MWH

BUILDING A BETTER WORLD

CMGP Reedy Project Dewatering Program - Level 1 Flora and Fauna Survey

Prepared for Metals X Group

May 2015

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1	25/05/15	Draft Report	KB	CK, MS	PB	SW
2	26/05/15	Final Report	PB	PB	SW	SW

Executive Summary

Metals X Limited (Metals X) is seeking approval to undertake operations at the Central Murchison Gold Project (CMGP) comprising six areas between Meekatharra and Cue in Western Australia. The Reedy Project (the Project) is located approximately 60 km north east of Cue. Approvals are being sought to undertake operations at the Project comprising three open pit extensions (North Rand, Jack Ryan and Callisto) and two underground developments (Rand and Triton).

Metals X commissioned MWH Australia (MWH) to undertake a Level 1 Flora and Fauna assessment to inform the approvals process for the Reedy Project Dewatering. The Study Area comprised three sections North Reedy, Central Reedy and South Reedy. The specific objectives of this Survey were to:

- undertake a desktop study of the Study Area to develop an inventory of the flora and vertebrate fauna species identified or likely to be present;
- define and delineate broad vegetation units and fauna habitats present within the Study Area and assess their suitability to support flora and fauna of conservation significance; and
- verify the results of the desktop study and investigate the likelihood of occurrence for flora, vegetation and vertebrate fauna of conservation significance within the Study Area.

Flora and Vegetation

The desktop study did not identify any flora taxa of conservation significance that have previously been recorded within the Study Area; however 41 taxa were recorded as occurring within 30 km of the Study Area. No Threatened or Priority Ecological Communities were identified by the desktop study as occurring within 30 km of the Study Area.

A total of 101 vascular flora taxa were recorded within the Study Area, representing 27 families and 53 genera. The most represented families were Fabaceae (18 taxa), Poaceae (17), and Chenopodiaceae (12). The most represented genera were *Acacia* (12 taxa), *Ptilotus* (9) and *Eremophila* (9).

No Threatened flora taxa were recorded at the Study Area. One potential Priority 3 (P3) flora taxon, *Ptilotus beardii*, was recorded at a single location within the Study Area. A collection specimen of this taxon is currently undergoing verification at the Western Australian Herbarium to confirm its identity.

Seven taxon were only partially identified as due to lack of reproductive material. These were

- Portulacaceae sp.
- *Eragrostis* sp.
- *Ptilotus* sp.
- *Maireana* sp.
- *Calandrinia* sp.
- *Eremophila* sp.
- *Scaevola* ?*spinescens*

An additional collection representing a Mulga hybrid, was identified as *Acacia* ? *caesaneura x incurvaneura*, matched the specimen of the same name at the Western Australian Herbarium.

Three introduced flora taxa, **Cucumis myriocarpus* (Prickly Paddy Melon), **Cynodon dactylon* (Couch) and **Sonchus oleraceus* (Common Sowthistle), were recorded in the Study Area,. There were no taxa listed as Declared Pests under the Biosecurity and Agricultural Management (BAM) Act 2007 (WA). There were no taxa listed as Weeds of National Significance (WONS) (Department of Environment 2015) recorded within the Study Area.

Fauna

Excluding areas of disturbance associated with the minesite, five broad fauna habitats were identified during the field survey. These habitats were:

- Low Open Mulga Woodland;
- Open Eremophila Shrubland;
- Stony Rise;
- Stony Plain; and
- Drainage Lines.

In addition to the broad habitats, there were two small areas of Ephemeral Wetland habitat located in the central section of the Study Area. Each of the broad habitats are widespread and well represented in the Murchison bioregion, however the Ephemeral Wetland habitat may be of local significance.

No conservation significant fauna were recorded during the survey, however seven species of conservation significance are considered likely or possible to occur on the basis of habitat present in the study area and the location of previous records.

Two fauna considered 'Likely' to occur in the Study Area comprised:

- Rainbow Bee-eater (*Merops ornatus*), which is listed as Migratory (EPBC Act) and Schedule 3 (WC Act); and
- *Lerista eupoda*, which is listed as Priority 1 Fauna (DPaW).

Five fauna considered 'Possible' to occur in the Study Area comprised:

- Fork-tailed Swift (*Apus pacificus*), Eastern Great Egret (*Ardea modesta*), Glossy Ibis (*Plegadis falcinellus*), which are listed as Migratory (EPBC Act) and Schedule 3 (WC Act);
- Grey Falcon (*Falco hypoleucos*), which is listed as Schedule 1 (WC Act); and

- Peregrine Falcon (*Falco peregrinus*), which is listed as Schedule 4 (WC Act).

Based on the proposed dewatering operations for the northern and southern portion of the Study Area, there are unlikely to be any significant impacts to any fauna species including any conservation significant species.

Limitations

The desktop study and field survey are considered complete for a Level 1 Flora and Fauna Assessment. The weather during the survey was mild and considered appropriate for the survey. There were no access, time or resource limitations during the study.

Metals X Group

CMGP Reedy Project Dewatering Program - Level 1 Flora and Fauna Survey

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1.1 Project Background and Location

Metals X Limited (Metals X) is currently seeking approval to undertake operations at the Central Murchison Gold Project (CMGP) comprising six areas between Meekatharra and Cue in Western Australia. The Reedy Project (the Project) is located approximately 60 km north east of Cue (**Figure 1-1**). Approvals are currently being sought to undertake operations at the Project comprising three open pit extensions (North Rand, Jack Ryan and Callisto) and two underground developments (Rand and Triton).

Metals X commissioned MWH Australia (MWH) to undertake a Level 1 Flora and Fauna assessment to inform the approvals process for the Reedy Project Dewatering (the Study Area). The Study Area comprised three sections North Reedy, Central Reedy and South Reedy (**Figure 1-2**).

1.2 Report Scope and Objectives

The overarching objectives for the Project was to undertake a Level 1 Flora, Vegetation and Fauna Habitat assessment and to establish photo monitoring points suitable for assessing impacts to the environment proposed to act as the receiving location for pit dewatering. The information obtained from the survey has been structured in order to complement and support the findings of a hydrological study conducted by Rockwater Pty Ltd for the dewatering program.

The specific objectives of the Project were to:

- Complete a desktop review of database searches in the area;
- Describe the vegetation communities, fauna habitats and their condition by means of a field survey of the specific drainage paths;
- Delineate and map vegetation communities, vegetation condition and fauna habitats in the Study Area;
- Establish photo points along the prescribed drainage paths which will enable the health of vegetation to be monitored over time; and
- Describe the soil types that occur within the Study Area.

The objectives and survey methods adopted for this survey were aligned with relevant regulatory guidelines including:

- Environmental Protection Authority (EPA) Position Statement No. 2 *Environmental Protection of Native Vegetation in Australia* (2000)*;*
- EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (2002)*;*

- EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004b)*;*
- EPA Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (2004a)*;* and
- EPA and Department of Parks and Wildlife (DPaW) *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (2010).

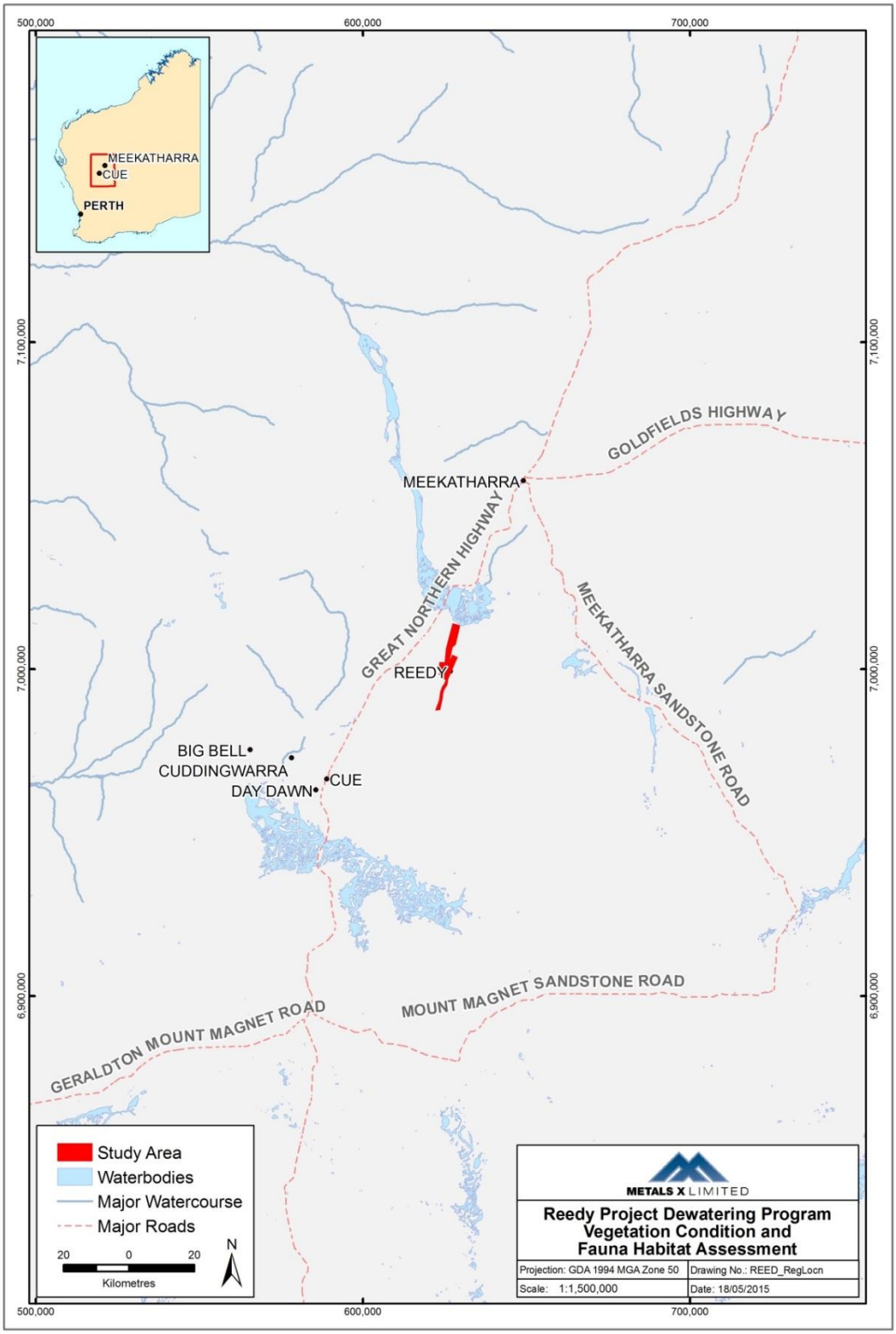

Figure 1-1: Regional Location of the Study Area

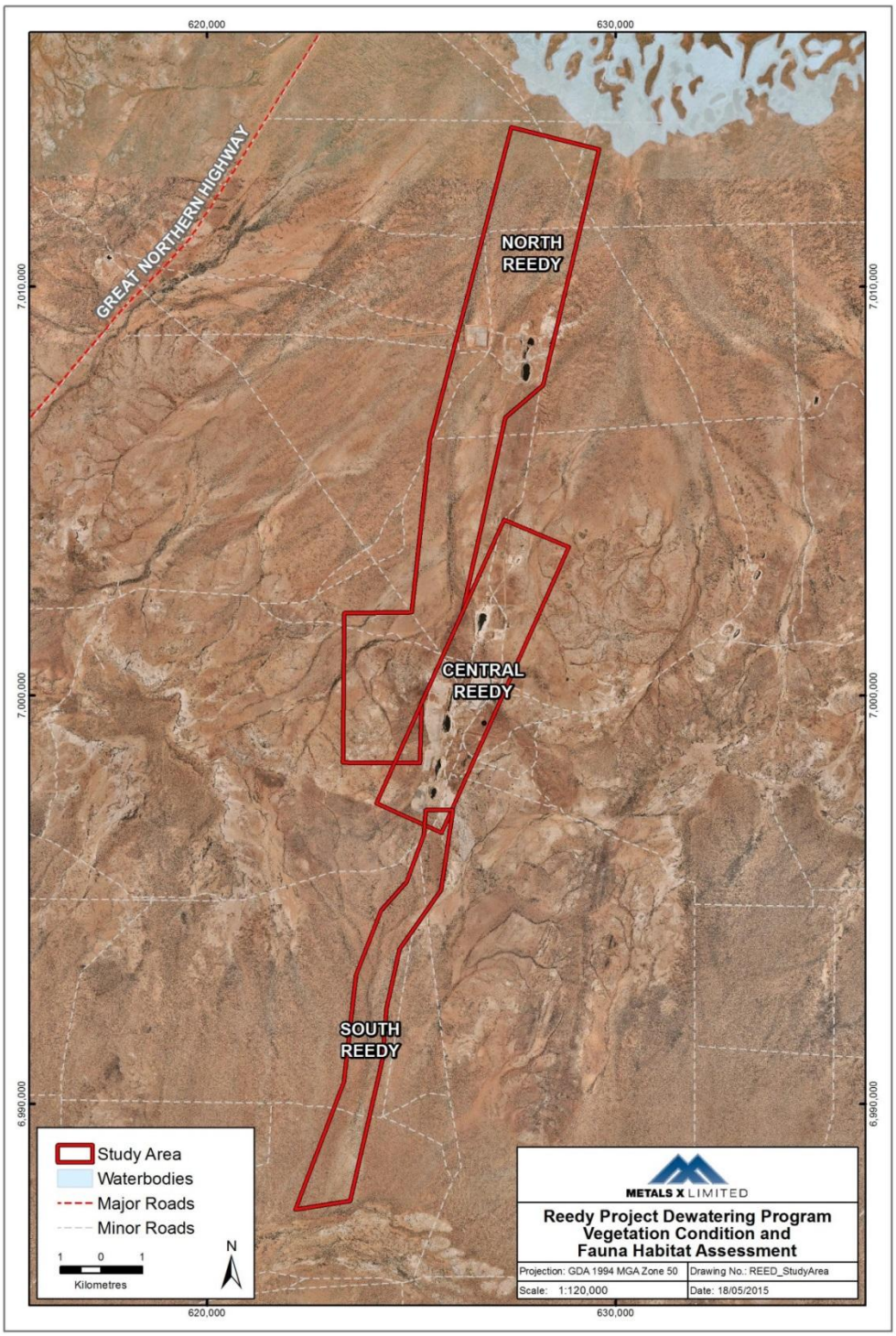

Figure 1-2: The Study Area

2 Existing Environment

2.1 Biogeographic Region

The Study Area is located in the Murchison bioregion, as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) classification system (Thackway and Cresswell 1995) (**Figure 2-1**). The Murchison bioregion covers an area of 278,360 km^2 encompassing the transitional zone between the Eucalypt dominated environs of south-west Western Australia and the Mulga spinifex dominated areas of central Australia (Morton *et al.* 1995). The bioregion contains several large ephemeral wetlands which provide refuge for waterbirds. The vegetation in the bioregion is closely associated with geology, soils and climate. Areas of outcropping rock with skeletal soils support Mulga low woodlands. Hummock grassland grows predominately on calcareous soils and samphire (*Halosarcia* spp.) low shrubland mostly on the saline alluvium areas. In the east of the bioregion, the red sand plains support Mallee-Mulga parkland over hummock grassland (Thackway and Cresswell 1995).

The Murchison bioregion is comprised of the East Murchison (MUR1) and the West Murchison (MUR2) subregions. The majority of the Study Area, (4381 ha, 83%), lies within the East Murchison subregion with the remainder positioned within the West Murchison subregion (873 ha, 17%) (**Figure 2-1**). The Eastern Murchison subregion is dominated by extensive areas of elevated red/red-brown desert sandplains with minimal dune development, breakaway complexes and internal drainage and salt lake systems associated with the occluded Palaeodrainage system (Cowan *et al.* 2001). In contrast, the Western Murchison subregion is dominated by extensive hardpan washplains, along with calcareous soils and saline alluvia (Desmond *et al.* 2001). Both the Eastern and Western subregions are dominated by mulga woodlands rich in ephemerals, along with hummock grasslands and saltbush shrublands. *Tecticornia* and *Halosarcia* shrublands are common in the Eastern and Western Murchison subregions, respectively. While the Eastern Murchison subregion drains internally, the Western Murchison subregion contains the headwaters of the Murchison and Wooramel Rivers, which drain the subregion westwards to the ocean (Cowan *et al.* 2001, Desmond *et al.* 2001).

Figure 2-1: IBRA region

2.2 Land Systems

An assessment of land systems provides an indication of the occurrence and distribution of fauna habitats and vegetation within and surrounding the Study Area. The Western Australian Department of Agriculture completed a regional survey of land systems occurring within the Murchison to provide a comprehensive description of biophysical resources within the area (Pringle *et al.* 1994). The Study Area is spread across ten land systems with Yanganoo comprising 42% (**Table 2-1**, **Figure 2-2**). This land system is characterised by "*Almost flat hardpan wash plains, with or without small wanderrie banks and showing variable development of weak graving; supports mulga shrublands.*"

Table 2-1: Land Systems within and surrounding the Study Area

Land System	Description	Hectares (% of Study Area)
Yanganoo	Almost flat hardpan wash plains, with or without small wanderrie banks and showing variable development of weak gravelling; supports mulga shrublands.	2211.3 (42%)
Violet	Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved mulga and bowgada shrublands and occasionally chenopod shrublands	921.7 (17.5%)
Jundee	Hardpan wash plains with variable dark gravelly mantling and weakly groved vegetation; minor sandy banks; supports scattered mulga shrublands.	714.3 (13.6%)
Wiluna	Low greenstone hills with occasional lateritic breakaways and broad stony slopes, lower saline stony plains and broad drainage tracts; supporting sparse mulga and other acacia shrublands with patches of halophytic shrubs.	501.2 (9.5%)
Gabanintha	Ridges, hills and footslopes of various metamorphosed volcanic rocks (greenstones), supporting sparse acacia and other mainly non-halophytic shrub lands.	300.1 (5.7%)
Sherwood	Breakaways, kaolinised footslopes and extensive gently sloping plains on granite supporting mulga shrublands and minor halophytic shrublands.	288.8 (5.5%)
Millex	Plains on granite, with irregularly distributed low sandy banks and saline alluvial plains lightly strewn with quartz mantles; supporting mulga shrublands and low halophytic shrublands	181.1 (3.4%)
Mindura	Low hills, ridges and outcrops of granite, gneiss and quartz above convex, quartz-strewn interfluves and lower plains supporting sparse acacia shrublands becoming more dense in drainage floors.	131.9 (2.5%)
Carnegie	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.	3.7 (0.1%)
Cunyu	Calcrete platforms, intervening drainage floors and channels and minor alluvial plains, supporting acacia shrublands, occasional casuarina woodlands and minor halophytic shrublands.	0.1 (<0.1%)

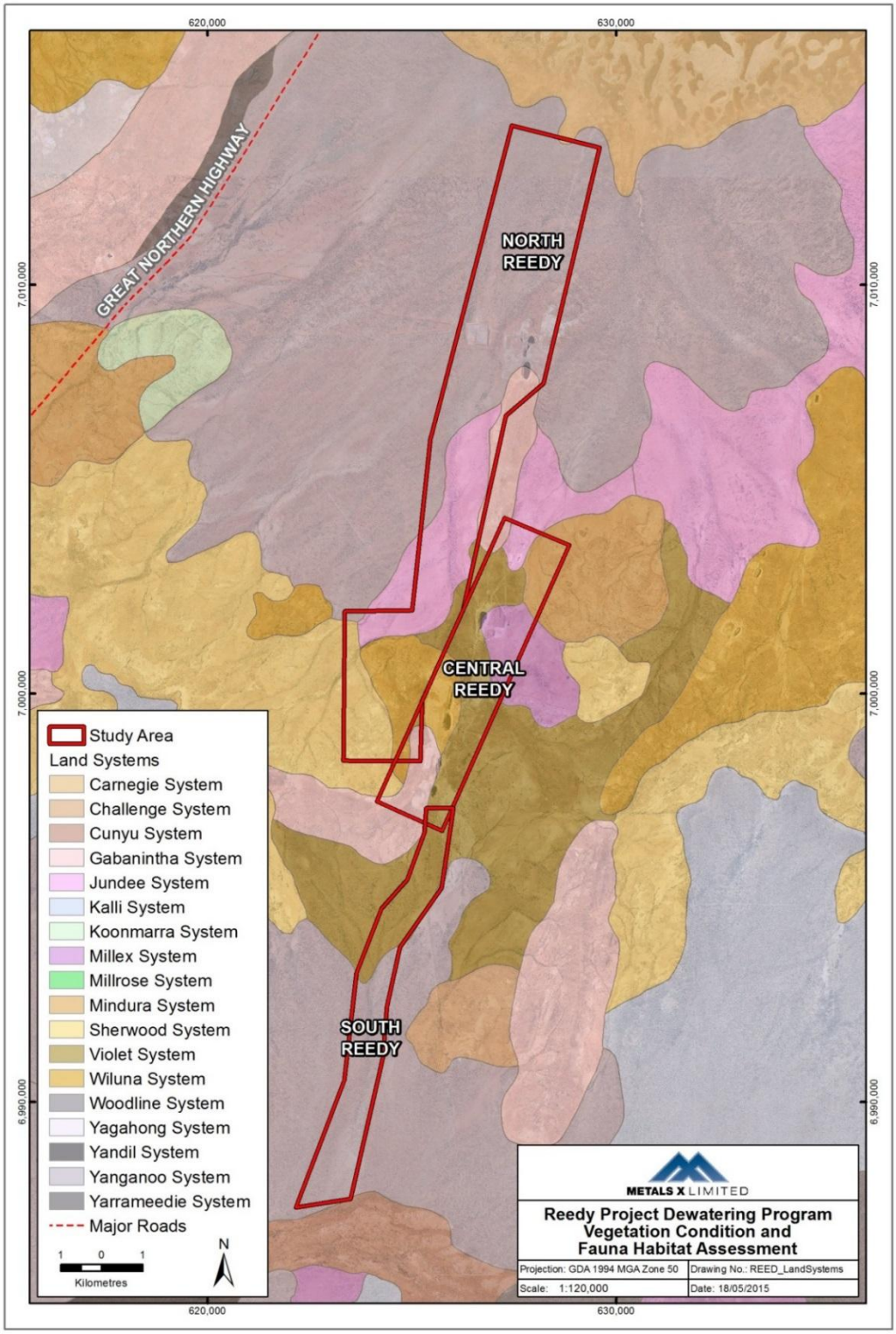

Figure 2-2: Land Systems within and surrounding the Study Area

2.3 Climate

The Murchison region experiences an arid climate, with summer and winter rain and an annual rainfall in the range 200 mm (Beard 1990, Pringle *et al.* 1994). The closest Bureau Meteorology (BoM) weather station is Cue located 60 km south west of the Study Area (BoM 2015). Rainfall over the Study Area is unreliable with zero rainfall potentially recordable in any month (Pringle *et al.* 1994). While summer rainfall is a feature of the region, most years have a dry spell lasting four to six months, typically commencing around October (Pringle *et al.* 1994).

Weather data collected from Cue indicates that rainfall occurs consistently throughout the first eight months of the year and then decreases in September, October and November, before increasing again in December (BoM 2015). The average annual rainfall recorded at Cue over the last 120 years is approximately 233 mm (BoM 2015). Mean daily maximum temperatures range from 18°C in July to around 38°C in January (BoM 2015). Mean daily minimum temperatures range from 7°C in July to 23°C in January and February (BoM 2015) (**Figure 2-3**).

