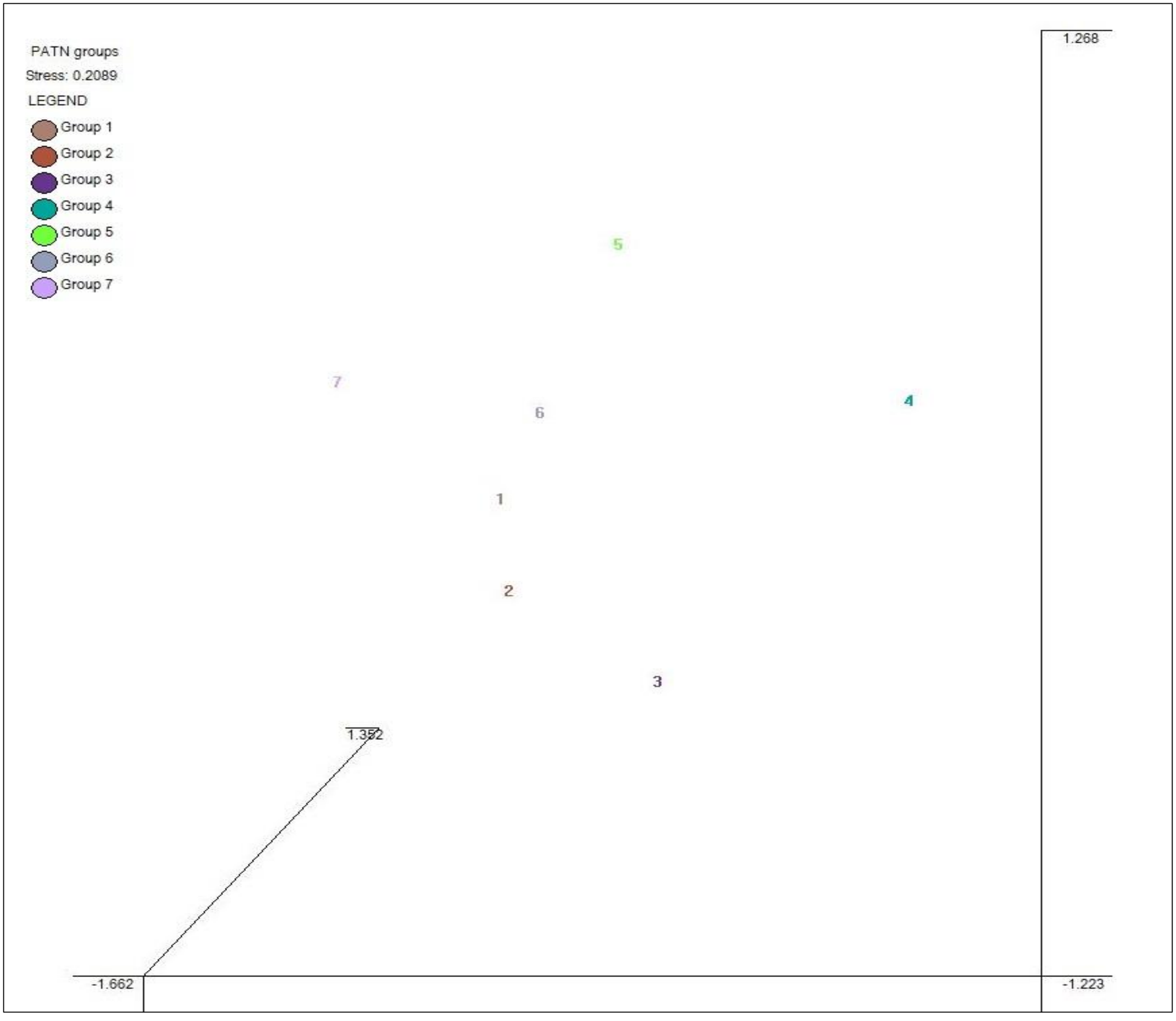
Acacia oswaldii
Sclerolaena eurotioides
Pimelea microcephala

F

Acacia caesaneura
Eucalyptus oleosa
Prostanthera althoferi subsp. althoferi
Prostanthera campbellii
Eragrostis eriopoda
Acacia kempeana
Allocasuarina campestris
Melaleuca hamata
Prostanthera albiflora

G

Acacia collegialis
Grevillea nematophylla subsp. nematophylla
Philotheca brucei
Alyxia buxifolia
Eremophila gibbosa
Eucalyptus flavida
Westringia cephalantha


PATN groups
Stress: 0.2089
LEGEND
Group 1
Group 2
Group 3
Group 4
Group 5
Group 6
Group 7
1.268
5
7
6
4
1
2
3
1.352
-1.662
-1.223

Appendix 9: Potential Fauna List

Potential Vertebrate Fauna List

Bardoc Project, W.A.

Compiled by Greg Harewood - Oct 2020

Recorded (Captured/Sighted/Heard/Signs) = X

Bamford Consulting Ecologists (2012). Fauna Assessment of the Excelsior Gold Bardoc Project. Unpublished report for Excelsior Gold Limited. May 2012.

Harewood, G. (2015). Fauna Survey (Level 2 - Phase 1 and 2) Proposed Tails Storage Facility Expansion. Unpublished report for KCGM Pty Ltd. June 2015.

Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) Proposed Powerline and Infrastucture Areas KCGM - Gidji Operations. Unpublished report for KCGM. January 2012.

Harewood, G. (2010a). Terrestrial Fauna Survey (Level 1) of the proposed Isabella Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.

Harewood, G. (2010b). Terrestrial Fauna Survey (Level 1) of the proposed Golden Valley Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.

Harewood, G. (2010c). Terrestrial Fauna Survey (Level 1) of the proposed Fenceline Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.

KLA (2009a). Barrick (Kanowna) Shamrock Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.

KLA (2009b). Barrick (Kanowna) Crossroads Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.

KLA (2009c). Barrick (Kanowna) Moonlight Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. March 2009.

WAM (1992). The Biological Survey of the Eastern Goldfields of Western Australia. Part 8. The Kurnalpi - Kalgoorlie Study Area. Rec. West. Aust. Mus. Supplement No. 41. (Black Flag Records).

DBCA (2020). NatureMap Database Search – “By Circle” Centre 121° 13' 19" E, 30° 14' 29" S (plus 40km buffer). Accessed 27/09/2020.

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Amphibia									
Myobatrachidae Ground or Burrowing Frogs									
Neobatrachus kunapalari	Kunapalari Frog	LC	X	X					X
Neobatrachus pelobatoides	Humming Frog	LC						X	
Neobatrachus sutor	Shoemaker Frog	LC		X				X	X
Neobatrachus wilsmorei	Plonking Frog	LC						X	X
Pseudophryne occidentalis	Western Toadlet	LC	X	X					X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions see Appendix A and https://www.iucnredlist.org/resources/categories-and-criteria

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Reptilia									
Carphodactylidae Knob-tailed Geckos									
Nephrurus laevissimus	Smooth Knob-tail	LC							X
Nephrurus vertebralis	Midline Knob-tailed Gecko	LC						X	X
Underwoodisaurus milii	Barking Gecko	LC	X	X				X	X
Diplodactylidae Geckoes									
Diplodactylus conspicillatus	Fat-tailed Gecko	LC							X
Diplodactylus granariensis	Western Stone Gecko	LC		X				X	X
Diplodactylus pulcher	Pretty Gecko	LC		X				X	X
Lucasium damaeum	Beaded Gecko	LC							
Lucasium maini	Main's Ground Gecko	LC		X				X	X
Oedura reticulata	Reticulated Velvet Gecko	LC		X				X	
Rhynchoedura ornata	Western Beaked Gecko	LC		X				X	X
Strophurus assimilis	Thorn-tailed Gecko	LC		X					X
Strophurus elderi	Jewelled Gecko	LC						X	X

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Gekkonidae Geckoes									
Gehyra purpurascens	Purple Arid Dtella	LC		X					X
Gehyra variegata	Variegated Dtella	LC		X				X	X
Heteronotia binoei	Bynoe's Gecko	LC	X	X				X	X
Pygopodidae Legless Lizards									
Delma australis	Marble-faced Delma	LC		X				X	X
Delma butleri	Unbanded Delma	LC						X	X
Lialis burtonis	Burton’s Legless Lizard	LC						X	X
Pygopus lepidopodus	Common Scaly Foot	LC							
Pygopus nigriceps	Hooded Scaly Foot	LC							X