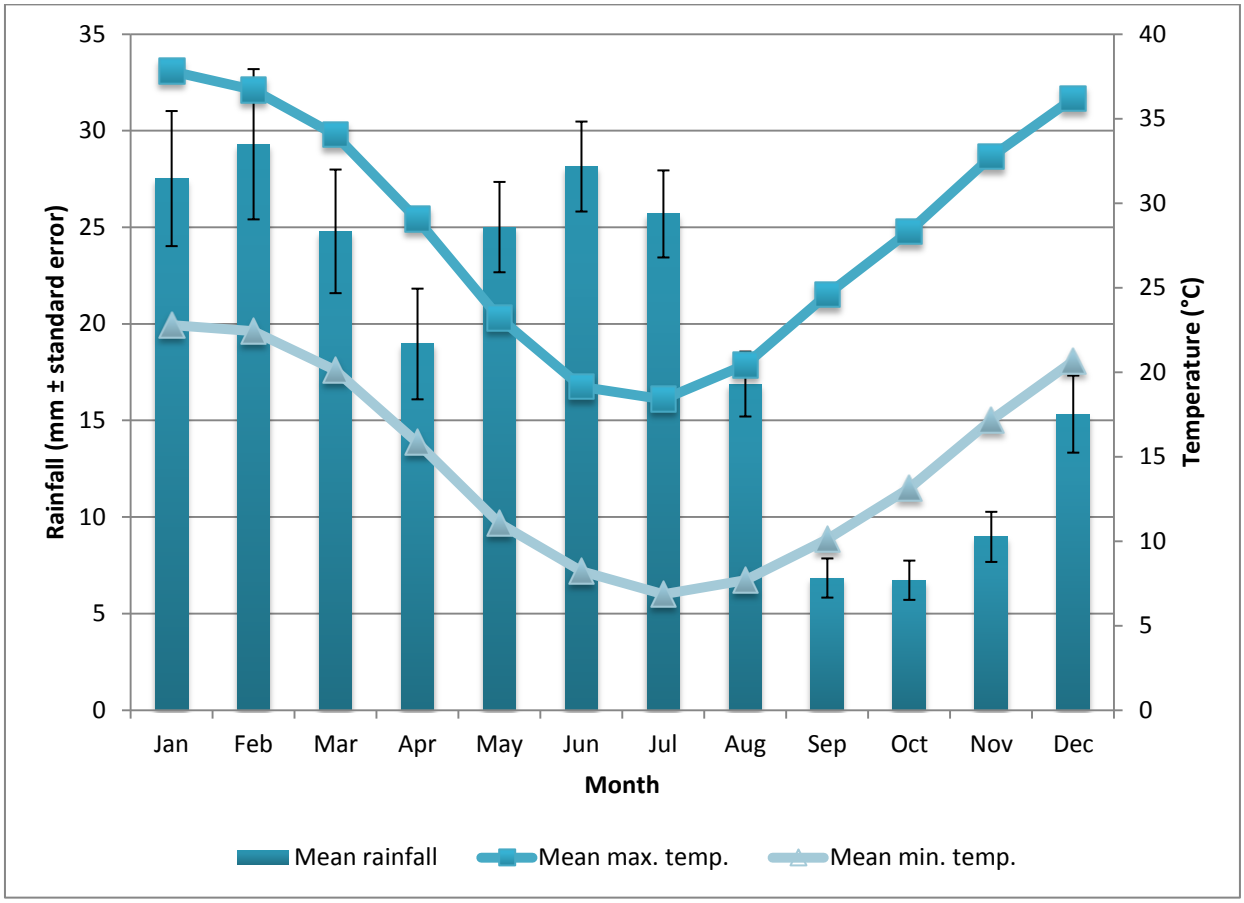

Figure 2-3: Climate Data recorded at Cue

Source data: BoM (2015) weather station number 007017 (1894 – 2015)

2.4 Pre-European Vegetation

Pre-European vegetation mapping of the Study Area was obtained from the Department of Agriculture and Food (DAFWA) dataset (2011), which utilised the mapping of Beard (1975) as source data. The Study Area comprises two vegetation associations dominated by association 18 described as *"Shrublands, mulga shrub"* (DAFWA 2011) (**Table 2-2** and **Figure 2-4**)

EPA *Position Statement No. 2* (2000) defines the threshold level of vegetation preservation, below which species loss appears to accelerate exponentially at the ecosystem level, as being 30 % of the pre-clearing extent of the vegetation type. Vegetation associations 18 and 39 remain at their Pre-European extent within the Murchison Bioregion (**Table 2-2**).

Table 2-2: Vegetation Associations within the Study Area

Vegetation Association	Description	Pre-European Extent Statewide (Ha)	Pre-European Regional Extent (Ha)	Current Regional Extent Ha, (%)	% of remaining in Class I - IV reserves	Pre-European extent within Study Area (ha) (%)
18	Low woodland; mulga (Acacia aneura)	19,892,304	12,403,172	12,403,172 (100%)	0.37%	3,230 (61%)
39	Shrublands, mulga shrub	6,613,569	1,148,400	1,148,400 (100%)	0.02%	2,024 (38%)
				Total	**0.39**	**5254**

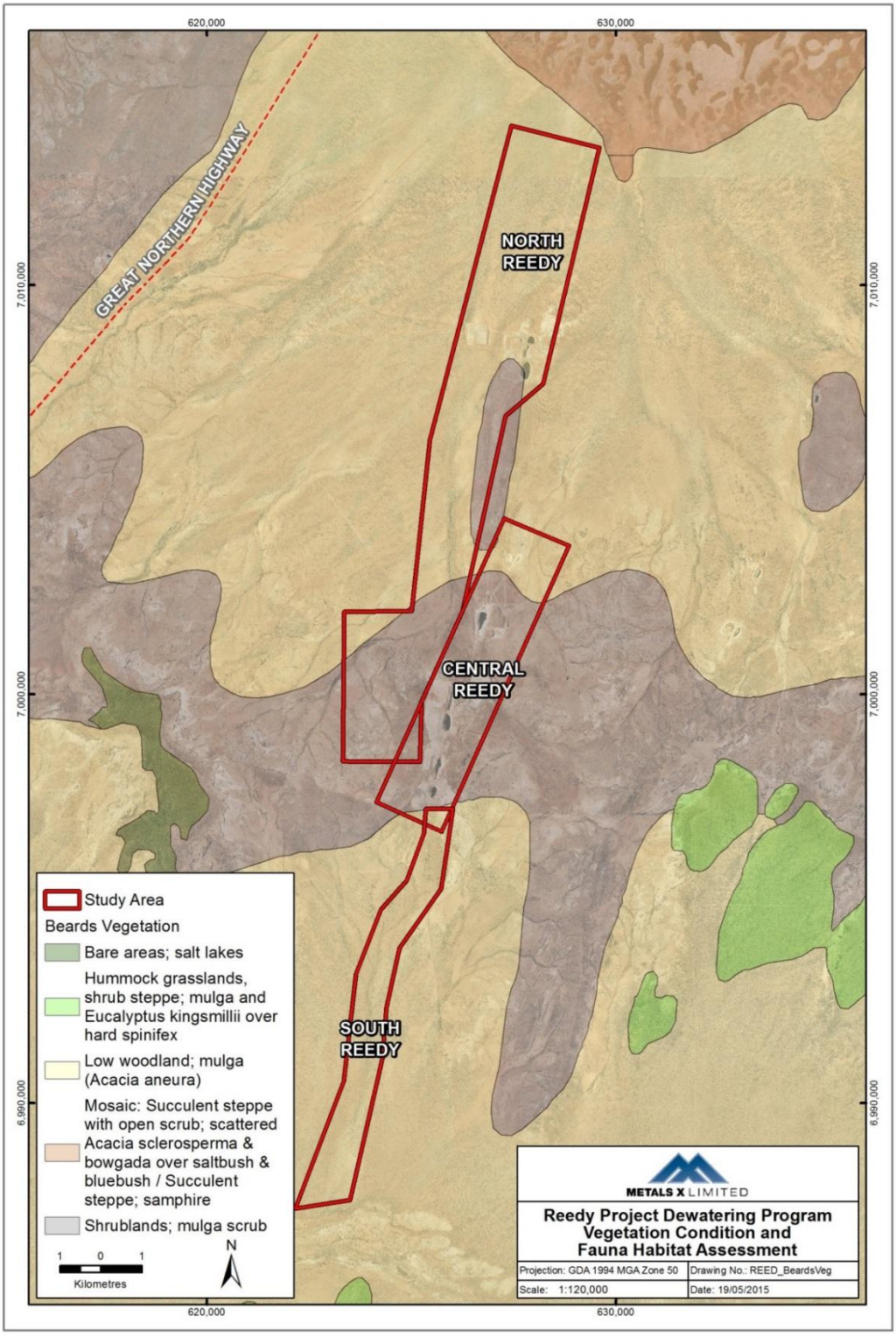

Figure 2-4: Pre-European Vegetation Associations mapped in the Study Area and Surrounds

2.5 Soils

Detailed soils mapping is not available for the Study Area with current mapping from the Australian Soil Resource Information System being broader and less descriptive than the soil descriptions presented for each of the Land Systems (**Section 2.2**). Consequently, broad soil descriptions for each of the landsystems has been included to provide information on soil types likely to be encountered in the Study Area (**Table 2-3**). Additionally, this information has been supplemented with brief descriptions of soil types encountered during the survey at each of the flora releve's (**Table 2-4**, **Appendix H**).

Table 2-3: Geomorphology and associated landsystems of the Study Area

Land System	Soil Description	Hectares (% of Study Area)
Yanganoo	Almost flat hardpan wash plains, with or without small wanderrie banks and showing variable development of weak gravelling.	2211.3 (42%)
Violet	Gentley undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains.	921.7 (17.5%)
Jundee	Hardpan wash plains with variable dark gravelly mantelling with minor sandy banks.	714.3 (13.6%)
Wiluna	Low greenstone hills with occaisional lateritic breakaways and broad stony slopes, lower saline stony plains and broad drainage tracts.	501.2 (9.5%)
Gabanintha	Ridges, hills and footslopes of varios metamorphosed volcanic rocks	300.1 (5.7%)
Sherwood	Extensive, gently slopeing stony and sandy plains on granite and gneiss below saline footslopes of lateritised breakaways and outcrops of weathered rock.	288.8 (5.5%)
Millex	Plains on granite, with irregularly distributed low sandy banks and saline alluvial plains lightly strewn with quartz mantles	181.1 (3.4%)
Mindura	Low hills, ridges and outcrops of granite, gneiss and quartz above convex, quartz-strewn interfluves	131.9 (2.5%)
Carnegie	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks	3.7 (0.1%)
Cunyu	Calcrete platforms, intervening drainage floors and channels and minor alluvial plains	0.1 (<0.1%)

Table 2-4: Soil descriptions at flora relevae's within the Study Area

Flora Relevae	Soil Description
1	Brown/red loam/clay with 55% covering of quartz particals 1-2 cm in size.
2	Red sandy/loam with 1% covering of quartz particals 1-2cm in size
3	Red sandy loam with 1% covering of quartz particals 1-5 cm in size
4	Orange/red sandy loam with 75% covering of quartz particals 1-20cm in size
5	Red sandyclay with 60% covering of laterite particals 5-50cm in size
6	Red sandy clay with 70% covering of laterite particals 1-15cm in size
7	Orange sandy clay with 30% coving of quartz particals 1-50 cm in size
8	Brown sand/clay with 2% covering of quartz 1-50cm in size
9	Red sandy/loam
10	Red sand/clay

11	Red sandy clay
12	Red sandy clay with 80% covering of quartz particals 1-20cm in size
13	Red sandy loam with 2% covering of laterite 1-100 cm in size
14	Orange sandy clay with 85% quartz covering 1-100cm in size
15	Red sandy clay with 2% coverage of quartz and laterite particals 1-10cm in size
16	Red/brown sany/clay with 5% vovering of quartz particals 1-15cm in size
17	Red sand/clay
18	Red sand/loam with 1% coverage of quartz particals 1-5 cm in size
19	Red sand/clay with 50% coverage of quartz particals 1-5 cm in size

2.6 Land Use

The dominant land use within the Murchison bioregion is grazing of sheep and cattle on nature pastures, with 86% of the Eastern Murchison sub-region and 96% of the Western Murchison subregion subject to such grazing (ANRA: Australian Natural Resources Atlas 2010, Cowan et al. 2001, Desmond et al. 2001) (Figure 2-5). Other land uses include Unallocated Crown Land (UCL), Crown reserves, and mining (predominantly gold and nickel). Most mining leases areas in the subregion, including the Study area are still required to be stocked as they come under the Pastoral Lands Act (ANRA: Australian Natural Resources Atlas 2010, Cowan et al. 2001, Desmond et al. 2001). Around 1% of the Murchison bioregion is classified as conservation estate. While there are several areas of ex pastoral lease land (now UCL) located with the surrounding areas that have been proposed to become conservation reserves, there are no areas of DPaW managed land within 100 km of the Study Area.

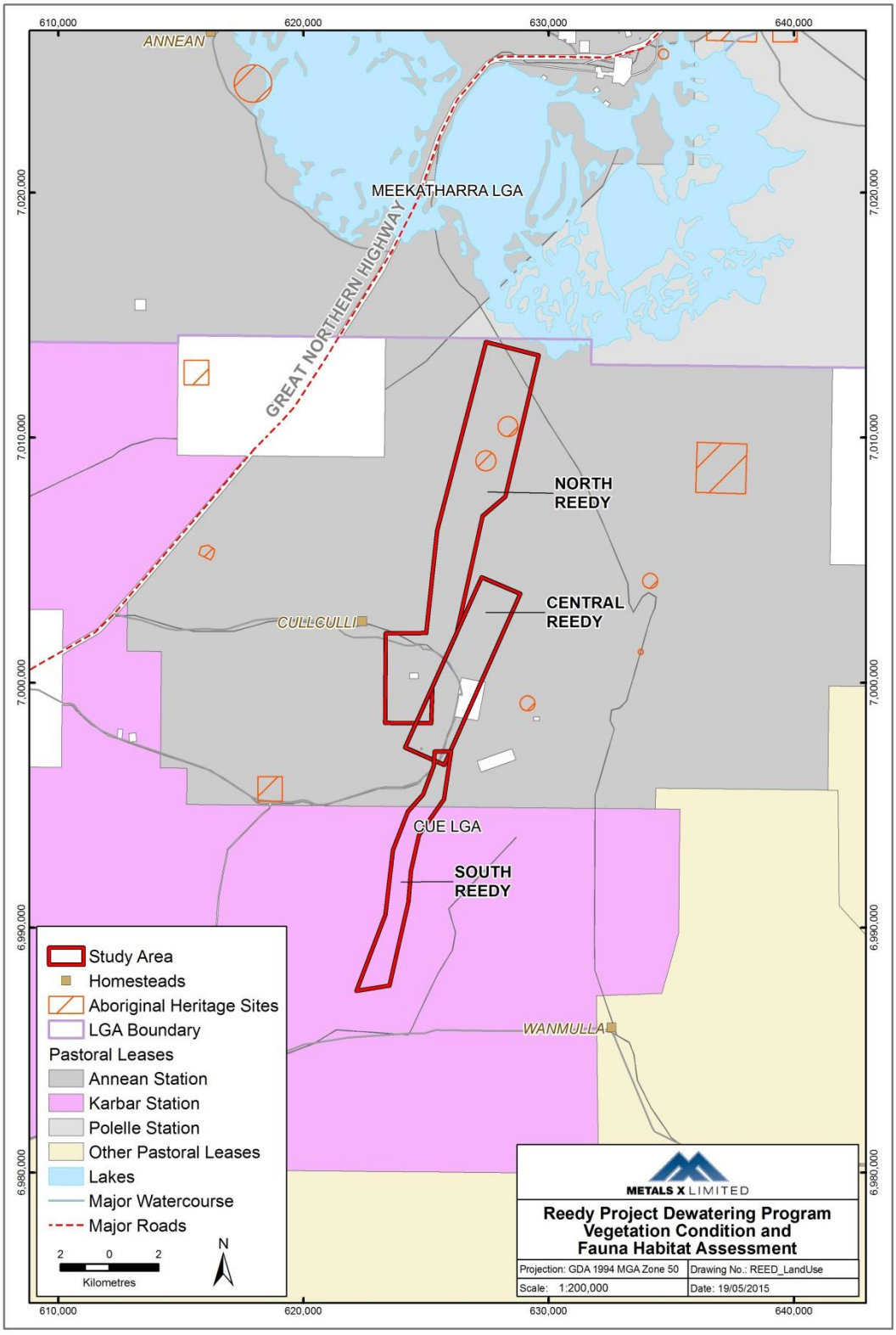

Figure 2-5: Land Use within and surrounding the Study Area

3 Desktop Study Methodology

Background information on the Study Area and surrounds was compiled prior to the field survey to inform survey design and prepare for the field survey. Historical vegetation mapping conducted by (Beard 1975), land systems mapping (Van Vreeswyk *et al.* 2004) and the IBRA classification system (Desmond *et al.* 2001) were consulted to provide broad contextual knowledge of the Study Area.

A desktop review was undertaken to identify Threatened and Priority Flora species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), and vertebrate fauna that could potentially occur in the Study Area.

Database searches were undertaken to generate a list of vascular flora and vertebrate fauna taxa previously recorded within, and nearby, the Study Area, including introduced species and specifically taxa of conservation significance (conservation codes for flora and fauna of conservation significance are provided in **Appendix A** and **Appendix B**). Six database searches were conducted around a central coordinate (UTM 50J 625550.83 mE, 7000609 mS), with varying buffers as deemed appropriate (**Table 3-1**).

Table 3-1: Database searches

Custodian	Database	Reference	Buffer (km)
DPaW	Threatened and Priority Fauna	DPaW (2015d)	75
DPaW	Threatened and Priority Ecological Communities	DPaW (2015c)	40
DPaW	Threatened and Priority Flora	DPaW (2015e)	40
DPaW	NatureMap	DPaW (2015b)	30
Birdlife Australia	Birdata	Birdlife Australia (2015)	75
Department of Environment	Protected Matters	DoE (2015)	75

3.1 Likelihoods of Occurrence for Flora and Fauna of Conservation Significance

The likelihood of occurrence of each species of conservation significance in the Survey Area was assessed and ranked. The rankings were assigned using the following definitions:

Confirmed – the presence of the species in the Survey Area has been recorded unambiguously during the last ten years (i.e. during recent surveys of the Survey Area or from reliable records obtained via database searches);

Very likely – the Survey Area lies within the known distribution of the species and is likely to contain suitable habitat(s), plus the species generally occurs in suitable habitat and has been recorded nearby within the last 20 years;

Likely – the Survey Area lies within the known distribution of the species and the species has been recorded nearby within the last 20 years; however, either:

a. the Survey Area is likely to contain only a small area of suitable habitat, or habitat that is only marginally suitable; or

b. the species is generally rare and patchily distributed in suitable habitat;

Possible – there is an outside chance of occurrence, because:

a. the Survey Area is just outside the known distribution of the species, but is likely to contain suitable and sufficient habitat (the species may be common, rare, or patchily distributed); or

b. the Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed; or

c. the Survey Area lies on the edge of, or within, the known distribution and is likely to contain suitable habitat, but the species has not been recorded in the area for over 20 years.

Unlikely – the Survey Area lies outside the known distribution of the species, the Survey Area is unlikely to contain suitable habitat, and the species has not been recorded in the area for over 20 years.

See **Appendix A** and **Appendix B** for full descriptions of conservation codes.

4 Field Methodology

4.1 Survey Timing and Weather

The field survey was conducted over six days from 15 to 20 April 2015. The closest meteorological weather station to the Study Area is at Cue (Station number 007017) (**Figure 2-3**) which is located approximately 40 km southwest of the Study Area. During the month preceding the Survey (March 2015), 189.6 mm of precipitation was recorded at the Cue weather Station which is more than seven times the long term average of 24.8 mm (BOM 2015). Rainfall during the five months preceding March was largely in line with the long-term average (BOM 2015). EPA recommends that surveys should be conducted following the season of highest rainfall to optimise the likelihood of encountering flowering and fruiting taxa and capturing ephemeral species. The timing of the survey was considered appropriate for a Level 1 Flora Survey.

Weather data for the survey period has been sourced from the Meekatharra weather station (station number 007045) (**Table 4-1**) located approximately 50 northeast of the Study Area as data was not available from the Cue weather station at the time of this report. Conditions during the survey were mild, with a maximum temperature 28.5°C, minimum temperature of 13.8°C and maximum humidity of 47% (BoM 2015). No rainfall was recorded during the survey period (BoM 2015). Weather conditions at the time of the survey were considered appropriate for a Level 1 Fauna Survey.

Table 4-1: Weather during the survey period

Source data: BoM (2015) weather station number 007045, 1944 - 2015

Date	Temperature (°C)		Rainfall (mm)	Relative humidity (%)	
	Min	Max		9.00 am	3.00 pm
15/04/2015	16.3	28.5	0.0	34	9
16/04/2015	14.9	21.4	0.0	18	8
17/04/2015	13.8	25.5	0.0	12	9
18/04/2015	15.1	24.2	0.0	12	11
19/04/2015	14.9	26.3	0.0	13	12
20/04/2015	14.6	25.3	0.0	18	11

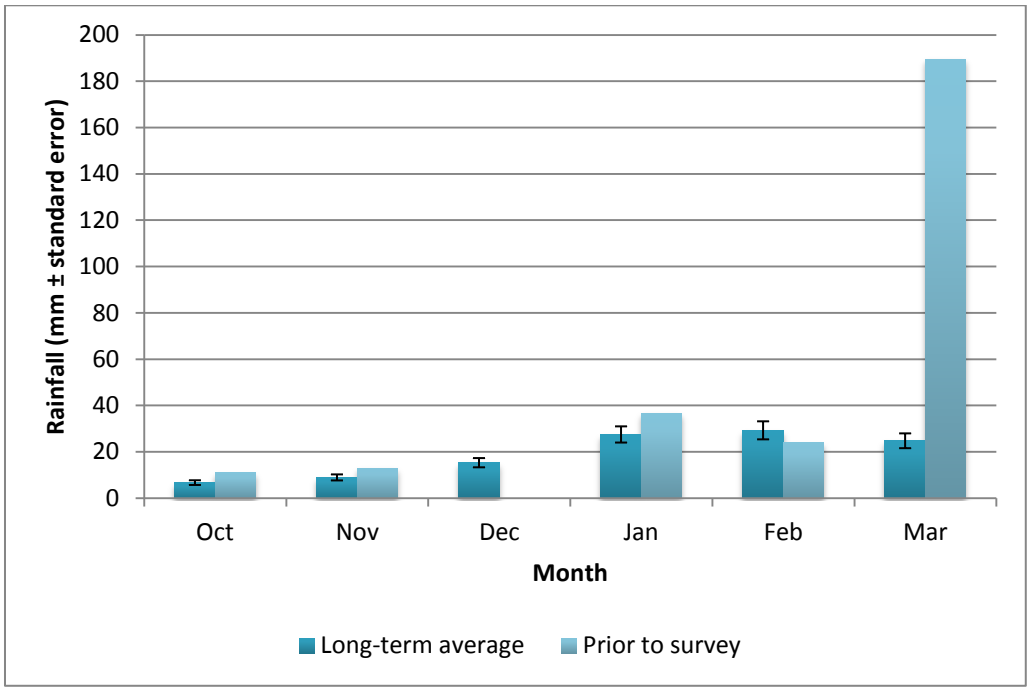

Figure 4-1: Relevé sites Monthly rainfall prior to the survey

Source data: BoM (2015) weather station number 007017, 1894–2015

4.2 Survey Team and Licensing

The field survey was undertaken by Matthew Quinn (experienced zoologist) and Scott Walker (experienced botanist). All plant collections were taken under flora collecting permit (SL011123), pursuant to the *Wildlife Conservation Act* 1950 (WA) Section 23C and Section 23F.

4.3 Survey Design

Site reconnaissance was undertaken to:

- verify the desktop assessment;
- create an inventory of vascular flora taxa and vertebrate fauna observed at the site;
- delineate and broadly map fauna habitat, vegetation units and vegetation condition; and
- select suitable monitoring locations for future vegetation health monitoring program.

The site was traversed on foot by MWH ecologists, ensuring that each vegetation unit and habitat type within the study area was visited. Transects were generally linear across the site, however detours were made to investigate vegetation, plants or habitat of particular interest, before returning, to the transect line. In the event that significant flora or fauna taxa were identified, survey intensity increased around that point to search for additional individuals and to delineate the population. All vascular flora and

vertebrate fauna taxa observed while traversing the site were recorded. Detours were also made to avoid large bodies of water present at the site.

4.3.1 Flora and Vegetation

Vegetation units at the site were described using the NVIS Vegetation Structural Classification System (ESCAVI 2003) based on their structure and composition, as defined by relevé data and field observations (**Appendix C**). A minimum of one flora relevé was undertaken for each broad vegetation community. A total of 19 relevés were undertaken (**Figure 4-3**). At each relevé site the following was recorded:

- relevé number;
- date of survey;
- personnel;
- GPS coordinates (GDA 94);
- site photograph;
- vascular flora taxa;
- soil characteristics (texture and colour);
- geology (type, size and nature of any rocks, stones, gravel, or outcropping);
- topography (landform type and aspect);
- vegetation condition, based on Keighery (1994) (**Appendix D**);
- vegetation structure, based on ESCAVI (2003);
- disturbance (if present); and
- approximate time since fire.

Broad vegetation mapping was conducted in the field, with vegetation boundaries delineated over aerial photography, and later refined based on survey data. The same method was used for habitat mapping, which often correspond with changing vegetation units.

Prior to the survey a list of conservation significant flora and vertebrate taxa with potential to occur within the Study Area was compiled. Field personnel familiarised themselves with photographs and descriptions of these taxa, and the habitat in which they might occur, and actively searched for them while traversing the Study Area. Any conservation significant flora taxa identified in the field were recorded. For Threatened Flora each individual was recorded with a GPS co-ordinate. For Priority Flora each discrete group was recorded with a GPS co-ordinate and a count or estimation of individual

plants. Where possible, the edges of conservation significant populations were recorded as points or by using a GPS track log. Reproductive condition and a brief community description were also recorded for all conservation significant taxa. A representative voucher specimen of each significant flora species was collected and submitted to the Western Australian Herbarium for verification, and to increase scientific knowledge of the taxa. A DPaW Threatened and Priority Flora Report Form was also submitted. High resolution photographs that clearly show plant habit, habitat and reproductive features were also taken for each population.

Flora taxa not identified in the field were collected and pressed for identification at the Western Australian Herbarium. Identifications were carried out by experienced taxonomist Cate Tauss and experienced MWH botanist Megan Stone. The nomenclature and taxonomy of all vascular flora taxa in this report follows that of the Western Australian Herbarium. All taxa were checked against FloraBase to ensure their currency and validity (DPaW 2015a). Any conservation significant flora taxa including potential Threatened and Priority species, range extensions and potential new taxa have been verified and vouchered at the Western Australian Herbarium.

4.3.2 Monitoring Sites

Locations of monitoring sites to determine vegetation condition during the dewatering operations was tentatively selected during the field campaign. Locations were selected based on representative vegetation within drainage lines and spatially from close to far proximity from the Northern and Southern

proposed discharge points.

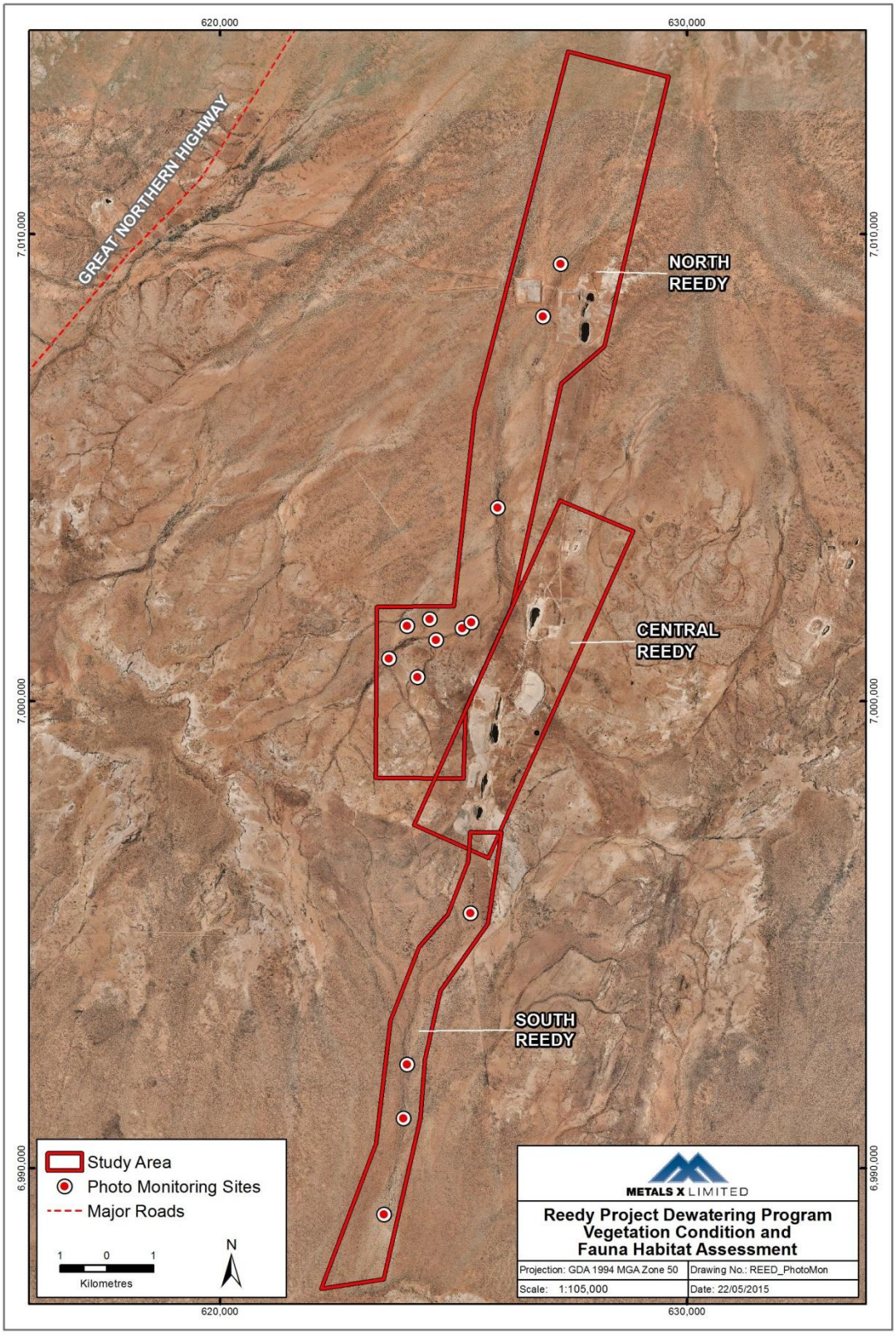

Figure 4-2 illustrates the spatial representation of the proposed monitoring sites throughout both the Northern and Southern Study Areas. These locations will be validated once the monitoring objectives have been defined and when the hydrological information incorporated.

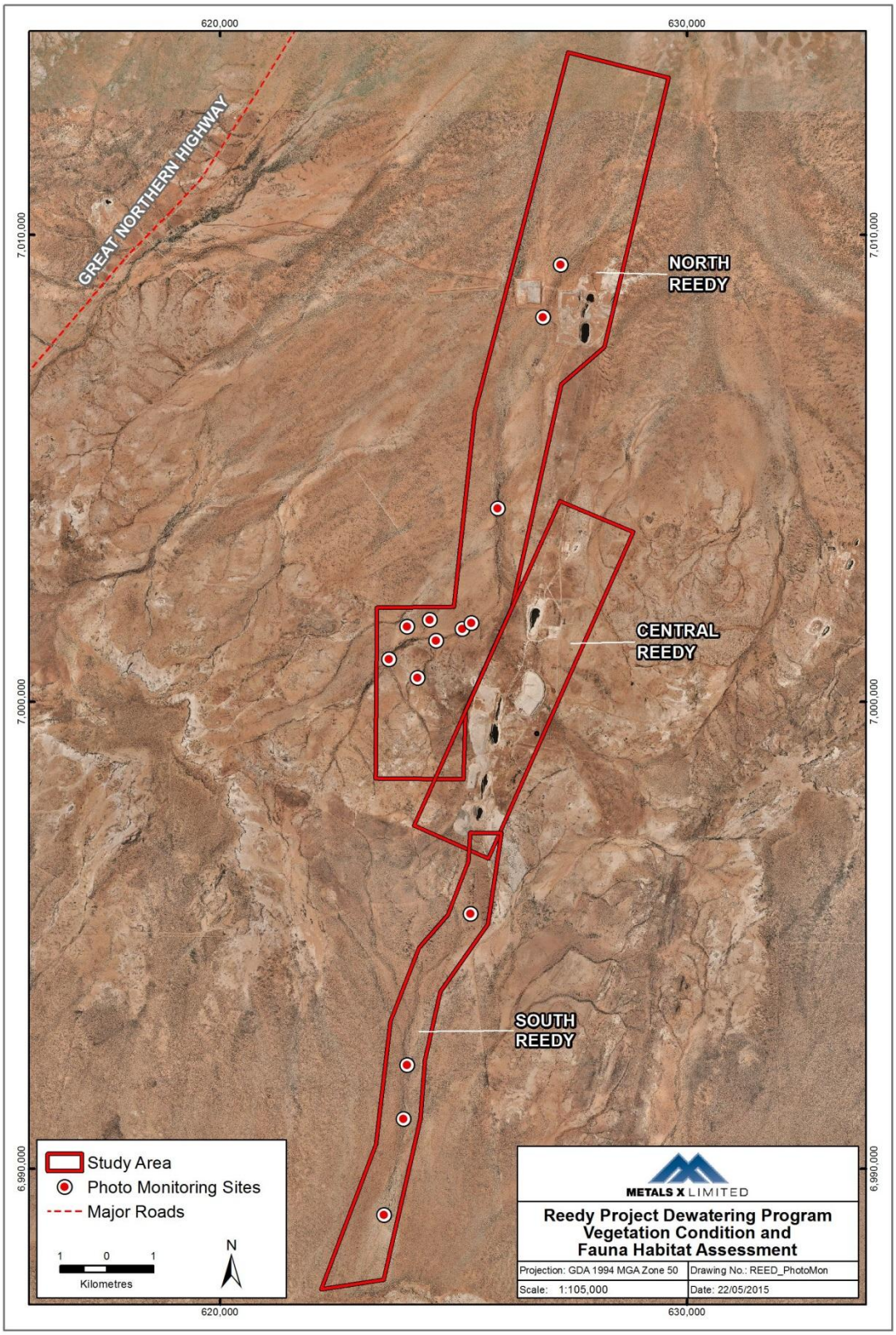

Figure 4-2: Proposed Vegetation Monitoring Site Locations

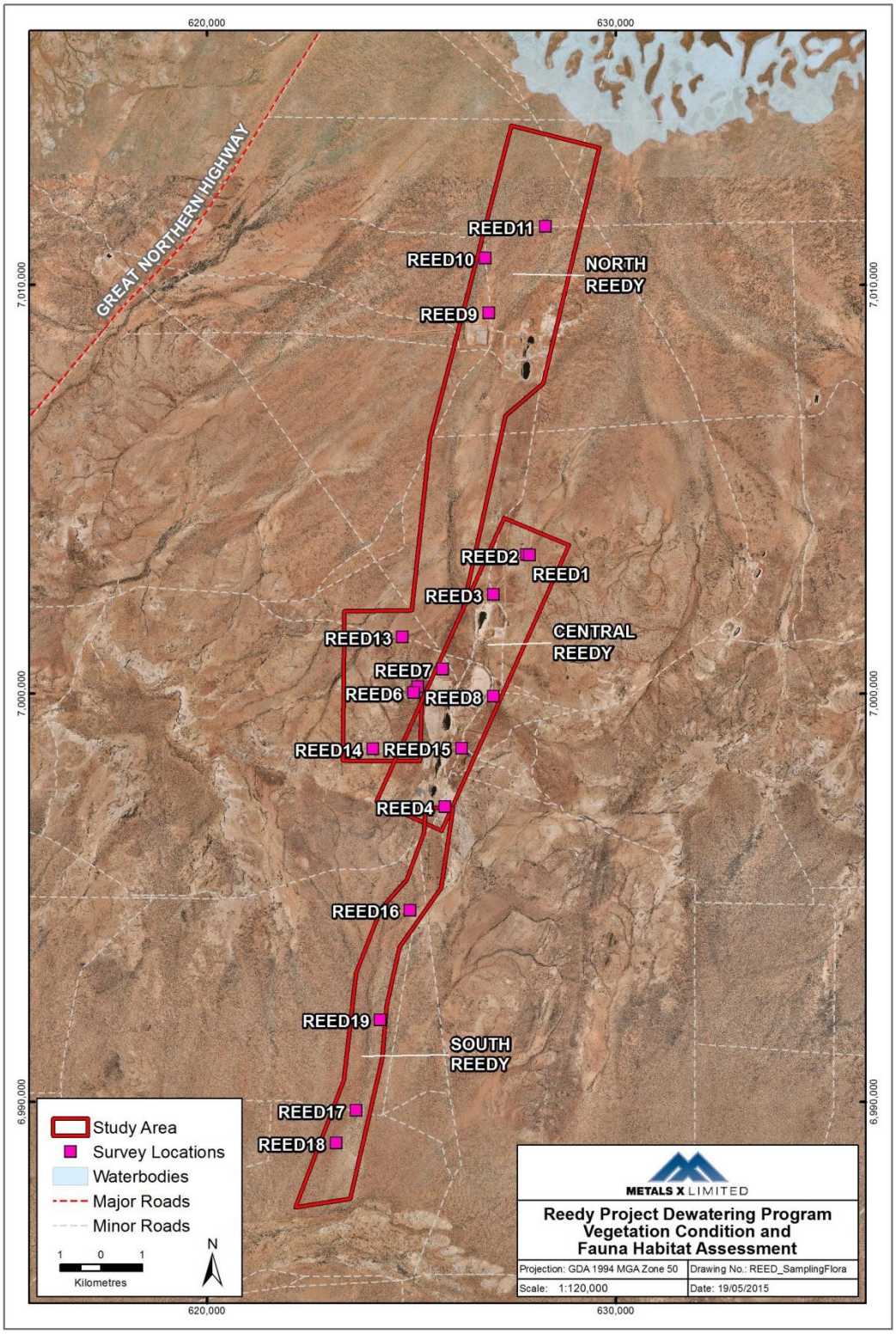

Figure 4-3: Relevé sites

4.3.3 Fauna

Fauna habitat assessments were undertaken at eight locations throughout the Study Area (**Figure 4-4**). At each location, the following parameters were recorded:

- Description of broad vegetation community;
- Hollow bearing trees and dead stag trees (average size and abundance);
- Rocky outcrops (average rock size and extent);
- Coarse woody debris, i.e. logs and fallen timber (abundance and size);
- Substrate (description of composition, presence of algal crust and % cover of leaf litter);
- Wetland habitats and water courses including drainage lines, billabongs, active floodplains, dams etc; and
- Any nests, roosts or other evidence of breeding habitat present.

Searches were conducted to search for fauna taxa of conservation significance, and to develop a species list. Effort focused on habitat likely to support fauna taxa of conservation significance, although all habitat types were sampled.

Searching methods included hand-searching for cryptic species, for example by overturning logs and stones, searching beneath the bark of dead trees, investigating crevices and exploring in the vicinity of burrows, tracks, diggings, scats, and other signs of vertebrate fauna. An aural survey for avifauna was also carried out. All vertebrate fauna seen or heard, or whose presence was inferred from secondary evidence were documented.

The nomenclature and taxonomy of mammals, reptiles and amphibians reported follow the Checklist of the Vertebrates of Western Australia (WAM 2015), and those of birds follow the Birds Australia Checklist of Australian Birds, based on Christidis and Boles (2008). Relevant texts, from which information on more recent taxonomic updates and general patterns of distribution are available, were also considered for:

- mammals (Van Dyck and Strahan 2008, Woinarski *et al.* 2014);
- birds (Johnstone and Storr 1998, 2004, Morcombe 2003, Pizzey and Knight 2007);
- reptiles (Cogger 2014, Wilson and Swan 2013); and
- amphibians (Cogger 2014, Tyler and Doughty 2009).

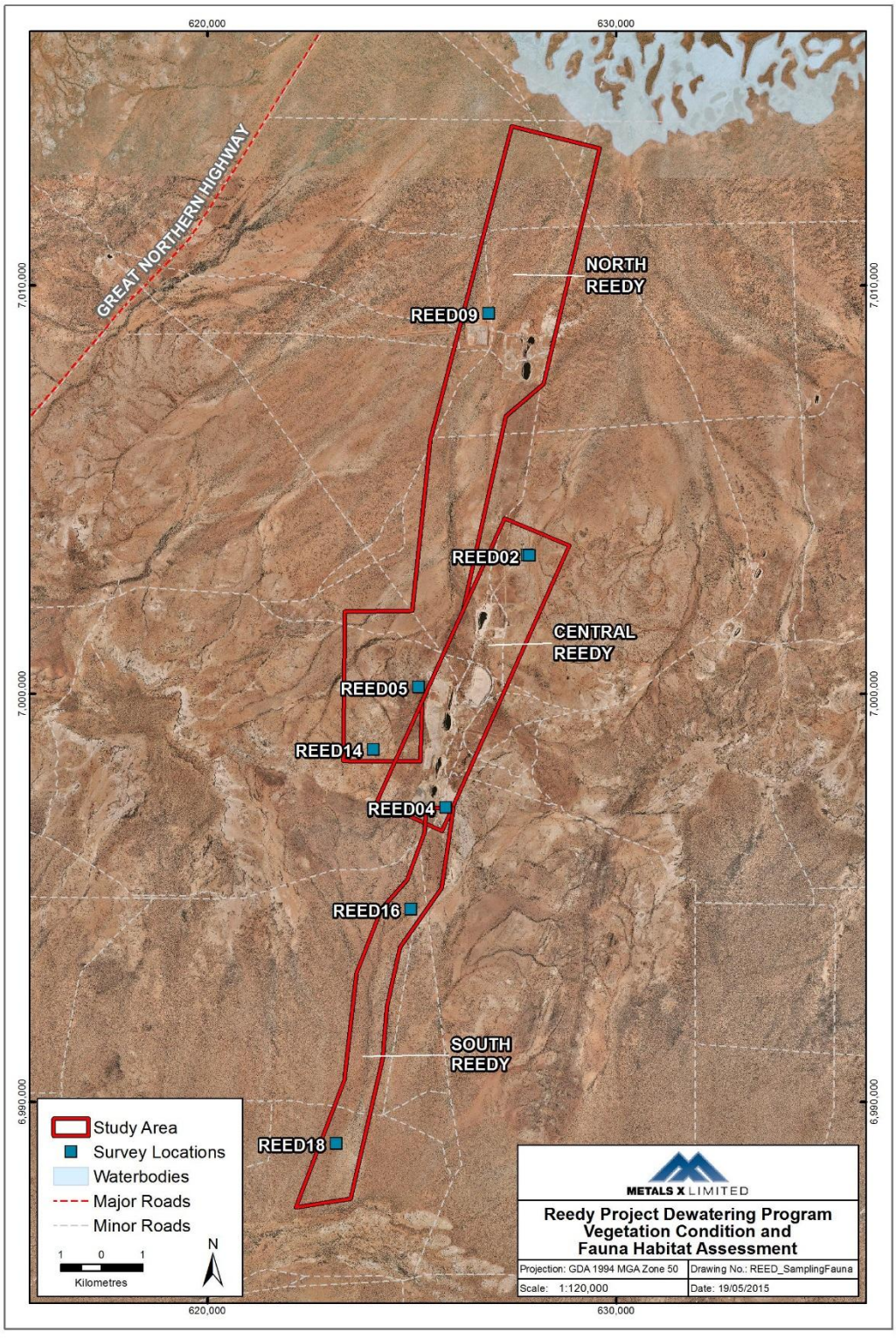

Figure 4-4: Fauna survey sites

5 Results and Discussion

5.1 Flora and Vegetation

5.1.1 Desktop Study

Forty-one (41 flora taxa of conservation significance were identified by the desktop study as potentially occurring in the Study Area, all being listed by DPaW as Threatened or Priority Flora (DPaW 2015e) (**Appendix E**). Of these:

- None were confirmed as occurring in the Study Area;
- One was considered very likely to occur;
- Ten were considered likely to occur;
- Eighteen were considered to possibly occur; and
- Eleven were considered unlikely to occur in the Study Area.

These rankings were assigned following definitions described in the desktop study methodology (**Section 3**). Flora identified by the EPBC Protected Matters Search was not included in this analysis as the results provided are very broad compared to the data provided by DPaW and the WA Herbarium records.

The conservation significant taxon that was considered very likely to occur was:

- *Acacia sclerosperma* subsp. *glaucescens* (P3)

The ten conservation significant taxa that were considered likely to occur were:

- *Acacia burrowsiana* (P3)
- *Drummondita miniata* (P3)
- *Hemigenia virescens* (P3)
- *Maireana prosthecochaeta* (P3)
- *Ptilotus lazaridis* (P3)
- *Sida picklesiana* (P3)
- *Tecticornia cymbiformis* (P3)
- *Acacia speckii* (P4)

5.1.2 Flora Composition

A total of 101 vascular flora taxa were recorded within the Study Area, representing 27 families and 53 genera (**Appendix F**; **Appendix G**). The most represented families were Fabaceae (18 taxa), Poaceae (17), and Chenopodiaceae (12). The most represented genera were *Acacia* (12 taxa), *Ptilotus* (9) and *Eremophila* (9).

No Threatened flora taxa were recorded at the Study Area. One Priority 3 flora taxon, *Ptilotus beardii*, was recorded at a single location within the Study Area. A collection specimen of this taxon is currently undergoing verification at the Western Australian Herbarium to confirm its identity. There were no flora range extensions from the Study Area.

Seven taxa were only partially identified as due to lack of reproductive material. These were

- Portulacaceae sp.
- *Eragrostis* sp.
- *Ptilotus* sp.
- *Maireana* sp.
- *Calandrinia* sp.
- *Eremophila sp.*
- *Scaevola ?spinescens*

Two of these unidentified specimens match the genera of conservation significant flora taxa that were considered likely to occur within the Study Area. These were *Maireana prosthecochaeta* (P3) and *Ptilotus lazaridis* (P3). It is unlikely that any of the remaining unidentified taxa represent a Threatened or Priority listed flora as none are analogous to any conservation significant flora taxa that were identified by the desktop study. An additional collection representing a Mulga hybrid, was identified as *Acacia ? caesaneura x incurvaneura*, matched the specimen of the same name at the Western Australian Herbarium.

Three introduced flora taxa, **Cucumis myriocarpus* (Prickly Paddy Melon), **Cynodon dactylon* (Couch) and **Sonchus oleraceus* (Common Sowthistle), were recorded in the Study Area. There were no taxa listed as Declared Pests under the Biosecurity and Agricultural Management (BAM) Act 2007 (WA). There were no taxa listed as Weeds of National Significance (WONS) (Department of Environment 2015) recorded within the Study Area.