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Agamidae Dragon Lizards									
Caimanops amphiboluroides	Mulga Dragon	LC							
Ctenophorus caudicinctus	Ring-tailed Dragon	LC		X					
Ctenophorus cristatus	Bicycle Dragon	LC		X	X	X	X	X	X
Ctenophorus fordi	Mallee Sand Dragon	LC						X	X
Ctenophorus nuchalis	Central Netted Dragon	LC							
Ctenophorus reticulatus	Western Netted Dragon	LC						X	X
Ctenophorus salinarum	Salt Pan Dragon	LC						X	X
Ctenophorus scutulatus	Lozenge-marked Bicycle Dragon	LC	X		X			X	X
Moloch horridus	Thorny Devil	LC						X	X
Pogona minor	Western Bearded Dragon	LC							X
Tympanocryptis cephalus	Pebble Dragon	LC							
Varanidae Monitor's or Goanna's									
Varanus caudolineatus	Stripe-tailed Pygmy Monitor	LC		X				X	X
Varanus gouldii	Sand Monitor	LC	X	X			X	X	X
Varanus tristis	Racehorse Monitor	LC							X

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Scincidae Skinks									
Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink	LC						X	X
Cryptoblepharus plagiocephalus	Peron's Snake-eyed Skink	LC		X					X
Ctenotus atlas	Southern Mallee Ctenotus	LC						X	X
Ctenotus leonhardii	Leonhardi's Skink	LC						X	X
Ctenotus pantherinus	Leopard Ctenotus	LC							X
Ctenotus schomburgkii	Barred Wedge-snout Ctenotus	LC						X	X
Ctenotus uber	Western Spotted Ctenotus	LC		X				X	X
Cyclodomorphus melanops elongatus	Eastern Slender Blue-tongue	LC						X	
Egernia depressa	Pygmy Spiny-tailed Skink	LC	X						X
Egernia formosa	Goldfields Crevise Skink	LC	X					X	X
Egernia inornata	Desert Skink	LC						X	
Eremiascincus richardsonii	Broad-banded Sand Swimmer	LC							X
Hemiergis initialis initialis	Sth Five-toed Mulch Skink	LC		X					
Hemiergis peronii peronii	Four-toed Earless Skink	LC							
Lerista kingi	King's Three-toed Slider	LC						X	X
Lerista picturata	Goldfields Robust Lerista	LC		X				X	X
Lerista timida	Dwarf Three-toed Slider	LC		X					X
Menetia greyii	Common Dwarf Skink	LC		X				X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions see Appendix A and https://www.iucnredlist.org/resources/categories-and-criteria

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Morethia adelaidensis	Saltbush Flecked Morethia	LC						X	X
Morethia butleri	Woodland Dark-flecked Morethia	LC							X
Morethia obscura	Shrubland Pale-flecked Morethia	LC							
Tiliqua occipitalis	Western Bluetongue	LC		X				X	X
Tiliqua rugosa	Bobtail	LC		X		X	X	X	X
Typhlopidae Blind Snakes									
Ramphotyphlops australis	Southern Blind Snake	LC							
Ramphotyphlops bicolor	Dark-spined Blind Snake	LC							
Ramphotyphlops bituberculatus	Prong-snouted Blind Snake	LC							
Ramphotyphlops hamatus	Northern Hook-snouted Blind Snake	LC							
Ramphotyphlops waitii	Common Beaked Blind Snake	LC							
Boidae Pythons, Boas									
Morelia spilota	Carpet Python	LC							