5.1.3 Conservation Significant Flora

The potential conservation significant flora taxon at the site is *Ptilotus beardii* (P3) (**Figure 5-1**). *Ptilotus beardii* is a compact perennial shrub 0.15 to 0.5 m high, with linear leaves and pink-red flowers August to October (DPaW 2015a). This taxon is found growing in clayey soils, saline flats and low breakaways (DPaW 2015a). There are 32 records of this taxon, all within the Murchison and Yalgoo IBRA regions (DPaW 2015b). The nearest known location is 47 km west of the Study Area. If the collection made within the Study Area is confirmed to be *Ptilotus beardii* it will represent a range extension of 47 km to the east for the taxon.

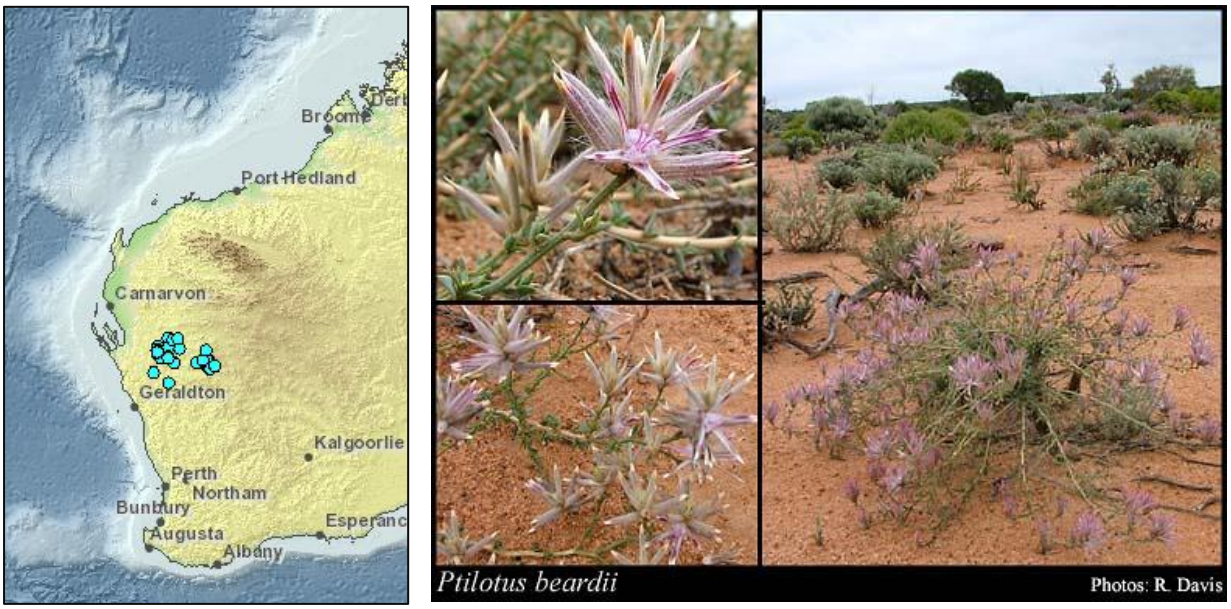

Figure 5-1: Ptilotus beardii (P3) distribution and habit

5.1.4 Vegetation Units

A total of ten broad vegetation units were identified within the Study Area (**Table 5-1** and **Figure 1-1**). All vegetation units were observed as extending beyond the Study Area boundaries and are likely well represented in the local area.

No vegetation units comparable to any Threatened Ecological Community (TEC) (listed under the EPBC Act and/or WC Act) or Priority Ecological Community (PEC) (as listed by DPaW) were recorded within the Study Area. Vegetation unit ApEpAk may be of local significance if it is confirmed to contain priority taxon *Ptilotus beardii* (P3).

Table 5-1: Vegetation units within the Study Area

Vegetation Unit	Description	Portion of Study Area		Presence of Significant Flora	Local Extent
		Ha	%		
MtSlAh	Tall open shrubland dominated by *Acacia* spp., over low forbs dominated by *Maireana triptera* and *Solanum lasiophyllum* with open grassland dominated and *Aristida holathera* var. *holathera* on red/orange sandy clay loam with quartzite, on plains.	903.11	17.19	No	Extends beyond the Study Area
AiSmMt	Tall shrubland dominated by *Acacia incurvaneura*, over low shrubland dominated by *Senna* sp. Meekatharra (E. Bailey 1-26) and *Eremophila forrestii*, over low forbland dominated by *Maireana triptera* on sandy red clay with laterite, on hills and slopes.	318.44	6.06	No	Extends beyond the Study Area
HpEgCd	Tall shrubland dominated by *Hakea preissii*, over mid sparse shrubland dominated by *Eremophila galeata and Grevillea deflexa*, over closed grassland dominated by **Cynodon dactylon*, *Chrysopogon fallax* and *Cyperus iria* and low sparse forbland of **Sonchus oleraceus*, on brown sandy clay with quartz, on floodway.	7.04	0.13	No	Further investigation would be required to determine of this vegetation unit is represented outside the Study Area.
AcEf	Tall shrubland dominated by *Acacia craspedocarpa* and *Acacia pteraneura*, over low open shrubland dominated by *Eremophila forrestii* on red sandy loam plains.	716.56	13.64	No	Extends beyond the Study Area
AiEfEe	Tall open shrubland dominated by *Acacia incurvaneura* and other mixed *Acacia* spp. over low open shrubland of *Eremophila forrestii* and *Eremophila galeata*, over grassland dominated by *Eragrostis pergracilis* and *Eragrostis eriopoda,* on red sandy clay plains.	1526.71	29.06	No	Extends beyond the Study Area

Vegetation Unit	Description	Portion of Study Area		Presence of Significant Flora	Local Extent
		Ha	%		
EeEfAh	Low sparse shrubs dominated by *Eremophila exilifolia* and *Eremophila forrestii,* over low grassland dominated by *Aristida holathera* var. *holathera*, with low sparse forbs dominated by *Ptilotus chamaecladus*, on red sandy clay with quartz on plains.	46.46	0.88	No	Extends beyond the Study Area
ApEpAk	Tall sparse shrubland dominated by *Acacia pteraneura*, over sparse shrubland dominated by *Eremophila oppositifolia* subsp. *angustifolia*, over low sparse shrubland of *Acacia kalgoorliensis,* on orange sandy clay with quartz.	136.38	2.59	Potentially (specimen awaiting verification)	Extends beyond the Study Area
AiAr	Tall shrubland dominated by *Acacia incurvaneura*, over mid open shrubland dominated by *Acacia ramulosa*, on red sandy clay with quartz in gullies.	123.01	2.34	No	Extends beyond the Study Area
AcAiAh	Tall shrubland dominated by *Acacia craspedocarpa*, *Acacia incurvaneura* and *Acacia tetragonophylla*, over low open shrubs dominated by *Eremophila* spp., over grassland dominated by *Aristida holathera* var. *holathera*, on red sandy clay loam with quartz or laterite in drainage lines.	513.5	9.78	No	Extends beyond the Study Area
AiAsEl	Tall shrubland dominated by *Acacia incurvaneura*, *Acacia sclerosperma* and *Acacia tetragonophylla*, over low open shrubland dominated by *Eremophila linearis,* on red sandy clay with quartz, on plains.	350.02	6.66	No	Extends beyond the Study Area
Total		**5254**	**100**		

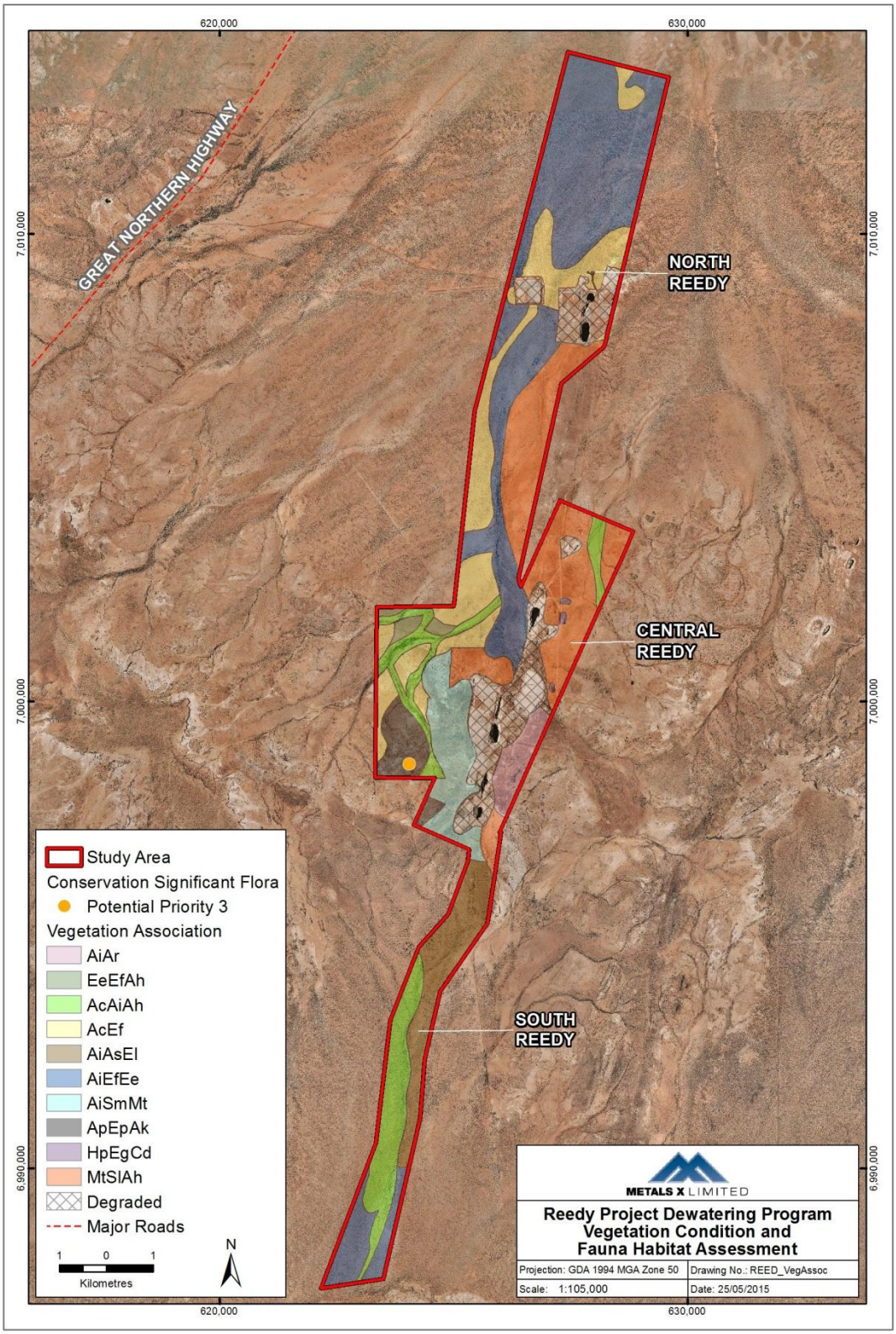

Figure 5-2: Vegetation mapping within the Study Area

5.1.5 Vegetation Condition

The vegetation condition within the Study Area ranged from Very Good to Completely Degraded (**Table 5-2** and **Figure 5-3**). Disturbances at the site included past mining operations and drilling programs, vehicle tracks, low density weeds, feral animal grazing and trampling. .

Table 5-2: Vegetation condition within the Study Area

Vegetation Condition	Portion of Study Area	
	Area ha	%
Degraded	517.42	9.85
Good	288.08	5.48
Very Good	4448.52	84.66
Excellent	0	0
Pristine	0	0
Total	**5254**	**100**

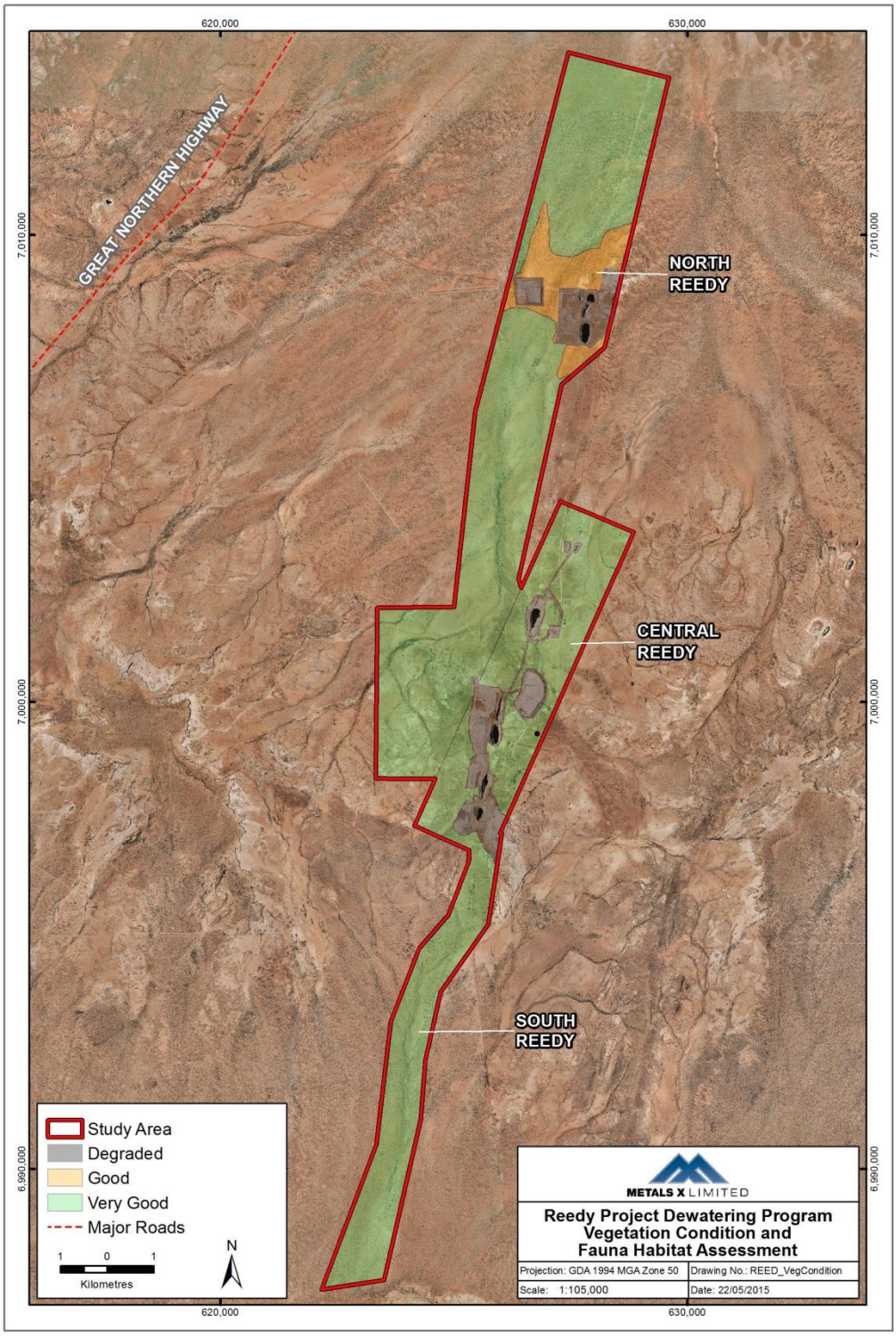

Figure 5-3: Vegetation condition within the Study Area

5.2 Fauna

5.2.1 Broad Fauna Habitats

Excluding areas of disturbance associated with the minesite, five broad habitats were identified during the field survey (**Figure 5-4**). These habitats were:

- Low Open Mulga Woodland;
- Open Eremophila Shrubland;
- Stony Rise;
- Stony Plain; and
- Drainage Lines.

In addition to the broad habitats, there were two small areas of Ephemeral Wetland habitat located in the central section of the Study Area. Each of the broad habitats are widespread and well represented in the Murchison bioregion (McKenzie *et al.* 2003), however the Ephemeral Wetland habitat may be of local significance.

Disturbances within the Study Area included past mining operations and drilling programs, vehicle tracks, low density weeds, feral animal grazing and trampling (**Table 5-3**; **Appendix I**). The habitat types in the Study Area varied in their extents and levels of significance according to the following criteria:

- Distribution: those habitats widespread and common within the surrounding regions were categorized as widespread; otherwise they were categorised as limited. All habitat types within the Study Area with the exception of the Ephemeral Wetland were considered widespread; and
- Significance: those habitats considered capable of supporting species of conservation significance or distinct fauna assemblages were categorised as significant; otherwise they were categorised as limited significance. All habitats with the exception of the Ephemeral Wetland were considered to be of limited significance.

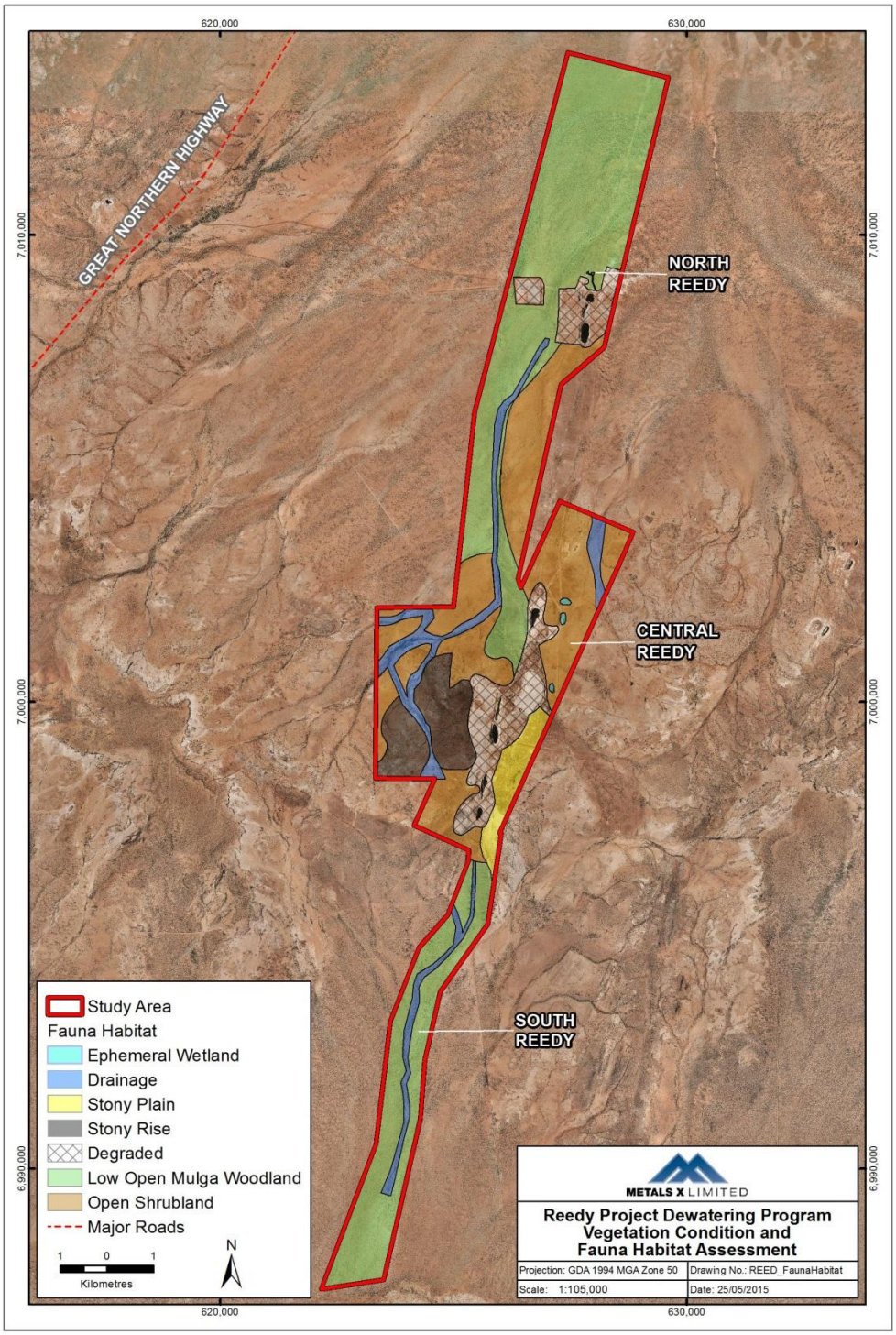

Figure 5-4: Fauna habitats within the Study Area

Table 5-3: Fauna habitats within the Study Area

Habitat type	Extent[#]	Land systems	Vegetation units	Disturbance and condition	Value to fauna assemblages (including species of conservation significance)
Low Open Mulga Woodland • Widespread Limited significance	2,437.5 ha (46.4%)	Yanganoo System Jundee System Violet System	• AiEfEe • AcAiAh • AiAsEl • AcEf	Very good. Disturbances included drilling programs, vehicle tracks, low density weeds and grazing.	Leaf litter and woody debris are moderately common. The substrate is defined as a red-brown clay-loam with occasional scattered quartz/ironstone rocks. Vegetation is homogenous varying from scattered trees to moderately-dense woodland. The vegetation is suitable for supporting small birds, reptiles and mammals and has high foraging potential for nectivorous avian fauna when in flower. The substrate is suitable for burrowing and fossorial species. Due to the homogeneity, this habitat is unlikely to support high species diversity. Generalist fauna of conservation significance such as the Australian Bustard may occur within this habitat. *Lerista eupoda* is endemic to the area and may occur in the sandy loam substrate within this habitat.
Open Eremophila Shrubland • Widespread Limited significance	1,341 ha (25.52%)	Sherwood System Jundee System Yanganoo System Mindura System Millex System	• MtSlAh • AiSmMt • ApEpAk • AiEfEe	Very good – good. Disturbances included drilling programs, vehicle tracks, low density weeds and grazing.	The Open Eremophila Shrubland was dominated by low sparse shrubs namely, *Eremophila* spp. over grasses and forbs on red sandy clay and quartz rocks. The vegetation has limited capability for supporting nesting avian fauna and other fauna more generally. This habitat was widespread and relatively homogenous throughout the area both within and outside the Study Area. The substrate was found to be compact and possess a stony surface layer, poorly suited to burrowing species. Due to the homogeneity, this habitat is unlikely to support high species diversity. Generalist fauna of conservation significance such as the Australian Bustard may occur within this habitat.
Stony Rise • Widespread Limited significance	349 ha (6.64%)	Wiluna System	• AiSmMt	Very good. Disturbances included drilling programs, vehicle tracks.	Stony Rise habitat consisted of low open woodland of Mulga over open shrubland of *Eremophila* spp and *Maireana* spp. on gradual slopes of sandy red clay with laterite. This habitat was located centrally in the Study Area in the vicinity of the minesite. It is unlikely that the Stony Rise would be an important habitat type for conservation significant fauna but may be utilised by the Australian Bustard.
Stony Plain • Widespread Limited	166.9 ha (3.18%)	Violet System	• AiAr	Very good. Disturbance from previous mining activities	The Stoney Plain habitat supported sparse vegetation comprising occasional *Acacia* spp. including Mulga over a stony plain consisting of quartz and orange sandy clay loam. It is unlikely that the Stony Plain would be an important habitat type for conservation significant fauna, however the Australian Bustard may possibly occur after periods of rain where there are

Habitat type	Extent[#]	Land systems	Vegetation units	Disturbance and condition	Value to fauna assemblages (including species of conservation significance)
significance					large numbers of insects such as grasshoppers.
Drainage Lines • Widespread Limited significance	375.3 ha (7.14%)	Jundee System Wiluna System	• AiSmMt	Very good. Minor disturbance.	The Drainage Line habitat intersected the Open Eremophila Shrubland and Low Open Mulga Woodland habitats. This habitat differed from the surrounding habitats due to the high density of vegetation, generally comprised of Mulga and smaller shrubs. Substrate comprised of red/orange sandy clay loam and alluvial sand and stones. Leaf litter was generally higher in this habitat than in the adjacent habitats as a result of the higher density of vegetation. This habitat has potential to support conservation significant fauna species such as the Rainbow Bee-eater, however they are unlikely to be solely reliant on this habitat.
Ephemeral Wetland • Limited Local significance	7 ha (0.13%)	Millex System	• HpEgCd	Very good. Minor disturbance.	This habitat comprises a very small portion of the Study Area and is located adjacent to the existing mine waste landform. This habitat was inundated at the time of the survey and was found to support a mixed shrubland over a dense cover of mixed grasses. Although no conservation significant fauna were observed utilising this habitat at the time survey, the presence of episodic water at this habitat means that the Ephemeral Wetland has potential to support migratory bird species of conservation significance including the Eastern Great Egret and Glossy Ibis. More generally this habitat may be an important refuge for fauna of the area.
Degraded	577.3 ha (10.99%)	n/a			

5.2.2 Fauna of Conservation Significance recorded

No fauna of conservation significance were recorded during the survey.

5.2.3 Likelihood for Fauna of Conservation Significance

The desktop study identified 23 vertebrate species of conservation significance and two invertebrate species of conservation significance as having the potential to occur within the Study Area. Of these:

- Six species are listed as Threatened under the EPBC Act and/or WC Act (**Table 5-4**). Legislation has been developed at national (EPBC Act) and state (WC Act) levels to protect species of fauna that have been formally recognised as rare, threatened with extinction or having high conservation value (**Appendix B**)
- Three are recognised by DPaW as Priority fauna. DPaW recognises several species that are not listed under the WC Act or the EPBC Act but for which there is some conservation concern, and has produced a supplementary list of Priority fauna (**Appendix B**);
- One species is listed recognised by state (WC Act) to be in need of special protection; and
- Fourteen species are listed as Migratory under the EPBC Act and Schedule 3 under the WC Act. Many species of migratory bird are listed under the EPBC Act, the WC Act and international agreements including the Japan-Australia Migratory Bird Agreement, the China-Australia Migratory Bird Agreement, the Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals (**Appendix B**).

Some of the species referred to above are listed as Threated, Migratory and/or Priority fauna may be included in multiple groups listed above. The likelihood of each of these species of conservation significance occurring in the Study Area has been assessed and ranked (**Table 5-4**). The rankings were assigned following definitions described in the desktop study methodology (**Section 3.1**)

Table 5-4: Fauna of conservation significance potentially occurring within the Study Area

Common name (*Scientific name*)	Status		Broad habitat type	Likelihood of occurrence: Reason for likelihood
	EPBC Act	In WA		
Greater Bilby (*Macrotis lagotis*)	VU	S1	Variety of habitats on soft soil including spinifex hummock grassland, acacia shrubland, open woodland and cracking clays (Burrows *et al.* 2012).	**Unlikely** Few recent records of the species within the vicinity of the Study Area and the species is likely to be locally extinct (Woinarski *et al.* 2014). Nearest DPaW (2015b) record was located ~40 km southeast of the Study Area in 1929 and 75 km west of the Study Area in 1984. Suitable habitat for the species not present within Study Area.
Malleefowl (*Leipoa ocellata*)	VU	S1	Mainly scrubs and thickets of mallee, boree and bowgada, but also other litter forming shrublands (Johnstone and Storr 1998).	**Unlikely** The species has been recorded at three locations within 100 km of the Study Area between 1999 and 2010 (Birdlife Australia 2015, DPaW 2015b). The species is only thought to be scattered throughout the region (Benshemesh 2007) with the majority of records occurring further to the south (DoE 2015). The species tends to occur in dense shrublands and low woodlands which may provide leaf litter suitable for use in the construction of nesting mounds (DoE 2015). Although the species may occur in low numbers in the region, it is unlikely to occur in the Study Area due to a lack of suitable dense habitat.
Western Spiny-tailed Skink (*Egernia stokesii badia*)	EN	S1	Small, isolated stands of granite to larger, more extensive clusters of rock (DoE 2015).	**Unlikely** The species has been recorded at three locations ~75 km southwest of the Study Area (DPaW 2015b). The black form of *Egernia stokesii badia* from the Murchison region inhabits areas ranging from small, isolated stands of granite to larger, more extensive clusters of rock (DoE 2015). This species is unlikely to occur in the Study Area given that habitat which support this species (rocky Granite outcrops) is not present in Study Area. Note: The population of *Egernia stokesii* on Baudin Island, within Shark Bay that was previously known as *Egernia stokesii aethiops*, has now been included under *Egernia stokesii badia* (DoE 2015). This is mentioned because *Egernia stokesii aethiops* was identified as a separate species with potential to occur in the Study Area in the recent database search results from the DPaW and DoE.

Common name (*Scientific name*)	Status		Broad habitat type	Likelihood of occurrence: Reason for likelihood
	EPBC Act	In WA		
Shield-backed Trapdoor (Idiosoma nigrum)	VU	S1	At the Weld Range, 50 km west of the Study Area, the species has been found to occur within the boundaries of drainage lines, predominantly under Acacias, on the slopes, footslopes or plains along BIF ranges (DoE 2015, ecologia Environment 2009). Substrate predominantly comprises clay and rocks (54%) or clay rock and sand 38% (DoE 2015, ecologia Environment 2009).	**Unlikely** There is estimated to be a population in excess of 3,000 individuals at Weld Range located approximately 50 km west of the Study Area (DoE 2015, DPaW 2015b, ecologia Environment 2009). The species appears to occur as isolated populations in the Midwest at Jack Hills, Weld Range and Blue Hills. Given the isolation of these populations and they association with prominent ranges, it appears unlikely that this species occurs within the Study Area.
Curlew Sandpiper (*Calidris ferruginea*)	M	S1/S3	Commonly inhabits coastal areas namely exposed tidal mudflats, and less frequently on inland freshwater wetlands (Geering *et al.* 2007).	**Unlikely** Species recorded approximately 50 km south of Study Area in 2005 (Birdlife Australia 2015), this records represents one of the few inland DPaW (2015b) records for central WA. The species is considered rare inland of north-west Australia and may be recorded on their southward migratory flights (Johnstone and Storr 1998). Suitable habitat (shallow ephemeral open waterbodies) is not present within the Study Area.
Grey Falcon (Falco hypoleucos)		S1	Mainly lightly wooded coastal and riverine plains (Johnstone and Storr 1998).	**Possible** The species was recorded <10 km form the Study Area in 2003 (Birdlife Australia 2015, DPaW 2015b). The species occurs in the northern half of the state as far south as 26°S, however has been known to occasionally occur further south in historical times (Johnstone and Storr 1998). The Study Area occurs just south of the species recent distribution and there has been a recent record in vicinity of the Study Area, consequently it is possible that it occurs in the Study Area from time to time for foraging, however it is unlikely to be dependent upon the Study Area for nesting due to a lack of suitable habitat.
Peregrine Falcon (*Falco peregrinus*)	-	S4	The species occurs along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes nesting on cliffs, granite outcrops, quarries (Johnstone and Storr 1998).	**Possible** Species has been recorded 10 km from within the Study Area in 2000 and there are an additional six records within 50 km from 1999-2013 (Birdlife Australia 2015, DPaW 2015b). The Low Open Mulga Woodland and Drainage Line habitats of the Study Area provide suitable foraging resources for the species however there is no suitable nesting habitat for the species in the Study Area.

Common name (*Scientific name*)	Status		Broad habitat type	Likelihood of occurrence: Reason for likelihood
	EPBC Act	In WA		
Fork-tailed Swift (*Apus pacificus*)	M	S3	Aerial species, which forages high above the tree canopy and rarely lower (Johnstone and Storr 1998).	**Possible** Species previously recorded approximately 60 km southwest of the Study Area in 2001 (Birdlife Australia 2015, DPaW 2015b). The Study Area is located within the species distribution. The species is an irregular visitor within the region (Johnstone and Storr 1998) and it is possible that the species may fly over and forage above the Study Area on an irregular basis but is not likely to be dependent upon habitat in the Study Area.
Eastern Great Egret (*Ardea modesta*)	M	S3	Shallow freshwater, riverpools, claypans, swamps, lagoons, inundated pastures and wheatfields, ephemeral pools, dams and sewage ponds (Johnstone and Storr 1998).	**Possible** This species has been recorded approximately 16 km to the north at Lake Annean and there are numerous records from Lake Austin approximately 50 km southwest of the Study Area. The species is considered a uncommon to very common visitor to flooded claypans or flooded samphire after periods of rain (Johnstone and Storr 1998). The species may forage in the Ephemeral Wetland when inundated with water, however it is not likely to be dependent upon this habitat.
Oriental Plover (*Charadrius veredus*)	M	S3	The species is found on sparsely vegetated plains including Samphire, Spinifex plains (particularly after fire), as well as beaches and tidal flats (Johnstone and Storr 2004)	**Unlikely** There are no records of this species within the vicinity of the Study Area, with the closest record being approximately 500 km away, however the DoE (2015) suggests that 'habitat may occur' in the vicinity of the Study Area. The species is common to coastal areas and may casually occur in inland areas. Suitable habitat is not present within the Study Area.
Rainbow Bee-eater (*Merops ornatus*)	M	S3	Lightly wooded, often sandy country, preferring areas near water (Johnstone and Storr 1998).	**Likely** The species is considered a partial migrant in the region and generally a common species (Barrett *et al.* 2003, Boland 2004). The species has previously been recorded within the vicinity of Study Area. The species may occur over the Study Area as a resident or as a migrant and is more likely to frequent areas where water accumulates such as the Drainage Lines and the Ephemeral Wetland habitats.

Common name (*Scientific name*)	Status		Broad habitat type	Likelihood of occurrence: Reason for likelihood
	EPBC Act	In WA		
Common Sandpiper (*Actitis hypoleucos*)	M	S3	Edge of sheltered waters, salt or fresh, estuaries, river pools, claypans, drying swamps etc. (Johnstone and Storr 1998).	**Unlikely** This species has been recorded 30 km south of the Study Area in 2001, however the majority of records of this species are along the Western Australian coastline (Birdlife Australia 2015, DPaW 2015b). The species prefers large open water bodies and may occur at the salt lakes to the north and south of the Study Area after periods of inundation, however the species is unlikely to occur within the Study Area due to a lack of suitable habitat.
Sharp-tailed Sandpiper (*Calidris acuminata*)	M	S3	Coastal and inland areas saline and freshwater but prefers non-tidal fresh or brackish wetlands (Geering *et al.* 2007)	**Unlikely** This species has been recorded at Lake Austin approximately 50 km south of the Study Area (Birdlife Australia 2015, DPaW 2015b). The species is more likely to occur in coastal habitats, but may occur inland after substantial rainfall events (Johnstone and Storr 1998). Consequently, the species may visit the large open water bodies of Lake Annean to the north and Austin to the south of the Study Area after periods of inundation, however the species is unlikely to occur within the Study Area due to a lack of suitable habitat.
Red-necked Stint (*Calidris ruficollis*)	M	S3	Edge of sheltered salt, brackish or fresh waters, mainly estuaries and near coastal wetlands (Johnstone and Storr 1998).	**Unlikely** The species has previously been recorded 25 km southwest of the Study Area at Lake Nallan (Birdlife Australia 2015, DPaW 2015b). The species has a preference for shallow open water bodies and may irregularly visit the large salt lakes in the region after periods of rainfall (Johnstone and Storr 1998), however it is unlikely to frequent the area on a regular basis. The species is unlikely to occur within the Study Area due to a lack of suitable habitat.
Wood Sandpiper (*Tringa glareola*)	M	S3	Freshwater wetlands and occasional brackish intertidal mudflats (Geering *et al.* 2007).	**Unlikely** The species has previously been recorded 25 km southwest of the Study Area at Lake Nallan and 50 km south of the Study Area at Lake Austin (Birdlife Australia 2015, DPaW 2015b). The species has a preference for shallow open water bodies and may irregularly visit the freshwater claypans associated with the large salt lakes in the region after periods of rainfall (Johnstone and Storr 1998), however it is unlikely to frequent the area on a regular basis. The species is unlikely to occur within the Study Area due to a lack of suitable habitat.

Common name (*Scientific name*)	Status		Broad habitat type	Likelihood of occurrence: Reason for likelihood
	EPBC Act	In WA		
Common Greenshank (*Tringa nebularia*)	M	S3	Intertidal mudflats, as well as fresh and saltwater wetlands of the coast or inland (Johnstone and Storr 1998).	**Unlikely** The species has previously been recorded 25 km southwest of the Study Area at Lake Nallan and 50km south of the Study Area at Lake Austin (Birdlife Australia 2015, DPaW 2015b). The species has a preference for shallow open water bodies and may irregularly visit the freshwater claypans and large salt lakes in the region after periods of rainfall (Johnstone and Storr 1998), however it is unlikely to frequent the area on a regular basis. The species is unlikely to occur within the Study Area due to a lack of suitable habitat.
Marsh Sandpiper (*Tringa stagnatilis*)	M	S3	It inhabits freshwater or saltwater wetlands but avoids open beaches and mudflats unless well protected (Geering *et al.* 2007, Johnstone and Storr 1998).	**Unlikely** The species was identified from two database searches (Birdlife Australia 2015, DPaW 2015b). The species inhabits freshwater or saltwater wetlands and may irregularly visit the freshwater claypans and large salt lakes in the region after periods of rainfall (Johnstone and Storr 1998), however it is unlikely to frequent the area on a regular basis. The species is unlikely to occur within the Study Area due to a lack of suitable habitat.
Glossy Ibis (*Plegadis falcinellus*)	M	S3	Freshwater wetlands, irrigated areas, margins of dams, floodplains, brackish and saline wetlands, tidal mudflats, pastures, lawns and public gardens (Johnstone *et al.* 2013)	**Possible** The species has previously been recorded 25 km southwest of the Study Area at Lake Nallan (Birdlife Australia 2015, DPaW 2015b). This species known to occur in the north-east and south-west Kimberley and the Swan Coastal Plain, however it may occur in more arid areas of WA when inundated after rainfall (Johnstone and Storr 1998). Within these areas it is known to frequent shallow and adjacent flats of freshwater lakes and swamps (Johnstone and Storr 1998) and consequently it may occur within the Ephemeral Wetland habitat in the Study Area. However the species is not likely to be dependent on this habitat given that the Study Area is outside its normal distribution.
White-winged Tern (*Chlidonias leucopterus*)	M	S3	Mainly estuaries and sheltered seas in the north and freshwater lakes in the south, but also inhabits samphire, short-grass flats, saltlakes and sewage ponds (Johnstone and Storr 1998).	**Unlikely** The species was identified from two database searches (Birdlife Australia 2015, DPaW 2015b). This species tends to prefer estuaries and lakes along the coast (Johnstone and Storr 1998) and rarely occurs on inland wetlands in WA (DoE 2015). It is possible that the species may occur at the nearby salt lakes when inundated, however it is unlikely to occur within the Study Area given the lack of suitable habitat.

Common name (*Scientific name*)	Status		Broad habitat type	Likelihood of occurrence: Reason for likelihood
	EPBC Act	In WA		
Oriental Pratincole (*Glareola maldivarum*)	M	S3	Usually inhabits open plains, flood plains or short grassland, or occurs near wetlands, and reservoirs, salt works and around the margins of sewage farms (DoE 2015, Johnstone and Storr 1998).	**Unlikely** The closest record is 400km west of the Study Area along the WA coast (Birdlife Australia 2015, DPaW 2015b), however the DoE (2015) suggests that 'habitat may occur' in the vicinity of the Study Area. Although records of this species align closely with the coast, there have been scattered records inland, mostly north of 20°S (DoE 2015). Although potential habitat occurs in the Study Area, the species is unlikely to occur given that the Study Area is outside of the species normal distribution and has not been recorded within 100km of the Study Area.
Lerista eupoda		P1	Open Mulga areas on loamy soils (Wilson and Swan 2013).	**Likely** This species is represented by 21 records within the vicinity of the Study Area with the closest record being approximately 5 km north of the Study Area and the furthest record being approximately 75 km to the southwest of the Study Area (DPaW 2015b). Given that suitable habitat occurs in the Study Area and that the species is endemic to the area, it is likely that this species occurs within the Low Open Mulga Woodland habitat and similar Mulga dominated habitats on loamy soils within the Study Area.
Branchinella simplex		P1	Ephemeral claypans associated with larger saltlakes (Gooderham and Tsyrlin 2002).	**Unlikely** This species of fairy shrimp was recorded within a claypan at Lake Annean, approximately 16 km north of the Study Area in 1978 (DPaW 2015b). The species has scattered records across WA as far east as Laverton and as far south as Corrigin (DPaW 2015b). Although the record is close to the Study Area, the species is unlikely to occur due to a lack of suitable habitat.
Blue-billed Duck (*Oxyura australis*)		P4	Mainly deeper freshwater swamps and lakes, but occasionally saltlakes and estuaries freshened by floodwaters (Johnstone and Storr 1998).	**Unlikely** There has been a single record of this species 25 km southwest of the Study Area at Lake Nallan, however the vast majority of this species records occur in the southwest of WA (Birdlife Australia 2015, DPaW 2015b). The species prefers deep waterbodies, but may occasionally visit the salt lakes surrounding the Study Area after periods of inundation. The species is unlikely to occur within the Study Area due to a lack of suitable habitat and the Study Area being outside the species normal distribution.

6 Survey Limitations and Constraints

There are a number of possible limitations and constraints that can impinge on the adequacy of vegetation, flora and fauna surveys (EPA 2004a, b).

Table 6-1: Potential limitations and constraints of the field survey

Factor	Constraint	Comments
Competency and experience of consultants	No	The surveyors were a botanist and a zoologist with appropriate qualifications and several years of experience undertaking flora and fauna surveys. The fauna survey was led by Matt Quinn who has five years zoological experience. The vegetation and flora survey was conducted by Scott Walker who has five years botanical experience. Megan Stone completed the identification of flora collections at the WA Herbarium with assistance from taxonomist Cate Tauss.
Scope	No	The scope of the study did not have any constraints. Database searches were conducted and flora and fauna were surveyed using standardised and well-established techniques.
Proportion of species identified	No	The field species inventory is considered appropriate for a Level 1 Flora and Fauna Assessment. Of the 101 flora taxa recorded during this survey, seven (6.9%) could not be identified with confidence, due to lack of reproductive material.
Information sources (e.g. historic or recent)	No	The Study Area is located in a relatively well-surveyed region of the Murchison in which MWH (previously trading as Outback Ecology) has experience.
Proportion of task achieved, and further work which might be needed	No	Planned survey works were conducted and completed according to scope.
Timing / weather / season / cycle	No	Weather was mild throughout the field survey and typical for the area during April. The survey followed significant rains and suitable proportions of plants were flowering to enable identification. Targeted searches for conservation significant species were not hampered.
Disturbances	No	Some areas of the Study Area were degraded as a result of previous mining activities, however the majority of the Study Area was considered to be in 'Very Good' condition. Disturbance in these areas comprised previous drilling programs, vehicle tracks, low density weeds, feral animal grazing and trampling.
Intensity	No	A total of 8 days was spent by a botanist and zoologist traversing the site conducting 19 relevés, targeted searches for conservation significant flora and fauna, and 8 habitat assessments. This level of on-ground survey effort is appropriate for a Level 1 Flora and Fauna Assessment for a Study Area of this size.
Completeness	No	The desktop study and field survey is considered complete for a Level 1 Flora and Fauna Assessment.
Resources	No	Resources were adequate to carry out the survey satisfactorily, and the survey participants were competent in identification of species present.
Remoteness / access problems	No	Access was not a constraint with the majority of the Study Area accessible by vehicle or by foot.
Availability of contextual information	No	The data available for the region was adequate for the level of survey undertaken during this assessment.

7 Conclusion

7.1 Flora and Vegetation

The Level 1 Flora and Vegetation Survey identified a total of 101 vascular flora taxa within the Study Area.

There were no DPaW listed Threatened flora taxa, as listed under the WC Act 1950 (WA) or EPBC Act (1999) (C'th) identified. There was one DPaW listed Priority 3 Flora taxon, awaiting verification at the Western Australian Herbarium. The survey identified three introduced flora taxa. There were no range extensions.

A total of ten broad vegetation units were identified and mapped. None of the vegetation units were analogous to any TECs or PECs listed as occurring in the region. One vegetation unit, ApEpAk, may be considered locally significant if found to be supporting the Priority 3 flora taxon (specimen awaiting verification at the Western Australian Herbarium). One vegetation type, a small wetland coded HpEgCd was not observed outside the Study Area. Further investigation would be required to determine if this vegetation unit is represented beyond the Study Area.

The vegetation condition of the Study Area was primarily Good with a small Degraded Area. The vegetation condition within the Study Area ranged from Very Good to Completely Degraded. Disturbance at the site included past mining operations and drilling programs, vehicle tracks, low density weeds, feral animal grazing and trampling.

Tentative monitoring locations for vegetation condition was selected during the field survey and will be validated and installed once the monitoring objectives have been verified by Metals X.

7.2 Vertebrate Fauna

Excluding areas of disturbance associated with the minesite, five broad fauna habitats were identified during the field survey. These habitats were:

- Low Open Mulga Woodland;
- Open Eremophila Shrubland;
- Stony Rise;
- Stony Plain; and
- Drainage Lines.

In addition to the broad habitats, there were two small areas of Ephemeral Wetland habitat located in the central section of the Study Area. Each of the broad habitats are widespread and well represented in the Murchison bioregion, however the Ephemeral Wetland habitat may be of local significance.

No conservation significant fauna were recorded during the survey, however seven species of conservation significance are considered likely or possible to occur on the basis of habitat present in the study area and the location of previous records.

Two fauna considered 'Likely' to occur in the Study Area comprised:

- Rainbow Bee-eater (Merops ornatus), which is listed as Migratory (EPBC Act) and Schedule 3 (WC Act); and
- Lerista eupoda, which is listed as Priority 1 Fauna (DPaW).

Five fauna considered 'Possible' to occur in the Study Area comprised:

- Fork-tailed Swift (Apus pacificus), Eastern Great Egret (Ardea modesta), Glossy Ibis (Plegadis falcinellus), which are listed as Migratory (EPBC Act) and Schedule 3 (WC Act);
- Grey Falcon (Falco hypoleucos), which is listed as Schedule 1 (WC Act); and
- Peregrine Falcon (Falco peregrinus), which is listed as Schedule 4 (WC Act).

Based on the proposed dewatering operations for the northern and southern portion of the Study Area, there are unlikely to be any significant impacts to any fauna species including any conservation significant species.

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Appendix A Codes and terms used to describe flora and vegetation of Conservation Significance

Definitions of Codes and Terms used to Describe Conservation Significance of Flora

Status	Code	Description
Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*		
Threatened	T	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such
Schedule 2 of the Wildlife Conservation (Rare Flora) Notice under the *Wildlife Conservation Act 1950*		
Presumed Extinct Flora	X	Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such
Threatened Flora (Schedule 1) are further ranked by DPaW according to their level of threat using IUCN Red List criteria:		
Critically Endangered	CR	considered to be facing an extremely high risk of extinction in the wild
Endangered	EN	considered to be facing a very high risk of extinction in the wild
Vulnerable	VU	considered to be facing a high risk of extinction in the wild.
DPAW Priority List		
Priority One (Poorly known taxa)	P1	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
Priority Two (Poorly known taxa)	P2	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
Priority Three (Poorly known taxa)	P3	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
Priority Four (Near threatened or other taxa in need of monitoring)	P4	1. Rare. Taxa 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 taxa are usually represented on conservation lands. 2. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. 3. Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Priority Five (Conservation dependent taxa)	P5	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Definitions for Threatened Ecological Communities (TEC)

TECs are indirectly protected under the Western Australian Environmental Protection Act 1986 and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. 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 (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):
   i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);
   ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
   i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);
   ii) 0there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
   iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):
   i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);
   ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
   i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);
   ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;
   iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout

its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definitions for Priority Ecological Communities (PEC)

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities

Ecological communities that are known from very few occurrences with a very restricted distribution (generally =5 occurrences or a total area of = 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few occurrences with a restricted distribution (generally =10 occurrences or a total area of =200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) 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: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four:

Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

Ecological communities that have been removed from the list of threatened communities during the past five years.