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Elapidae Elapid Snakes									
Acanthophis pyrrhus	Desert Death Adder	LC							
Brachyurophis fasciolata	Southern Shovel-nosed Snake	LC		X					
Demansia psammophis	Yellow-faced Whipsnake	LC		X					X
Furina ornata	Moon Snake	LC							
Neelaps bimaculatus	Black-naped Snake	LC							
Parasuta gouldii	Gould's Hooded Snake	LC							X
Parasuta monachus	Monk Snake	LC						X	X
Pseudechis australis	Mulga Snake	LC		X					X
Pseudonaja modesta	Ringed Brown Snake	LC						X	X
Pseudonaja nuchalis	Gwardar	LC		X				X	
Simoselaps bertholdi	Jan's Banded Snake	LC		X					X
Suta fasciata	Rosen's Snake	LC							X
Aves									
Casuariidae Emus, Cassowarries									
Dromaius novaehollandiae	Emu	LC	X	X		X	X	X	X
Megapodiidae Moundbuilders									
Leipoa ocellata	Malleefowl	S3 VU VU							X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions see Appendix A and https://www.iucnredlist.org/resources/categories-and-criteria

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Accipitridae Kites, Goshawks, Eagles, Harriers									
Accipiter cirrocephalus	Collared Sparrowhawk	LC							X
Accipiter fasciatus	Brown Goshawk	LC	X		X				X
Aquila audax	Wedge-tailed Eagle	LC	X	X					X
Aquila morphnoides	Little Eagle	LC							
Circus assimilis	Spotted Harrier	LC							X
Elanus caeruleus	Black-shouldered Kite	LC		X					
Haliastur sphenurus	Whistling Kite	LC							X
Hamirostra isura	Square-tailed Kite	LC							
Falconidae Falcons									
Falco berigora	Brown Falcon	LC	X	X				X	X
Falco cenchroides	Australian Kestrel	LC	X	X					X
Falco longipennis	Australian Hobby	LC		X					X
Falco peregrinus	Peregrine Falcon	S7 LC							
Otididae Bustards									
Ardeotis australis	Australian Bustard	LC							X
Turnicidae Button-quails									
Turnix velox	Little Button-quail	LC			X				

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions see Appendix A and https://www.iucnredlist.org/resources/categories-and-criteria

Class **Family** *Species*	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Charadriidae Lapwings, Plovers, Dotterels									
Vanellus tricolor	Banded Lapwing	LC							
Columbidae Pigeons, Doves									
Geopelia cuneata	Diamond Dove	LC							X
Ocyphaps lophotes	Crested Pigeon	LC	X	X	X		X	X	X
Phaps chalcoptera	Common Bronzewing	LC	X	X	X	X			X
Psittacidae Parrots									
Cacatua roseicapilla	Galah	LC		X	X			X	
Cacatua sanguinea	Little Corella	LC							
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC	X	X				X	
Melopsittacus undulatus	Budgerigar	LC			X				X
Nymphicus hollandicus	Cockatiel	LC						X	X
Platycercus varius	Mulga Parrot	LC	X	X				X	
Platycercus zonarius	Australian Ringneck Parrot	LC	X	X	X	X	X	X	X

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Cuculidae Parasitic Cuckoos									
Cacomantis flabelliformis	Fan-tailed Cuckoo	LC							X
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC		X	X			X	
Chrysococcyx osculans	Black-eared Cuckoo	LC							X
Cuculus pallidus	Pallid Cuckoo	LC						X	
Strigidae Hawk Owls									
Ninox novaeseelandiae	Boobook Owl	LC							
Tytonidae Barn Owls									
Tyto alba	Barn Owl	LC							
Podargidae Frogmouths									
Podargus strigoides	Tawny Frogmouth	LC	X	X					X
Caprimulgidae Nightjars									
Eurostopodus argus	Spotted Nightjar	LC							X
Aegothelidae Owlet-nightjars									
Aegotheles cristatus	Australian Owlet-nightjar	LC							X

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Halcyonidae Tree Kingfishers									
Todiramphus pyrrhopygia	Red-backed Kingfisher	LC		X		X			
Todiramphus sanctus	Sacred Kingfisher	LC							X
Meropidae Bee-eaters									
Merops ornatus	Rainbow Bee-eater	JA LC		X	X	X	X	X	X
Climacteridae Treecreepers									
Climacteris affinis	White-browed Treecreeper	LC							X
Climacteris rufa	Rufous Treecreeper	LC						X	
Maluridae Fairy Wrens, GrassWrens									
Malurus lamberti	Variegated Fairy-wren	LC				X			
Malurus leucopterus	White-winged Fairy-wren	LC	X	X	X			X	X
Malurus pulcherrimus	Blue-breasted Fairy-wren	LC				X			X
Malurus splendens	Splendid Fairy-wren	LC	X	X	X	X			X