These communities require regular monitoring.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix B Codes and terms used to describe fauna of Conservation Significance

Fauna may be accorded legislative protection by being listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) and/or the *Wildlife Conservation Act 1950* (WA) (WC Act), or by being listed on the WA Department of Environment and Conservation's *Priority Species List*. This Appendix presents a summary of the different rankings and listings used to describe conservation status. Some categories, such as 'extinct', 'extinct in the wild' and 'conservation dependent' (EPBC Act) are not presented here, as the table includes only the information needed to fully understand the codes presented in the preceding report. Refer to the relevant legislation for a full description of all codes in use, as well as their associated criteria.

Definitions of Codes and Terms Used to Describe Conservation Significance Status

Status	Code	Description
Categories used under the EPBC Act		
Critically Endangered	CR	Fauna that is considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	EN	Fauna that is considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	VU	Fauna that is considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	M	Species that migrate to, over and within Australia and its external territories.
Schedules used under the WC Act		
Schedule 1	S1	Fauna that is rare or likely to become extinct. Threatened fauna listed under Schedule 1 of the WC Act are further ranked by the DEC, according to the level of threat facing each species. The ranks are CR, EN and VU.
	CR	Critically endangered: considered to be facing an extremely high risk of extinction in the wild
	EN	Endangered: considered to be facing a very high risk of extinction in the wild
	VU	Vulnerable: considered to be facing a high risk of extinction in the wild
Schedule 2	S2	Fauna that is presumed to be extinct
Schedule 3	S3	Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds
Schedule 4	S4	Fauna that is in need of special protection, other than for reasons mentioned above

DEC Priority Fauna Lists		
Priority 1	P1	Taxa with few, poorly known populations on threatened lands. These are known from few specimens or sight records from one or a few localities on lands not managed for conservation, eg agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands. These are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, eg national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands. These are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 4	P4	Taxa in need of monitoring. These are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring. These are not considered threatened but are subject to a specific conservation programme, the cessation of which would result in the species becoming threatened within five years.

Appendix C Vegetation structural scales

NVIS Vegetation Structural Classifications

Cover Characteristics							
Foliage cover *	70-100	30-70	10-30	<10	≈0	0-5	unknown
Crown cover **	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
% Crown cover ***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
Cover code	d	c	i	r	bi	bc	unknown

Growth Form	Height ranges (m)	Structural Formation Classes						
tree, palm	>30 Tall 10-30 Mid <10 Low	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	10-30 Tall <10 Mid <3 Low	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, fern	>2 Tall 1-2 Mid <1 Low	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	10-30 Tall <10 Mid <3 Low	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	>2 Tall 1-2 Mid <1 Low	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	>2 Tall 1-2 Mid <1 Low	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	>0.5 Low <0.5 Low	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	>2 Tall <2 Tall	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses

Growth Form	Height ranges (m)	Structural Formation Classes						
tussock grass	>0.5 Mid <0.5 Low	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grasses
other grass	>0.5 Mid <0.5 Low	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	>0.5 Mid <0.5 Low	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	>0.5 Mid <0.5 Low	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	>0.5 Mid <0.5 Low	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	>2 Tall 1-2 Tall <1Low	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumpsof ferns	ferns
bryophyte	<0.5	closed bryophyte land	bryophyte land	open bryophyte land	sparse bryophyte land	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	>30 Tall 10-30 Med <10 Low	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	<1 Tall 0-0.5 Low	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	<1 Tall 0-0.5 Low	closed seagrass bed	seagrassbed	open seagrassbed	sparse seagrassbed	isolated seagrasses	isolated clumps of seagrasses	seagrasses

From: NVIS Structural Formation Terminology (Australian Vegetation Attribute Manual Version 6.0 August 2003 http://www.environment.gov.au/erin/nvis/publications/avam/pubs/vegetation-attribute-manual-6.pdf)

* Foliage Cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is similar to the Crown type of Walker & Hopkins (1990) but is applied to a stratum or plot rather than an individual crown. It is generally not directly measured in the field for the upper stratum, although it can be measured by various line interception methods for ground layer vegetation. For the attribute COVER CODE in the Stratum table, the ground cover category refers to ground foliage cover not percentage cover.

** Crown Cover (canopy cover) as per Walker & Hopkins (1990). Although relationships between the two are dependent on season, species, species age etc (Walker & Hopkins (1990), the crown cover category classes have been adopted as the defining measure.

*** The percentage cover is defined as the percentage of a strictly defined plot area, covered by vegetation. This can be an estimate and is a less precise measure than using, for example, a point intercept transect methods on ground layer, or overstorey vegetative cover. That is for precisely measured values (e.g. crown densitometer or point intercept transects) the value measured would be 'foliage' cover. Where less precise or qualitative measures are used these will most probably be recorded as 'percentage' cover.

Appendix D Vegetation condition scales

Vegetation Condition Scale (Keighery 1994)

Code	Description
Pristine	Pristine or nearly so. No obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
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 or shrubs.

Appendix E Conservation Significant Flora taxa identified by the desktop study

Taxon	Conservation Status	Habitat	Likelihood of Occurrence in the Study Area	Reason
Eremophila rostrata subsp. *rostrata*	T	Saline quartzite loams. Hills and flats.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Acacia dilloniorum	1	Red clay-loam over exposed dolerite outcropping. Gully. Dry fluviatile gravel. Granite boulder.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Angianthus uniflorus	1	Margin of calcrete rise near gypseous salt lake.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Eremophila retropila	1	Gravelly loam. Stony flats.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Eremophila rhegos	1	Skeletal stony loam over granite.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Eremophila sp. Meekatharra (D.J. Edinger 4430)	1	No information available	Unlikely	The Survey Area lies outside the known distribution of the species.
Jacksonia lanicarpa	1	Red sand.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Millotia depauperata	1	Sandy loam. Granite outcrops.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Minuria tridens	1	Roadsides.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Rhodanthe sphaerocephala	1	Clayey loam. On flats.	Unlikely	The Survey Area lies outside the known distribution of the species.
Stenanthemum patens	1	Rocky hillside.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed
Angianthus microcephalus	2	Sandy or clayey soils. Salt swamps and pans.	Possible	The Survey Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed

Taxon	Conservation Status	Habitat	Likelihood of Occurrence in the Study Area	Reason
Bergia auriculata	2	Clay soils. Mud flats.	Possible	The Survey Area lies within the known distribution of the species, but the species is patchily distributed. The nearest known location is 28km north of the Study Area.
Acacia burrowsiana	3	Red-brown loams with ironstone rubble on surface, calcrete soils, laterite, quartz. Flats adjacent to watercourses, crests of low rises, breakaways.	Likely	The Survey Area lies within the known distribution of the species and likely contains suitable habitat
Acacia sclerosperma subsp. glaucescens	3	Sand, sandy loam, stony soils.	Very Likely	The Survey Area lies within the known distribution and is likely to contain suitable habitat. The nearest known location is 13.5km north of the Study Area.
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	3	Banded ironstone, red-brown soils	Unlikely	The Survey Area is unlikely to contain suitable habitat.
Calytrix verruculosa	3	Sandy clay.	Very Likely	The Survey Area lies within the known distribution and is likely to contain suitable habitat. The nearest known location is 16km east of the Study Area.
Drummondita miniata	3	Laterite. Breakaways.	Likely	The Survey Area lies within the known distribution and may contain suitable habitat. The nearest known location is 21km south of the Study Area.
Eremophila fasciata	3	Hills, breakaways, plains. Red-brown ironstone gravel.	Possible	The Survey Area lies within the known distribution of the species and may contain suitable habitat
Euryomyrtus recurva	3	Yellow/red sand, brown/yellow sandy clay. Gravel pits, catchment slopes.	Possible	The Survey Area lies within the known distribution of the species and may contain suitable habitat
Hemigenia tysonii	3	Red sand, sandy clay, lateritic sand. Flats, sand dunes, hills.	Unlikely	The Survey Area is unlikely to contain suitable habitat
Hemigenia virescens	3	Brown very rocky sand. Hillside. Rangeland. Brown ironstone gravel. Yellow-red sandy clay. Shallow loam.	Likely	The Survey Area lies within the known distribution and may contain suitable habitat. The nearest known location is 17km north west of the Study Area.
Maireana prosthecochaeta	3	Laterite. Hills, salty places.	Likely	The Survey Area lies within the known distribution and is may contain suitable habitat.
Menkea draboides	3	Red sand or clay, granite.	Possible	The Survey Area lies within the known distribution of the species and may contain suitable habitat
Micromyrtus placoides	3	Gently undulating plains, dry creek beds, hillcrests, ridges.	Possible	The Survey Area lies within the known distribution of the species and may contain suitable habitat
Podotheca pritzelii	3	Sand ridges in salt flats.	Unlikely	The Survey Area lies outside the known distribution of the species.

Taxon	Conservation Status	Habitat	Likelihood of Occurrence in the Study Area	Reason
Prostanthera petrophila	3	Lateritic soils.	Possible	The Survey Area lies within the known distribution of the species and may contain suitable habitat
Ptilotus crosslandii	3	Colluvial plains.	Unlikely	The Survey Area lies outside the known distribution of the species.
Ptilotus lazaridis	3	Clay loam. Floodplains.	Likely	The Survey Area lies within the known distribution and may contain suitable habitat. The nearest known location is 15km north east of the Study Area.
Ptilotus luteolus	3	Hills and gravelly slopes. Brown, rocky soil with quartzite.	Possible	The Survey Area lies within the known distribution of the species and may contain suitable habitat
Sida picklesiana	3	Breakaways and ridges. Sandy loam with quartz and ironstone gravels and patches of BIF.	Likely	The Survey Area lies within the known distribution and may contain suitable habitat. The nearest known location is 9km east of the Study Area.
Tecticornia cymbiformis	3	Saline soils. Along the edge of creek lines.	Likely	The Survey Area lies within the known distribution and may contain suitable habitat. The nearest known location is 5km north of the Study Area.
Tecticornia fimbriata	3	Clay, loam. Margins of salt & gypsum lakes.	Unlikely	The Survey Area is unlikely to contain suitable habitat.
Verticordia jamiesonii	3	Sandy clay soils. Lateritic breakaways.	Unlikely	The Survey Area is unlikely to contain suitable habitat.
Acacia speckii	4	Rocky soils over granite, basalt or dolerite. Rocky hills or rises.	Likely	The Survey Area lies within the known distribution and may contain suitable habitat. The nearest known location is 25km north of the Study Area.
Dodonaea amplisemina	4	Red-brown sandy clay on basalt and gabbro and banded ironstone or on dolerite and quartzite. Rocky hills.	Possible	The Survey Area lies within the known distribution of the species and may contain suitable habitat
Eremophila pungens	4	Sandy loam, clayey sand over laterite. Plains, ridges, breakaways.	Unlikely	The Survey Area lies outside the known distribution of the species.
Eremophila youngii subsp. *lepidota*	4	Stony red sandy loam. Flats plains, floodplains, sometimes semi-saline, clay flats.	Unlikely	The Survey Area lies outside the known distribution of the species.
Goodenia berringbinensis	4	Red sandy loam. Along watercourses.	Likely	The Survey Area lies within the known distribution and may contain suitable habitat. The nearest known location is 25km west south-west of the Study Area.
Grevillea inconspicua	4	Loam, gravel. Along drainage lines on rocky outcrops, creek lines.	Likely	The Survey Area lies within the known distribution and likely contains suitable habitat.

Taxon	Conservation Status	Habitat	Likelihood of Occurrence in the Study Area	Reason
Trithuria australis	4	Wetland. Clay soils.	Unlikely	The Survey Area lies outside the known distribution of the species.

Appendix F Inventory of flora taxa recorded during the field survey

Family	Taxon
Amaranthaceae	*Ptilotus beardii* (P3)
	Ptilotus chamaecladus
	Ptilotus drummondii
	Ptilotus helipteroides
	Ptilotus macrocephalus
	Ptilotus obovatus
	Ptilotus roei
	Ptilotus rotundifolius
	Ptilotus sp.
Apocynaceae	*Marsdenia australis*
Asteraceae	*Pluchea dentex*
Asteraceae	**Sonchus oleraceus*
Chenopodiaceae	*Dissocarpus paradoxus*
	Dysphania melanocarpa
	Enchylaena tomentosa
	Maireana planifolia
	Maireana sp.
	Maireana tomentosa
	Maireana triptera
	Maireana villosa
	Salsola australis
	Sclerolaena bicornis
	Sclerolaena cuneata
	Tecticornia pterygosperma subsp. *denticulata*
Colchicaceae	*Wurmbea densiflora*
Cucurbitaceae	**Cucumis myriocarpus*
Cyperaceae	*Bulbostylis barbata*
	Cyperus iria
Euphorbiaceae	*Euphorbia drummondii*
	Euphorbia tannensis subsp. eremophila
Fabaceae	*Acacia ? caesaneura x incurvaneura*
	Acacia aptaneura
	Acacia craspedocarpa
	Acacia grasbyi
	Acacia incurvaneura
	Acacia kalgoorliensis
	Acacia pruinocarpa
	Acacia pteraneura
	Acacia ramulosa var. *linophylla*
	Acacia sclerosperma subsp. *sclerosperma*
	Acacia tetragonophylla

Family	Taxon
	Isotropis forrestii
	Senna artemisioides subsp. helmsii x oligophylla
	Senna glutinosa subsp. glutinosa
	Senna glutinosa subsp. glutinosa x luerssenii
	Senna glutinosa subsp. *pruinosa*
	Senna sp. Meekatharra (E. Bailey 1-26)
Frankeniaceae	*Frankenia laxiflora*
Geraniaceae	*Erodium cygnorum*
Goodeniaceae	*Goodenia triodiophila*
	Scaevola ? spinescens
	Scaevola spinescens
Lamiaceae	*Teucrium racemosum*
Loranthaceae	*Amyema nestor*
Malvaceae	*Abutilon cryptopetalum*
	Hibiscus burtonii
	Hibiscus leptocladus
	Sida arenicola
	Sida ectogama
	Sida fibulifera
	Sida sp. dark green fruits (S. van Leeuwen 2260)
	Sida sp. Excedentifolia (J.L. Egan 1925)
Nyctaginaceae	*Boerhavia coccinea*
Pedaliaceae	*Josephinia eugeniae*
Phyllanthaceae	*Phyllanthus maderaspatensis*
Pittosporaceae	*Pittosporum angustifolium*
Poaceae	*Aristida holathera* var. *holathera*
	Chrysopogon fallax
	**Cynodon dactylon*
	Dactyloctenium radulans
	Digitaria brownii
	Enneapogon caerulescens
	Enneapogon polyphyllus
	Eragrostis eriopoda
	Eragrostis falcata
	Eragrostis leptocarpa
	Eragrostis pergracilis
	Eragrostis setifolia
	Eragrostis sp.
	Eriachne pulchella subsp. pulchella
	Iseilema membranaceum

Family	Taxon
	Poaceae sp.
	Tragus australianus
Portulacaceae	*Portulacaceae* sp.
	Calandrinia sp.
Proteaceae	*Grevillea deflexa*
	Grevillea striata
	Hakea preissii
Rubiaceae	*Psydrax latifolia*
Scrophulariaceae	*Eremophila exilifolia*
	Eremophila forrestii subsp. forrestii
	Eremophila galeata
	Eremophila georgei
	Eremophila latrobei subsp. latrobei
	Eremophila linearis
	Eremophila oppositifolia subsp. angustifolia
	Eremophila sp.
Solanaceae	*Nicotiana occidentalis subsp. obliqua*
	Solanum lasiophyllum
Zygophyllaceae	*Tribulus astrocarpus*
	Zygophyllum ovatum

*Denotes an introduced flora taxon.

Appendix G Flora Site by Species Matrix

Taxon	Relevé																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Abutilon cryptopetalum		x			x					x			x	x		x			x
Acacia ? caesaneura x incurvaneura					x													x	x
Acacia aptaneura																x			
Acacia craspedocarpa		x							x	x			x			x	x		
Acacia grasbyi				x				x			x								
Acacia incurvaneura		x	x	x		x	x			x	x		x		x	x	x	x	x
Acacia kalgoorliensis														x					
Acacia pruinocarpa			x																
Acacia pteraneura									x					x					
Acacia ramulosa var. *linophylla*															x				
Acacia sclerosperma subsp. *sclerosperma*							x	x			x								x
Acacia tetragonophylla		x		x						x			x			x	x		x
Amyema nestor				x															
Aristida holathera var. *holathera*	x	x		x			x		x			x	x	x	x	x	x		x
Boerhavia coccinea	x							x											
Bulbostylis barbata												x				x	x		
Calandrinia sp.		x	x							x		x	x			x	x	x	x
Chrysopogon fallax								x											
**Cucumis myriocarpus*				x				x											
**Cynodon dactylon*								x											
Cyperus iria								x											
Dactyloctenium radulans	x	x		x				x	x			x	x						
Digitaria brownii		x								x									

Taxon	Relevé																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Dissocarpus paradoxus				x															
Dysphania melanocarpa		x											x						
Enchylaena tomentosa					x														
Enneapogon caerulescens	x		x	x			x					x							
Enneapogon polyphyllus	x			x			x					x				x	x		
Eragrostis eriopoda			x								x				x				
Eragrostis falcata																x			
Eragrostis leptocarpa		x												x					
Eragrostis pergracilis										x								x	
Eragrostis setifolia														x				x	
Eragrostis sp.																		x	
Eremophila exilifolia												x							
Eremophila forrestii					x	x	x		x	x	x	x	x		x	x		x	x
Eremophila galeata			x					x	x	x	x	x	x		x	x	x	x	x
Eremophila georgei									x						x				
Eremophila latrobei subsp. *latrobei*														x					
Eremophila linearis	x	x														x			x
Eremophila oppositifolia subsp. angustifolia				x										x					
Eremophila sp.			x		x														
Eriachne pulchella subsp. *pulchella*										x			x			x	x	x	
Erodium cygnorum															x				
Euphorbia drummondii																	x		
Euphorbia tannensis subsp.													x						

Taxon	Relevé																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
eremophila																			
Frankenia laxiflora														x					
Goodenia triodiophila																		x	
Grevillea deflexa								x						x					
Grevillea striata									x										
Hakea preissii							x	x											
Hibiscus burtonii					x				x	x				x	x				
Hibiscus leptocladus			x		x														
Iseilema membranaceum													x						
Isotropis forrestii														x					
Josephinia eugeniae																	x		
Maireana planifolia												x							
Maireana sp.	x					x													
Maireana tomentosa		x	x	x		x			x					x					
Maireana triptera	x	x	x	x	x	x	x					x	x	x	x				
Maireana villosa			x												x				
Marsdenia australis															x				
Nicotiana occidentalis subsp. *obliqua*					x			x					x				x		
Phyllanthus maderaspatensis			x																
Pittosporum angustifolium																			
Pluchea dentex								x											
Poaceae sp.				x															
Portulacaceae sp.		x		x															
Psydrax latifolia															x				

Taxon	Relevé																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Ptilotus beardii														x					
Ptilotus chamaecladus		x	x	x								x	x			x		x	x
Ptilotus drummondii																		x	
Ptilotus helipteroides					x														
Ptilotus macrocephalus																			
Ptilotus obovatus	x			x	x														
Ptilotus roei					x														
Ptilotus rotundifolius		x	x	x		x	x								x				
Ptilotus sp.				x															
Salsola australis	x	x																	
Scaevola ? spinescens				x															
Scaevola spinescens														x	x				x
Sclerolaena bicornis													x						
Sclerolaena cuneata	x																		
Senna artemisioides subsp. *helmsii x oligophylla*						x	x					x	x	x		x			
Senna glutinosa subsp. glutinosa						x													
Senna glutinosa subsp. glutinosa x luerssenii														x					
Senna glutinosa subsp. pruinosa					x														
Senna sp. Meekatharra (E. Bailey x-26)						x													
Sida arenicola								x		x		x							
Sida ectogama					x														
Sida fibulifera		x	x																

Taxon	Relevé																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Sida sp. dark green fruits (S. van Leeuwin 2260)			x																
Sida sp. Excedentifolia (J.L. Egan 1925)	x																		
Solanum lasiophyllum	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x		x	x
**Sonchus oleraceus*								x											
Tecticornia pterygosperma subsp. *denticulata*														x					
Teucrium racemosum									x										
Tragus australianus				x															
Tribulus astrocarpus					x				x	x	x					x		x	
Wurmbea densiflora												x	x						
Zygophyllum ovatum	x																		

Appendix H Flora relevés

Flora Relevé 1

Site Details:

Described by:	Scott Walker	
Date:	15/04/2015	
Type:	Relevé	
MGA Zone: 50	627811 mE	7003392 mN

Environmental Variables:

Landform: Plain
Slope: <1%

Soils:

Soil Texture: Loam/clay
Soil Colour: Brown/red
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 55%
Size: 1 to 2 cm
Outcropping: 5%

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): None

FLORA AND VEGETATION DATA

Description: Sparse heathland dominated by *Eremophila linearis* and *Solanum lasiophyllum* over sparse chenopod shrubland dominated by *Maireana* spp. over mixed sparse grassland dominated by *Aristida holathera var. holathera*

Species List

Species Name	Height (m)	Cover (%)
Aristida holathera var. *holathera*	0.2	5
Boerhavia coccinea	0.1	<1
Dactyloctenium radulans	0.3	1
Enneapogon caerulescens	0.2	2
Enneapogon polyphyllus	0.3	2
Eremophila linearis	2	5
Maireana sp.	0.2	1
Maireana triptera	0.2	1
Ptilotus obovatus	0.2	1
Salsola australis	0.1	<1
Sclerolaena cuneata	0.2	1
Sida sp. *Excedentifolia* (J.L. Egan 1925)	0.1	<1
Solanum lasiophyllum	0.5	<1
Zygophyllum ovatum	0.1	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
5	<1	

Vegetation Condition: Good
Weeds: Nil
Fire Age: >5 years

SITE PHOTOGRAPH

Flora Relevé 2

Site Details:

Described by: Scott Walker
Date: 15/04/2015
Type: Relevé
MGA Zone: 50 627885 mE 7003387 mN

Environmental Variables:

Landform: Drainage line
Slope: <1

Soils:

Soil Texture: Sandy/loam
Soil Colour: Red
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: <1%
Size: 1 to 2 cm
Outcropping: 1%

FLORA AND VEGETATION DATA

Description: Low woodland dominated by mixed *Acacia spp.* over tall open shrubland dominated by *Eremophila linearis* over mixed low sparse chenopod shrubland over mixed open grassland

Species List

Species Name	Height (m)	Cover (%)
Abutilon cryptopetalum	0.5	<1
Acacia craspedocarpa	4	15
Acacia incurvaneura	5	15
Acacia tetragonophylla	3	3
Aristida holathera var. *holathera*	0.2	5
Calandrinia sp.	0.1	<1
Dactyloctenium radulans	0.2	15
Digitaria brownii	0.5	20
Dysphania melanocarpa	0.1	<1
Eragrostis leptocarpa	0.6	5
Eremophila linearis	3	10
Maireana tomentosa	0.2	<1
Maireana triptera	0.1	<1
Portulacaceae sp.	0.1	<1
Ptilotus chamaecladus	0.1	<1
Ptilotus rotundifolius	0.4	2
Salsola australis	0.1	<1
Sida fibulifera	0.1	1
Solanum lasiophyllum	0.5	2