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Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces									
Acanthiza apicalis	Broad-tailed Thornbill	LC	X	X	X	X		X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	LC	X	X		X		X	X
Acanthiza uropygialis	Chestnut-rumped Thornbill	LC	X	X	X	X		X	X
Aphelocephala leucopsis	Southern Whiteface	LC		X					X
Calamanthus campestris	Rufous Fieldwren	LC							
Gerygone fusca	Western Gerygone	LC			X				X
Pyrrholaemus brunneus	Redthroat	LC	X	X	X				X
Smicrornis brevirostris	Weebill	LC	X	X	X	X	X	X	X
Pardalotidae Pardalotes									
Pardalotus punctatus	Spotted Pardalote	LC							
Pardalotus striatus	Striated Pardalote	LC	X	X	X	X	X	X	X

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Meliphagidae Honeyeaters, Chats									
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	LC	X	X	X			X	X
Anthochaera carunculata	Red Wattlebird	LC	X	X	X	X	X	X	X
Certhionyx variegatus	Pied Honeyeater	LC							X
Epthianura albifrons	White-fronted Chat	LC							X
Epthianura tricolor	Crimson Chat	LC							X
Lichenostomus leucotis	White-eared Honeyeater	LC	X	X	X			X	X
Lichenostomus ornatus	Yellow-plumed Honeyeater	LC	X	X	X	X			
Lichenostomus plumulus	Grey-fronted Honeyeater	LC	X	X					
Lichenostomus virescens	Singing Honeyeater	LC	X	X	X			X	
Lichmera indistincta	Brown Honeyeater	LC	X	X	X	X		X	X
Manorina flavigula	Yellow-throated Miner	LC	X	X	X	X	X	X	X
Melithreptus brevirostris	Brown-headed Honeyeater	LC	X	X					X
Phylidonyris albifrons	White-fronted Honeyeater	LC	X	X	X	X		X	
Petroicidae Australian Robins									
Eopsaltria australis griseogularis	Western Yellow Robin	LC							
Microeca fascinans	Jacky Winter	LC	X	X	X	X		X	X
Petroica cucullata	Hooded Robin	LC						X	
Petroica goodenovii	Red-capped Robin	LC	X	X		X	X	X	X

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Pomatostomidae Babblers									
Pomatostomus superciliosus	White-browed Babbler	LC	X	X				X	X
Cinclosomatidae Whipbirds, Wedgebills, Quail Thrushes									
Cinclosoma castanotus	Chestnut Quail-thrush	LC		X	X				
Neosittidae Sitellas									
Daphoenositta chrysoptera	Varied Sittella	LC		X				X	X
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers									
Colluricincla harmonica	Grey Shrike-thrush	LC	X	X	X		X	X	X
Oreoica gutturalis	Crested Bellbird	LC	X	X	X	X	X	X	X
Pachycephala inornata	Gilbert's Whistler	LC	X	X					X
Pachycephala rufiventris	Rufous Whistler	LC	X	X					X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo									
Grallina cyanoleuca	Magpie-lark	LC		X	X				X
Rhipidura fuliginosa	Grey Fantail	LC							
Rhipidura leucophrys	Willie Wagtail	LC		X		X	X		X

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Campephagidae Cuckoo-shrikes, Trillers									
Coracina maxima	Ground Cuckoo-shrike	LC							X
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC	X	X	X	X		X	X
Lalage tricolor	White-winged Triller	LC		X				X	
Artamidae Woodswallows, Butcherbirds, Currawongs									
Artamus cinereus	Black-faced Woodswallow	LC	X					X	X
Artamus cyanopterus	Dusky Woodswallow	LC		X	X	X			X
Artamus minor	Little Woodswallow	LC							X
Artamus personatus	Masked Woodswallow	LC							X
Artamus superciliosus	White-browed Woodswallow	LC							
Cracticidae Currawongs, Magpies & Butcherbirds									
Cracticus nigrogularis	Pied Butcherbird	LC		X	X	X	X	X	X
Cracticus tibicen	Australian Magpie	LC	X	X		X	X	X	X
Cracticus torquatus	Grey Butcherbird	LC	X	X	X	X		X	X
Strepera versicolor	Grey Currawong	LC	X	X	X		X	X	X

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Corvidae Ravens, Crows									
Corvus bennetti	Little Crow	LC							X
Corvus coronoides	Australian Raven	LC	X	X	X		X		X
Corvus orru	Torresian Crow	LC							X
Corvus sp	Corvid	LC						X	
Motacillidae Old World Pipits, Wagtails									
Anthus australis	Australian Pipit	LC		X				X	
Estrilidae Grass Finches & Mannikins									
Taeniopygia guttata	Zebra Finch	LC							X
Dicaeidae Flowerpeckers									
Dicaeum hirundinaceum	Mistletoebird	LC	X	X					X
Hirundinidae Swallows, Martins									
Cheramoeca leucosternus	White-backed Swallow	LC		X					
Hirundo ariel	Fairy Martin	LC							
Hirundo neoxena	Welcome Swallow	LC		X		X		X	X
Hirundo nigricans	Tree Martin	LC		X				X	

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Sylviidae Old World Warblers									
Cincloramphus cruralis	Brown Songlark	LC						X	
Cincloramphus mathewsi	Rufous Songlark	LC							
Zosteropidae White-eyes									
Zosterops lateralis	Silvereye	LC							
Mammalia									
Tachyglossidae Echidnas									
Tachyglossus aculeatus	Echidna	LC	X	X		X	X		
Dasyuridae Carnivorous Marsupials									
Antechinomys laniger	Kultarr	DD							X
Ningaui yvonneae	Southern Ningaui	LC							X
Sminthopsis crassicaudata	Fat-tailed Dunnart	LC						X	X
Sminthopsis dolichura	Little long-tailed Dunnart	LC		X				X	X
Sminthopsis gilberti	Gilbert's Dunnart	LC							X
Sminthopsis ooldea	Ooldea Dunnart	LC		X					X
Burramyidae Pygmy Possums									
Cercartetus concinnus	Western Pygmy-possum	LC		X				X	X

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Macropodidae Kangaroos, Wallabies									
Macropus fuliginosus	Western Grey Kangaroo	LC	X	X	X		X	X	
Macropus robustus	Euro	LC				X			X
Macropus rufus	Red Kangaroo	LC		X		X		X	
Emballonuridae Sheath-tailed Bats									
Taphozous hilli	Hill's Sheathtail-bat	LC		X					
Molossidae Freetail Bats									
Austronomus australis	White-striped Freetail-bat	LC	X	X				X	
Ozimops petersi	Inland Freetail-bat	LC	X	X				X	
Vespertilionidae Ordinary Bats									
Chalinolobus gouldii	Gould's Wattled Bat	LC	X	X				X	X
Chalinolobus morio	Chocolate Wattled Bat	LC		X				X	
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC		X				X	X
Nyctophilus major tor	Central Long-eared Bat	P3							
Scotorepens balstoni	Inland Broad-nosed Bat	LC		X				X	X
Vespadelus baverstocki	Inland Forest Bat	LC		X					X
Vespadelus finlaysoni	Finlayson's Cave Bat	LC		X					
Vespadelus regulus	Southern Forest Bat	LC		X				X	X

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Muridae Rats, Mice									
Mus musculus	House Mouse	Introduced	X	X				X	X
Pseudomys bolami	Bolam's Mouse	LC		X					X
Pseudomys hermannsburgensis	Sandy Inland Mouse	LC							X
Canidae Dogs, Foxes									
Canis lupus	Dingo/Dog	Introduced		X					
Vulpes vulpes	Red Fox	Introduced	X						X
Felidae Cats									
Felis catus	Cat	Introduced	X	X					
Bovidae Horned Ruminants									
Bos taurus	European Cattle	Introduced		X					
Capra hircus	Goat	Introduced	X	X		X	X		X
Ovis aries	Sheep	Introduced		X			X		
Leporidae Rabbits, Hares									
Oryctolagus cuniculus	Rabbit	Introduced	X	X	X	X	X		X

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