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
70	<1	

Vegetation Condition: Good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 3

Site Details:

Described by:	Scott Walker	
Date:	15/04/2015	
Type:	Relevé	
MGA Zone: 50	627002 mE	7002422 mN

Environmental Variables:

Landform: Plain
Slope: <1

Soils:

Soil Texture: Sandy loam
Soil Colour: Red
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 1%
Size: 1 to 5 cm
Outcropping: 1%

FLORA AND VEGETATION DATA

Description: Low isolated trees dominated by *Acacia spp.* over tall sparse shrubland dominated by *Eremophila spp* and *Acacia spp.* over mixed isolated grasses

Species List

Species Name	Height (m)	Cover (%)
Acacia incurvaneura	5	7
Acacia pruinocarpa	6	2
Calandrinia sp.	0.1	<1
Enneapogon caerulescens	0.2	0.5
Eragrostis eriopoda	0.3	0.5
Eremophila galeata	2.2	1
Eremophila sp.		
Hibiscus leptocladus	0.2	<1
Maireana tomentosa	0.3	1
Maireana triptera	0.2	1
Maireana villosa	0.8	1
Phyllanthus maderaspatensis	0.5	<1
Ptilotus chamaecladus	0.1	<1
Ptilotus rotundifolius	0.3	0.5
Sida fibulifera	0.1	<1
Sida sp. *dark green fruits* (S. van Leeuwen 2260)	0.5	<1
Solanum lasiophyllum	0.2	1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
80	2	

Vegetation Condition: Good
Weeds: Nil

Fire Age: >5 years

SITE PHOTOGRAPH

Flora Relevé 4

Site Details:

Described by:	Scott Walker	
Date:	16/04/2015	
Type:	Relevé	
MGA Zone: 50	625811 mE	6997220 mN

Environmental Variables:

Landform: Plain
Slope: <1

Soils:

Soil Texture: Sandy loam
Soil Colour: Orange/red
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 75%
Size: 1 to 20cm
Outcropping: No

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Isolated tall shrubs dominated by *Acacia incurvaneura* over isolated tall shrubland dominated by *Acacia spp.* over mixed sparse chenopod shrubland

Species List

Species Name	Height (m)	Cover (%)
Acacia grasbyi	2	3
Acacia incurvaneura	5	2
Acacia tetragonophylla	1.3	2
Amyema nestor	0.2	<1
Aristida holathera var. *holathera*	0.2	<1
Cucumis myriocarpus	0.1	<1
Dactyloctenium radulans	0.1	0.5
Dissocarpus paradoxus	1	1
Enneapogon caerulescens	0.2	2
Enneapogon polyphyllus	0.3	<1
Eremophila oppositifolia subsp. *angustifolia*	3	-
Maireana tomentosa	0.1	<1
Maireana triptera	0.3	2
Poaceae sp.	0.3	<1
Portulacaceae sp.	0.1	<1
Ptilotus chamaecladus	0.1	<1
Ptilotus obovatus	0.2	1
Ptilotus rotundifolius	0.1	<1
Ptilotus sp.	0.1	<1
Scaevola? *spinescens*	0.5	<1
Solanum lasiophyllum	0.3	2
Tragus australianus	0.2	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
10	-	

Vegetation Condition: Good
Fire Age: >5 years
Weeds: *Cucumis myriocarpus*

SITE PHOTOGRAPH

Flora Relevé 5

Site Details:

Described by: Scott Walker
Date: 16/04/2015
Type: Relevé
MGA Zone: 50 625148 mE 7000162 mN

Environmental Variables:

Landform: Hill
Slope: 2%

Soils:

Soil Texture: Sandy/clay
Soil Colour: Red
Rock Type: Laterite

Coarse Surface Particles:

Site coverage: 60%
Size: 5 to 50cm
Outcropping: 5%

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Mid open mulga woodland dominated by over low sparse shrubland dominated by *Eremophila forrestii* over mixed sparse chenopod shrubland.

Species List

Species Name	Height (m)	Cover (%)
Abutilon cryptopetalum	0.1	<1
Acacia ? caesaneura x incurvaneura	5	55
Enchylaena tomentosa	0.2	0.5
Eremophila forrestii	1	5
Eremophila sp.	0.5	0.5
Hibiscus burtonii	0.1	0.5
Hibiscus leptocladus	0.3	<1
Maireana triptera	0.1	<1
Nicotiana occidentalis subsp. *obliqua*	0.1	<1
Ptilotus helipteroides	0.2	<1
Ptilotus obovatus	0.7	1
Ptilotus roei	0.1	0.5
Senna glutinosa subsp. *pruinosa*	0.8	0.5
Sida ectogama	0.1	<1
Solanum lasiophyllum	0.2	0.5
Tribulus astrocarpus	0.2	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
20	1	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 6

Site Details:

Described by:	Scott Walker	
Date:	16/04/2015	
Type:	Relevé	
MGA Zone: 50	625049 mE	7000017 mN

Environmental Variables:

Landform: Slope
Slope: 3

Soils:

Soil Texture: Sandy clay
Soil Colour: Red
Rock Type: Laterite

Coarse Surface Particles:

Site coverage: 70%
Size: 1 to 15cm
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low open woodland dominated by *Acacia incurvaneura* over low mixed heathland dominated by *Senna spp.* over low heathland dominated by *Maireana triptera*.

Species List

Species Name	Height (m)	Cover (%)
Acacia incurvaneura	4	5
Eremophila forrestii	0.4	0.5
Maireana sp.	0.3	<1
Maireana tomentosa	0.2	<1
Maireana triptera	0.2	40
Ptilotus rotundifolius	0.1	<1
Senna artemisioides subsp. *helmsii x oligophylla*	0.5	0.5
Senna glutinosa subsp. *glutinosa*	0.5	0.5
Senna sp. *Meekatharra* (E. Bailey 1-26)	0.5	30
Solanum lasiophyllum	0.3	1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
5%	-	

Vegetation Condition: Excellent
Weeds: Nil
Fire Age: >5 years

SITE PHOTOGRAPH

Flora Relevé 7

Site Details:

Described by:	Scott Walker	
Date:	16/04/2015	
Type:	Relevé	
MGA Zone: 50	625762 mE	7000598 mN

Environmental Variables:

Landform: Slope
Slope: 2

Soils:

Soil Texture: Sandy clay
Soil Colour: Orange
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 30%
Size: 1 to 50cm
Outcropping: 2%

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Isolated mallee trees of *Acacia incurvaneura* over isolated shrubs dominated by *Hakea preissii* over mixed isolated hummock grasses

Species List

Species Name	Height (m)	Cover (%)
Acacia incurvaneura	3	3
Acacia sclerosperma subsp. *sclerosperma*	0.3	0.5
Aristida holathera var. *holathera*	0.2	<1
Enneapogon caerulescens	0.2	15
Enneapogon polyphyllus	0.2	1
Eremophila forrestii	0.2	0.5
Hakea preissii	1.5	0.5
Maireana triptera	0.1	5
Ptilotus rotundifolius	0.1	<1
Senna artemisioides subsp. *helmsii x oligophylla*	0.3	0.1
Solanum lasiophyllum	0.5	5

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover

Vegetation Condition: Good
Weeds: Nil

Fire Age: >5 years

SITE PHOTOGRAPH

Flora Relevé 8

Site Details:

Described by:	Scott Walker	
Date:	16/04/2015	
Type:	Relevé	
MGA Zone: 50	626999 mE	6999928 mN

Environmental Variables:

Landform: Floodway
Slope: 0

Soils:

Soil Texture: Sand/clay
Soil Colour: Brown
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 2%
Size: 1 to 50cm
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Isolated trees dominated by *Acacia grasbyi* over low woodland dominated by *Hakea preissii* over closed grassland dominated by **Cynodon dactylon*.

Species List

Species Name	Height (m)	Cover (%)
Acacia grasbyi		
Acacia sclerosperma	2.2	0.5
Boerhavia coccinea		
Chrysopogon fallax	1	10
Cucumis myriocarpus	0.2	0.5
Cynodon dactylon	0.1	40
Cyperus iria	0.3	20
Dactyloctenium radulans	0.2	0.5
Eremophila galeata	1.2	1
Grevillea deflexa	2	1
Hakea preissii	4	35
Nicotiana occidentalis subsp. *obliqua*	0.4	<1
Pluchea dentex	0.2	<1
Sida arenicola	0.4	<1
Solanum lasiophyllum	0.3	<1
Sonchus oleraceus	0.3	10

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
10	-	

Vegetation Condition: Good
Fire Age: >5 years
Weeds: **Cynodon dactylon*, **Sonchus oleraceus*

SITE PHOTOGRAPH

Flora Relevé 9

Site Details:

Described by:	Scott Walker	
Date:	16/04/2015	
Type:	Relevé	
MGA Zone: 50	626889 mE	7009320 mN

Environmental Variables:

Landform: Plain
Slope: <1

Soils:

Soil Texture: Sandy/loam
Soil Colour: Red
Rock Type: -

Coarse Surface Particles:

Site coverage: -
Size: -
Outcropping: -

Impacts:

Waterlogging:
Inundation:
Flooding:

Erosion:
Human disturbance:
Introduced species:

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low woodland dominated by *Acacia craspedocarpa* over low to mid mixed sparse shrubland dominated by *Eremophila forrestii* over open mixed grassland.

Species List

Species Name	Height (m)	Cover (%)
Acacia craspedocarpa	4	40
Acacia pteraneura	3	10
Aristida holathera var. *holathera*	0.2	<1
Dactyloctenium radulans	0.2	0.5
Eremophila forrestii	1	20
Eremophila galeata	1.8	1
Eremophila georgei	0.4	<1
Grevillea striata	3	0.5
Hibiscus burtonii	0.3	<1
Maireana tomentosa	0.3	1
Teucrium racemosum	0.4	<1
Tribulus astrocarpus	0.1	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
80	2	

Vegetation Condition: Good
Weeds: Nil

Fire Age: >5 years

SITE PHOTOGRAPH

Flora Relevé 10

Site Details:

Described by: Scott Walker
Date: 16/04/2015
Type: Relevé
MGA Zone: 50 626798 mE 7010658 mN

Environmental Variables:

Landform: Plain
Slope: <1

Soils:

Soil Texture: Sand/clay
Soil Colour: Red
Rock Type: -

Coarse Surface Particles:

Site coverage: -
Size: -
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low open woodland dominated by *Acacia tetragonophylla* and *Acacia incurvaneura* over tall open shrubland dominated by *Acacia craspedocarpa* and *Eremophila* spp. over low grassland dominated by *Eragrostis pergracilis.*

Species List

Species Name	Height (m)	Cover (%)
Abutilon cryptopetalum	0.3	<1
Acacia craspedocarpa	2.5	20
Acacia incurvaneura	6	10
Acacia tetragonophylla	5	20
Calandrinia sp.	0.1	0.5
Digitaria brownii	0.5	<1
Eragrostis pergracilis	0.2	80
Eremophila forrestii	1	3
Eremophila galeata	1.2	5
Eriachne pulchella subsp. *pulchella*	0.2	0.5
Hibiscus burtonii	0.5	<1
Sida arenicola	0.3	<1
Solanum lasiophyllum	0.3	<1
Tribulus astrocarpus	0.1	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
30	2	

Vegetation Condition:
Fire Age:
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 11

Site Details:

Described by:	Scott Walker	
Date:	16/04/2015	
Type:	Relevé	
MGA Zone: 50	628274 mE	7011428 mN

Environmental Variables:

Landform: Plain
Slope: <1

Soils:

Soil Texture: Sandy clay
Soil Colour: Red
Rock Type: -

Coarse Surface Particles:

Site coverage: -
Size: -
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low open woodland dominated by *Acacia incurvaneura* and *Acacia sclerosperma* over mid shrubland dominated by *Eremophila spp.* with *Acacia grasbyi* over hummock grassland dominated by *Eragrostis eriopoda*.

Species List

Species Name	Height (m)	Cover (%)
Acacia grasbyi	2.2	4
Acacia incurvaneura	4	10
Acacia sclerosperma	6	3
Eragrostis eriopoda	0.4	30
Eremophila forrestii	2	2
Eremophila forrestii subsp. *forrestii*	0.4	2
Eremophila forrestii subsp. *forrestii*	1.5	80
Eremophila galeata	0.8	0.5
Solanum lasiophyllum	0.3	<1
Tribulus astrocarpus	0.1	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
40	2	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 12

Site Details:
Described by: Scott Walker
Date: 17/04/2015
Type: Relevé

Environmental Variables:
Landform: Plain
Slope: <1

Soils:
Soil Texture: Sandy clay
Soil Colour: Red
Rock Type: Quartz

Coarse Surface Particles:
Site coverage: 80%
Size: 1 to 20cm
Outcropping: -

FAUNA HABITAT DATA
Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA
Description: Low isolated shrubs dominated by *Eremophila galeata* over low isolated shrubs dominated by *Eremophila forrestii* over hummock grassland dominated by *Aristida holathera var. holathera* with *Ptilotus chamaecladus*

Species List

Species Name	Height (m)	Cover (%)
Aristida holathera var. *holathera*	0.2	60
Bulbostylis barbata	0.2	<1
Calandrinia sp.	0.1	<1
Dactyloctenium radulans	0.2	<1
Enneapogon caerulescens	0.2	1
Enneapogon polyphyllus	0.3	1
Eremophila exilifolia	0.4	2
Eremophila forrestii	0.2	5
Eremophila galeata	0.7	0.5
Maireana planifolia	0.3	<1
Maireana triptera	0.3	<1
Ptilotus chamaecladus	0.1	5
Senna artemisioides subsp. *helmsii x oligophylla*	0.2	0.5
Sida arenicola	0.3	<1
Solanum lasiophyllum	0.3	0.5
Wurmbea densiflora	0.2	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
15	2	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 13

Site Details:
Described by: Scott Walker
Date: 17/04/2015
Type: Relevé
MGA Zone: 50 mE mN

Environmental Variables:
Landform: Drainage line
Slope:

Soils:
Soil Texture: Sandy loam
Soil Colour: Red
Rock Type: River bed laterite

Coarse Surface Particles:
Site coverage: 2%
Size: 1 to 100cm
Outcropping: 2%

FAUNA HABITAT DATA
Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA
Description: Low woodland dominated by *Acacia spp.* over isolated shrubs of *Eremophila galeata* over low mixed shrubland over grassland dominated by *Aristida holathera var. holathera*

Species List

Species Name	Height (m)	Cover (%)
Abutilon cryptopetalum	0.3	1
Acacia craspedocarpa	5	20
Acacia craspedocarpa	4	15
Acacia incurvaneura	6	15
Acacia tetragonophylla	5	10
Aristida holathera var. *holathera*	0.2	30
Calandrinia sp.	0.1	<1
Dactyloctenium radulans	0.2	1
Dysphania melanocarpa	0.1	<1
Eremophila forrestii	0.5	2
Eremophila galeata	2	1
Eriachne pulchella subsp. *pulchella*	0.1	0.5
Euphorbia tannensis subsp. *eremophila*	0.2	0.5
Iseilema membranaceum	0.2	1
Maireana triptera	0.4	0.5
Nicotiana occidentalis subsp. *obliqua*	0.3	2
Ptilotus chamaecladus	0.1	<1
Sclerolaena bicornis	0.4	<1
Senna artemisioides subsp. *helmsii x oligophylla*	0.5	0.5
Solanum lasiophyllum	0.4	0.5
Wurmbea densiflora	0.2	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
70	1	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 14

Site Details:

Described by: Scott Walker
Date: 17/04/2015
Type: Relevé
MGA Zone: 50 624052 mE 6998645 mN

Environmental Variables:

Landform:
Slope:

Soils:

Soil Texture: Sandy clay
Soil Colour: Orange
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 85%
Size: 1 to 100cm
Outcropping: 15%

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low open woodland of *Acacia pteraneura* over sparse low woodland dominated by *Eremophila oppositifolia subsp. angustifolia* over sparse low mixed shrubland dominated by *Acacia kalgoorliensis* over mixed isolated grasses

Species List

Species Name	Height (m)	Cover (%)
Abutilon cryptopetalum	0.3	<1
Acacia kalgoorliensis	0.8	5
Acacia pteraneura	3	5
Aristida holathera var. *holathera*	0.2	0.5
Eragrostis leptocarpa	0.2	<1
Eragrostis setifolia	0.2	0.5
Eremophila latrobei subsp. *latrobei*	0.5	0.5
Eremophila oppositifolia subsp. *angustifolia*	1.2	3
Frankenia laxiflora	0.2	1
Grevillea deflexa	0.3	<1
Hibiscus burtonii	0.2	0.5
Isotropis forrestii	0.4	<1
Maireana tomentosa	0.3	<1
Maireana triptera	0.2	<1
Ptilotus beardii (P3)	0.4	<1
Scaevola spinescens	0.7	0.5
Senna artemisioides subsp. *helmsii x oligophylla*	0.6	0.5
Senna glutinosa subsp. *glutinosa x luerssenii*	1.2	0.5
Solanum lasiophyllum	0.2	<1
Tecticornia pterygosperma subsp. *denticulata*	0.4	1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
5%	-	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 15

Site Details:

Described by: Scott Walker
Date: 17/04/2015
Type: Relevé
MGA Zone: 50 626221 mE 6998659 mN

Environmental Variables:

Landform: Gully
Slope:

Soils:

Soil Texture: Sandy clay
Soil Colour: Red
Rock Type: Quartz, laterite

Coarse Surface Particles:

Site coverage: 2%
Size: 1 to 10cm
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low woodland dominated by *Acacia incurvaneura* over mid-open shrubland dominated by *Acacia ramulosa var. linophylla* over mixed low sparse shrubland dominated by *Eremophila spp.* over mixed sparse clumps of grasses.

Species List

Species Name	Height (m)	Cover (%)
Acacia incurvaneura	6	40
Acacia ramulosa var. *linophylla*	2	20
Aristida holathera var. *holathera*	0.2	<1
Eragrostis eriopoda	0.4	<1
Eremophila forrestii	0.5	0.5
Eremophila galeata	0.8	0.5
Eremophila georgei	0.5	<1
Erodium cygnorum	0.1	<1
Hibiscus burtonii	0.3	<1
Maireana triptera	0.3	<1
Maireana villosa	0.4	0.5
Marsdenia australis	0.1	<1
Psydrax latifolia	2	1
Ptilotus rotundifolius	0.1	<1
Scaevola spinescens	1.6	<1
Solanum lasiophyllum	0.5	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
80	2	

Vegetation Condition: Degraded
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 16

Site Details:

Described by: Scott Walker
Date: 17/04/2015
Type: Relevé
MGA Zone: 50 624962 mE 6994692 mN

Environmental Variables:

Landform: Drainage line
Slope:

Soils:

Soil Texture: Sand/clay
Soil Colour: Red/brown
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 5%
Size: 1 to 15cm
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Mid woodland dominated by *Acacia incurvaneura* over low woodland dominated by *Acacia craspedocarpa* over mid sparse shrubland dominated by *Eremophila spp.* over mixed low sparse shrubland and open grassland dominated by *Aristida holathera var. holathera*

Species List

Species Name	Height (m)	Cover (%)
Abutilon cryptopetalum	0.4	0.5
Acacia aptaneura	2	2
Acacia craspedocarpa	5	25
Acacia incurvaneura	10	30
Acacia tetragonophylla	4	1
Aristida holathera var. *holathera*	0.2	15
Bulbostylis barbata	0.2	<1
Calandrinia sp.	0.1	0.5
Enneapogon polyphyllus	0.2	<1
Eragrostis falcata	0.2	0.5
Eremophila forrestii	0.3	<1
Eremophila galeata	2	3
Eremophila linearis	0.6	<1
Eriachne pulchella subsp. *pulchella*	0.2	1
Ptilotus chamaecladus	0.3	<1
Senna artemisioides subsp. *helmsii x oligophylla*	0.4	2
Solanum lasiophyllum	0.2	<1
Tribulus astrocarpus	0.1	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
60%	-	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 17

Site Details:

Described by: Scott Walker
Date: 17/04/2015
Type: Relevé
MGA Zone: 50 623646 mE 6989785 mN

Environmental Variables:

Landform: Drainage line
Slope: <1

Soils:

Soil Texture: Sand/clay
Soil Colour: Red
Rock Type: -

Coarse Surface Particles:

Site coverage: -
Size: -
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low woodland dominated by *Acacia spp.* over tall open shrubland dominated by *Acacia spp.* over closed grassland dominated by *Aristida holathera var. holathera* and *Enneapogon polyphyllus*

Species List

Species Name	Height (m)	Cover (%)
Acacia craspedocarpa	6	30
Acacia incurvaneura	7	20
Acacia tetragonophylla	3	10
Aristida holathera var. *holathera*	0.4	40
Bulbostylis barbata	0.3	40
Calandrinia sp.	0.1	<1
Enneapogon polyphyllus	0.2	20
Eremophila galeata	2	1
Eriachne pulchella subsp. *pulchella*	0.2	1
Euphorbia drummondii	0.2	<1
Josephinia eugeniae	0.3	<1
Nicotiana occidentalis subsp. *obliqua*	0.4	5

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
20	-	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 18

Site Details:

Described by: Scott Walker
Date: 17/04/2015
Type: Relevé
MGA Zone: 50 623153 mE 6988988 mN

Environmental Variables:

Landform: Plain
Slope:

Soils:

Soil Texture: Sand/loam
Soil Colour: Red
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 1%
Size: 1 to 5 cm
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low open woodland dominated by *Acacia spp.* over tall isolated shrubs dominated by *Eremophila galeata* over low sparse shrubland dominated by *Eremophila spp.* over closed grassland dominated by *Eragrostis pergracilis* and *Eriachne pulchella* subsp. *pulchella*.

Species List

Species Name	Height (m)	Cover (%)
Acacia ? caesaneura x incurvaneura	6	5
Acacia incurvaneura	6	5
Calandrinia sp.	0.1	<1
Eragrostis pergracilis	0.1	40
Eragrostis setifolia	0.4	<1
Eragrostis sp.	0.1	15
Eremophila forrestii	0.6	7
Eremophila galeata	3	0.5
Eriachne pulchella subsp. *pulchella*	0.1	20
Goodenia triodiophila	0.3	<1
Ptilotus chamaecladus	0.1	0.5
Ptilotus drummondii	0.2	<1
Solanum lasiophyllum	0.3	<1
Tribulus astrocarpus	0.1	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
70%	-	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Flora Relevé 19

Site Details:

Described by:	Scott Walker	
Date:	17/04/2015	
Type:	Relevé	
MGA Zone: 50	624234 mE	6992010 mN

Environmental Variables:

Landform: Plain
Slope: <1

Soils:

Soil Texture: Sand/clay
Soil Colour: Red
Rock Type: Quartz

Coarse Surface Particles:

Site coverage: 50%
Size: 1 to 5cm
Outcropping: -

FAUNA HABITAT DATA

Habitat trees (Lge w > 20cm DBH): No
Visible hollows: No

FLORA AND VEGETATION DATA

Description: Low open forest dominated by *Acacia spp.* over mid open woodland dominated by *Acacia spp.* over mixed low isolated grasses and shrubs

Species List

Species Name	Height (m)	Cover (%)
Abutilon cryptopetalum	0.3	<1
Acacia ? caesaneura X incurvaneura	5	5
Acacia incurvaneura	6	10
Acacia sclerosperma	8	30
Acacia tetragonophylla	4	5
Aristida holathera var. *holathera*	0.1	<1
Calandrinia sp.	0.1	<1
Eremophila forrestii	0.3	0.5
Eremophila galeata	2	<1
Eremophila linearis	0.4	1
Ptilotus chamaecladus	0.1	0.5
Scaevola spinescens	0.7	<1
Solanum lasiophyllum	0.3	<1

Ground Cover (percent)

Bare soil	Litter	Perennial ground cover
40	-	

Vegetation Condition: Very good
Fire Age: >5 years
Weeds: Nil

SITE PHOTOGRAPH

Appendix I Fauna habitat assessments

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 01	627817.2468	7003395.656	Plain	Good	Open Shrubland

% Ground Cover	Rock	50
	Soil	20
	Leaf Litter	5
	Vegetation	25
Rocks	Type	Quartzite
	Size (mm)	60 - 200 mm
	Abundance (%)	20 - 50%
	Exposed Bedrock	0
Soil	Type	Clayey sand
	Colour	Orange red
Habitat Features	Water	None
	Fire Presence	>15 years
	Woody Debris	Rare
	Peeling Bark	Rare
	Rock Crevices	None
	Burrowing Suitability	Moderate
	Tree Hollows (<10cm)	None
	Tree Hollows (>10cm)	None

Vegetation

Stratum	Form	Stage	Height (m)	Cover (%)	Species
Upper	Shrub	Mature Phase	1 – 2	5 - 10	*Eremophila* sp.
Middle	Shrub	Advanced regeneration	0.02-0.5	5-10	*Solanum* sp.
Lower	Shrub	Mature Phase	0-0.2	50	Grasses and sedges

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 02	627876.6259	7003383.969	Drainage	Degraded	Drainage

% Ground Cover	Rock	5
	Soil	70
	Leaf Litter	5
	Vegetation	20
Rocks	Type	Quartzite
	Size (mm)	60 - 200 mm
	Abundance (%)	20 - 50%
	Exposed Bedrock	0
Soil	Type	Clayey sand
	Colour	Orange red
Habitat Features	Water	None
	Fire Presence	None
	Woody Debris	Rare
	Peeling Bark	None
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10cm)	None
	Tree Hollows (>10cm)	None

Vegetation

Stratum	Form	Stage	Height (m)	Cover (%)	Species
Upper	Shrub	Mature Phase	2 – 4	10 – 30	*Acacia craspedocarpa, Acacia incurvaneura*
Middle	Shrub	Mature phase	1-2	30-50	*Acacia incurvaneura*
Lower	Tussock grass	Mature phase	0.1-0.4	20-30	*Aristida holathera* var. *holathera*

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 03	625821.0736	6997211.806	Plain	Good	Low Open Mulga Woodland

% Ground Cover	Rock	40
	Soil	40
	Leaf Litter	5
	Vegetation	15
Rocks	Type	Quartzite
	Size (mm)	60 - 200 mm
	Abundance (%)	2 - 10%
	Exposed Bedrock	0
Soil	Type	Clayey sand
	Colour	Red grey
Habitat Features	Water	None
	Fire Presence	None
	Woody Debris	Rare
	Peeling Bark	None
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10cm)	None
	Tree Hollows (>10cm)	None

Vegetation

Stratum	Form	Stage	Height (m)	Cover (%)	Species
Upper	Shrub	Mature Phase	2 – 4	10 – 15	*Acacia incurvaneura*
Middle	Shrub	Mature Phase	0.05-0.08	20-40	*Eremophila oppositifolia* subsp. *angustifolia*
Lower	Tussock grass	Uneven age	0.01-0.02	20-30	Mixed annuals

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 04	625166.8709	7000165.372	Plain	Very Good	Stony Rise

% Ground Cover	Rock	60
	Soil	20
	Leaf Litter	5
	Vegetation	15
Rocks	Type	Ironstone
	Size (mm)	20 - 60 mm
	Abundance (%)	20 - 50%
	Exposed Bedrock	2 - 10%
Soil	Type	Clayey sand
	Colour	Red
Habitat Features	Water	None
	Fire Presence	None
	Woody Debris	Moderate
	Peeling Bark	None
	Rock Crevices	None
	Burrowing Suitability	None
	Tree Hollows (<10cm)	None
	Tree Hollows (>10cm)	None

Vegetation

Stratum	Form	Stage	Height (m)	Cover (%)	Species
Upper	Sedge	Mature Phase	2 – 4	10 – 20	*Acacia ? caesaneura x incurvaneura*
Middle	Shrub	Uneven age	0.5-1	20-25	*Eremophila forrestii, Eremophila* spp.
Lower	Hummock grass	Uneven age	0.1-0.2	20-25	Annuals and grasses

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 05	626875.7607	7009310.261	Plain	Good	Open Shrubland

% Ground Cover	Rock	5
	Soil	80
	Leaf Litter	5
	Vegetation	10
Rocks	Type	Ferricrete
	Size (mm)	2 - 6 mm
	Abundance (%)	10 - 20%
	Exposed Bedrock	0
Soil	Type	Clayey sand
	Colour	Red
Habitat Features	Water	None
	Fire Presence	None
	Woody Debris	Moderate
	Peeling Bark	None
	Rock Crevices	None
	Burrowing Suitability	None
	Tree Hollows (<10cm)	None
	Tree Hollows (>10cm)	None

Vegetation

Stratum	Form	Stage	Height (m)	Cover (%)	Species
Upper	Shrub	Mature Phase	1 – 3	30 – 35	*Acacia pteraneura*
Middle	Shrub	Uneven age	0.05-1	20-25	*Acacia craspedocarpa, Grevillea striata*
Lower	Shrub	n/a	0.1-0.2	10-20	*Dactyloctenium radulans, Maireana tomentosa*

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 06	624051.2137	6998636.582	Rises	Very Good	Stony Rise
% Ground Cover	Rock	70			
	Soil	5			
	Leaf Litter	5			
	Vegetation	20			
Rocks	Type	Quartzite			
	Size (mm)	20 - 60 mm			
	Abundance (%)	20 - 50%			
	Exposed Bedrock	10 - 20%			
Soil	Type	Clayey sand			
	Colour	Red			
Habitat Features	Water	None	**Vegetation**		
	Fire Presence	None	Stratum	Form	Stage	Height (m)	Cover (%)	Species
	Woody Debris	Rare	Upper	Shrub	Mature Phase	1-2	10-20	*Acacia pteraneura*
	Peeling Bark	None						
	Rock Crevices	None	Middle	Shrub	Mature Phase	0.5-1	10-15	*Acacia kalgoorliensis, Eremophila oppositifolia* subsp. *angustifolia*
	Burrowing Suitability	None						
	Tree Hollows (<10cm)	None	Lower	Shrub	Mature	0.2-0.4	5-10	*Maireana tomentosa, Ptilotus beardii*
	Tree Hollows (>10cm)	None						

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 07	624973.3476	6994716.527	Drainage	Very good	Low Open Mulga Woodland

% Ground Cover	Rock	30
	Soil	10
	Leaf Litter	10
	Vegetation	50
Rocks	Type	Quartzite
	Size (mm)	20 - 60 mm
	Abundance (%)	10 - 20%
	Exposed Bedrock	0
Soil	Type	Clayey sand
	Colour	Red
Habitat Features	Water	None
	Fire Presence	None
	Woody Debris	Moderate
	Peeling Bark	None
	Rock Crevices	None
	Burrowing Suitability	None
	Tree Hollows (<10cm)	None
	Tree Hollows (>10cm)	None

Vegetation

Stratum	Form	Stage	Height (m)	Cover (%)	Species
Upper	Shrub	Mature Phase	1-3	10-20	*Acacia incurvaneura, Acacia aptaneura*
Middle	Shrub	Mature Phase	1-2	20-30	*Acacia tetragonophylla, Eremophila galeata*
Lower	Tussock grass	Uneven age	0.1-0.3	20-25	*Eriachne pulchella* subsp. *pulchella, Aristida holathera* var. *holathera*

Name	Easting	Northing	Landform	Condition	Habitat Type
Hab 08	623142.6015	6988973.8	Plain	Very good	Low Open Mulga Woodland
% Ground Cover	Rock	0			
	Soil	20			
	Leaf Litter	10			
	Vegetation	70			
Rocks	Type	N/A			
	Size (mm)	2 – 6 mm			
	Abundance (%)	0			
	Exposed Bedrock	0			
Soil	Type	Clayey sand			
	Colour	Red			
Habitat Features	Water	None	**Vegetation**		
	Fire Presence	None	Stratum	Form	Stage	Height (m)	Cover (%)	Species
	Woody Debris	Moderate	Upper	Shrub	Mature Phase	2-3	10-30	*Acacia ? caesaneura x incurvaneura, Acacia incurvaneura*
	Peeling Bark	None						
	Rock Crevices	None	Middle	Shrub	Mature phase	1-1.5	20-25	*Eremophila galeata*
	Burrowing Suitability	None						
	Tree Hollows (<10cm)	None	Lower	Tussock grass	Uneven age	0.1-0.3	60-70	*Eriachne pulchella* subsp. *pulchella*
	Tree Hollows (>10cm)	None						

Appendix J Vertebrate fauna taxa identified in the desktop study

Table Codes:

Databases

A. DPaW Threatened and Priority Fauna Database
B. NatureMap
C. Birdlife Australia
D. EPBC Protected Matters Search

Family	Species Name	Common Name	Conservation Code		Database Searches			
			EPBC Act	In WA	A	B	C	D
Mammals								
Dasyuridae	*Pseudantechinus woolleyae*	Woolley's Pseudantechinus				x		
Dasyuridae	*Sminthopsis dolichura*	Little long-tailed Dunnart				x		
Dasyuridae	*Sminthopsis macroura*	Stripe-faced Dunnart				x		
Leporidae	*Oryctolagus cuniculus*	*Rabbit				x		
Potoroidae	*Bettongia lesueur*	Burrowing Bettong	Ex	S2		x		
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna				x		
Thylacomyidae	*Macrotis lagotis*	Bilby	Vu	S1	x			
Birds								
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill				x	x	
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill				x	x	
Acanthizidae	*Acanthiza iredalei*	Slender-billed Thornbill					x	
Acanthizidae	*Acanthiza robustirostris*	Slaty-backed Thornbill				x	x	
Acanthizidae	*Acanthiza uropygialis*	Chestnut-rumped Thornbill				x	x	
Acanthizidae	*Aphelocephala leucopsis*	Southern Whiteface				x	x	
Acanthizidae	*Aphelocephala nigricincta*	Banded Whiteface				x	x	
Acanthizidae	*Calamanthus campestris*	Rufous Fieldwren					x	
Acanthizidae	*Gerygone fusca*	Western Gerygone				x	x	
Acanthizidae	*Pyrrholaemus brunneus*	Redthroat				x	x	
Acanthizidae	*Smicrornis brevirostris*	Weebill					x	
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk				x	x	
Accipitridae	*Accipiter fasciatus*	Brown Goshawk				x	x	
Accipitridae	*Circus approximans*	Swamp Harrier				x	x	
Accipitridae	*Circus assimilis*	Spotted Harrier				x	x	

Accipitridae	*Haliastur sphenurus*	Whistling Kite				x	x	
Accipitridae	*Hamirostra isura*	Square-tailed Kite				x		
Accipitridae	*Hamirostra melanosternon*	Black-breasted Buzzard				x	x	
Accipitridae	*Milvus migrans*	Black Kite					x	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle				x	x	
Accipitridae	*Elanus caeruleus*	Black-shouldered Kite					x	
Accipitridae	*Aquila morphnoides*	Little Eagle					x	
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar				x	x	
Anatidae	*Anas gracilis*	Grey Teal				x	x	
Anatidae	*Anas rhynchotis*	Australasian Shoveler				x	x	
Anatidae	*Anas superciliosa*	Pacific Black Duck				x	x	
Anatidae	*Aythya australis*	Hardhead				x	x	
Anatidae	*Biziura lobata*	Musk Duck				x	x	
Anatidae	*Chenonetta jubata*	Australian Wood Duck				x	x	
Anatidae	*Cygnus atratus*	Black Swan				x	x	
Anatidae	*Malacorhynchus membranaceus*	Pink-eared Duck				x	x	
Anatidae	*Oxyura australis*	Blue-billed Duck			x		x	
Anatidae	*Tadorna tadornoides*	Australian Shelduck				x	x	
Anatidae	*Anas castanea*	Chestnut Teal					x	
Anatidae	*Stictonetta naevosa*	Freckled Duck				x	x	
Anhingidae	*Anhinga melanogaster*	Darter					x	
Apodidae	*Apus pacificus*	Fork-tailed Swift	Mi	S3	x			x
Ardeidae	*Ardea modesta*	Eastern Great Egret	Mi	S3	x	x	x	x
Ardeidae	*Ardea pacifica*	White-necked Heron				x	x	
Ardeidae	*Ardea novaehollandiae*	White-faced Heron					x	

Artamidae	*Artamus cinereus*	Black-faced Woodswallow				x	x	
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow				x	x	
Artamidae	*Artamus personatus*	Masked Woodswallow				x	x	
Artamidae	*Artamus superciliosus*	White-browed Woodswallow				x	x	
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew					x	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike				x		
Campephagidae	*Coracina maxima*	Ground Cuckoo-shrike					x	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike					x	
Campephagidae	*Lalage tricolor*	White-winged Triller					x	
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar				x	x	
Casuariidae	*Dromaius novaehollandiae*	Emu				x	x	
Charadriidae	*Charadrius veredus*	Oriental Plover						x
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover				x	x	
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel				x	x	
Charadriidae	*Peltohyas australis*	Inland Dotterel				x		
Charadriidae	*Vanellus tricolor*	Banded Lapwing				x	x	
Charadriidae	*Peltohyas australis*	Inland Dotterel				x	x	
Charadriidae	*Charadrius melanops*	Black-fronted Dotterel					x	
Charadriidae	*Charadrius rubricollis*	Hooded Plover					x	x
Cinclosomatidae	*Cinclosoma castaneothorax*	Chestnut-breasted Quail-thrush				x	x	
Cinclosomatidae	*Cinclosoma marginatum*	Western Quail-thrush				x		
Cinclosomatidae	*Psophodes occidentalis*	Western Wedgebill				x	x	
Climacteridae	*Climacteris affinis*	White-browed Treecreeper					x	
Columbidae	*Columba livia*	Domestic Pigeon					x	
Columbidae	*Geopelia cuneata*	Diamond Dove				x	x	
Columbidae	*Geopelia striata*	Zebra Dove				x	x	

Columbidae	*Geophaps plumifera*	Spinifex Pigeon					x	
Columbidae	*Ocyphaps lophotes*	Crested Pigeon				x	x	
Columbidae	*Phaps chalcoptera*	Common Bronzewing				x	x	
Columbidae	*Streptopelia senegalensis*	*Laughing Turtle-Dove					x	
Corvidae	*Corvus bennetti*	Little Crow				x	x	
Corvidae	*Corvus orru*	Torresian Crow				x	x	
Cracticidae	*Cracticus nigrogularis*	Pied Butcherbird				x	x	
Cracticidae	*Cracticus tibicen*	Australian Magpie				x	x	
Cracticidae	*Cracticus torquatus*	Grey Butcherbird				x	x	
Cracticidae	*Cracticus tibicen*	Australian Magpie				x	x	
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo				x	x	
Cuculidae	*Chrysococcyx basalis*	Horsfield's Bronze Cuckoo					x	
Cuculidae	*Chrysococcyx osculans*	Black-eared Cuckoo					x	
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird				x	x	
Dicruridae	*Grallina cyanoleuca*	Magpie-lark				x	x	
Dicruridae	*Rhipidura leucophrys*	Willie Wagtail				x	x	
Dicruridae	*Rhipidura fuliginosa*	Grey Fantail					x	
Estrildidae	*Taeniopygia guttata*	Zebra Finch				x	x	
Falconidae	*Falco berigora*	Brown Falcon				x	x	
Falconidae	*Falco cenchroides*	Australian Kestrel				x	x	
Falconidae	*Falco hypoleucos*	Grey Falcon		S1	X	X	x	
Falconidae	*Falco longipennis*	Australian Hobby				x	x	
Falconidae	*Falco peregrinus*	Peregrine Falcon		S4	X	X	x	
Glareolidae	*Glareola maldivarum*	Oriental Pratincole			x			
Halcyonidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher				x	x	
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher				x	x	

Hirundinidae	*Hirundo neoxena*	Welcome Swallow				x	x	
Hirundinidae	*Hirundo ariel*	Fairy Martin					x	
Hirundinidae	*Hirundo nigricans*	Tree Martin					x	
Laridae	*Sterna hybrida*	Whiskered Tern				x		
Laridae	*Sterna nilotica*	Gull-billed Tern				x		
Laridae	*Sterna hybrida*	Whiskered Tern					x	
Laridae	*Sterna leucoptera*	White-winged Black Tern			x		x	
Laridae	*Larus novaehollandiae*	Silver Gull					x	
Laridae	*Sterna nilotica*	Gull-billed Tern					x	
Laridae	*Sterna caspia*	Caspian Tern	Mi	S3			x	
Laridae	*Larus novaehollandiae*	Silver Gull				x		
Maluridae	*Amytornis textilis*	Thick-billed Grasswren		P4	x			
Maluridae	*Malurus lamberti*	Variegated Fairy-wren				x	x	
Maluridae	*Malurus leucopterus*	White-winged Fairy-wren				x	x	
Maluridae	*Malurus splendens*	Splendid Fairy-wren				x	x	
Megapodiidae	*Leipoa ocellata*	Malleefowl	Vu	S1	x			x
Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater				x	x	
Meliphagidae	*Certhionyx variegatus*	Pied Honeyeater				x		
Meliphagidae	*Epthianura albifrons*	White-fronted Chat					x	
Meliphagidae	*Epthianura aurifrons*	Orange Chat				x	x	
Meliphagidae	*Epthianura tricolor*	Crimson Chat				x	x	
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater				x		
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner				x	x	
Meliphagidae	*Ptilotula penicillatus*	White-plumed Honeyeater				x		
Meliphagidae	*Purnella albifrons*	White-fronted Honeyeater				x	x	
Meliphagidae	*Sugomel niger*	Black Honeyeater				x	x	

Meliphagidae	*Lacustroica whitei*	Grey Honeyeater					x	
Meliphagidae	*Ptilotula penicillatus*	White-plumed Honeyeater					x	
Meliphagidae	*Ptilotula plumulus*	Grey-fronted Honeyeater					x	
Meliphagidae	*Gavicalis virescens*	Singing Honeyeater					x	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	Mi	S3	x		x	x
Motacillidae	*Anthus australis*	Australian Pipit					x	
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella				x	x	
Otididae	*Ardeotis australis*	Australian Bustard				x	x	
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush				x	x	
Pachycephalidae	*Oreoica gutturalis*	Crested Bellbird				x	x	
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler				x	x	
Pardalotidae	*Pardalotus rubricatus*	Red-browed Pardalote					x	
Pardalotidae	*Pardalotus striatus*	Striated Pardalote				x	x	
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican				x	x	
Petroicidae	*Microeca fascinans*	Jacky Winter					x	
Petroicidae	*Petroica goodenovii*	Red-capped Robin				x	x	
Petroicidae	*Petroica cucullata*	Hooded Robin					x	
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant					x	
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant				x	x	
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant					x	
Phasianidae	*Coturnix pectoralis*	Stubble Quail				x	x	
Podargidae	*Podargus strigoides*	Tawny Frogmouth					x	
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe					x	
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe				x	x	
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe				x	x	
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler				x	x	

Pomatostomidae	*Pomatostomus temporalis*	Grey-crowned Babbler				x	x	
Psittacidae	*Cacatua sanguinea*	Little Corella				x	x	
Psittacidae	*Melopsittacus undulatus*	Budgerigar				x	x	
Psittacidae	*Neophema elegans*	Elegant Parrot					x	
Psittacidae	*Neophema bourkii*	Bourke's Parrot				x		
Psittacidae	*Nymphicus hollandicus*	Cockatiel				x	x	
Psittacidae	*Platycercus zonarius*	Australian Ringneck				x	x	
Psittacidae	*Cacatua roseicapilla*	Galah					x	
Psittacidae	*Platycercus varius*	Mulga Parrot					x	
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird				x	x	
Rallidae	*Fulica atra*	Eurasian Coot				x	x	
Rallidae	*Gallinula ventralis*	Black-tailed Native-hen				x	x	
Rallidae	*Porzana fluminea*	Australian Spotted Crake					x	
Recurvirostridae	*Cladorhynchus leucocephalus*	Banded Stilt				x	x	
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt				x	x	
Recurvirostridae	*Recurvirostra novaehollandiae*	Red-necked Avocet				x	x	
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt				x		
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper	Mi	S3	x		x	
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	Mi	S3	x		x	
Scolopacidae	*Calidris ruficollis*	Red-necked Stint	Mi	S3	x		x	
Scolopacidae	*Tringa glareola*	Wood Sandpaper	Mi	S3	x		x	
Scolopacidae	*Tringa nebularia*	Common Greenshank	Mi	S3	x		x	
Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	Mi	S3	x		x	
Scolopacidae	*Tringa hypoleucos*	Common Sandpiper	Mi	S3	x		x	
Strigidae	*Ninox connivens*	Barking Owl					x	
Strigidae	*Ninox novaeseelandiae*	Boobook Owl					x	

Sylviidae	*Cincloramphus cruralis*	Brown Songlark				x	x	
Sylviidae	*Cincloramphus mathewsi*	Rufous Songlark				x	x	
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill				x	x	
Threskiornithidae	*Platalea regia*	Royal Spoonbill					x	
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	Mi	S3	x		x	
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis				x	x	
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis				x	x	
Turnicidae	*Turnix velox*	Little Button-quail				x	x	
Tytonidae	*Tyto alba*	Barn Owl					x	
Zosteropidae	*Zosterops lateralis*	Silvereye					x	
Reptiles								
Agamidae	*Ctenophorus caudicinctus*					x		
Agamidae	*Pogona minor*	Dwarf Bearded Dragon				x		
Agamidae	*Ctenophorus nuchalis*	Central Netted Dragon				x		
Agamidae	*Ctenophorus reticulatus*	Western Netted Dragon				x		
Agamidae	*Ctenophorus salinarum*	Salt Pan Dragon				x		
Agamidae	*Ctenophorus scutulatus*					x		
Boidae	*Antaresia perthensis*	Pygmy Python				x		
Carphodactylidae	*Nephrurus wheeleri*					x		
Diplodactylidae	*Diplodactylus pulcher*					x		
Diplodactylidae	*Rhynchoedura ornata*	Western Beaked Gecko				x		
Diplodactylidae	*Strophurus wellingtonae*					x		
Egerniidae	*Egernia depressa*	Southern Pygmy Spiny-tailed Skink				x		
Egerniidae	*Egernia stokesii badia*	Western Spiny-tailed Skink	En	S1		x		x
Elapidae	*Parasuta monachus*					x		

Elapidae	*Pseudechis butleri*	Spotted Mulga Snake				x		
Elapidae	*Pseudonaja modesta*	Ringed Brown Snake				x		
Eugongylidae	*Menetia greyii*					x		
Gekkonidae	*Gehyra punctata*					x		
Gekkonidae	*Gehyra variegata*					x		
Gekkonidae	*Heteronotia binoei*	Bynoe's Gecko				x		
Pygopodidae	*Lialis burtonis*					x		
Pygopodidae	*Pygopus nigriceps*					x		
Sphenomorphidae	*Ctenotus leonhardii*					x		
Sphenomorphidae	*Ctenotus schomburgkii*					x		
Sphenomorphidae	*Ctenotus severus*					x		
Sphenomorphidae	*Ctenotus uber*					x		
Sphenomorphidae	*Eremiascincus richardsonii*	Broad-banded Sand Swimmer				x		
Sphenomorphidae	*Lerista bipes*					x		
Sphenomorphidae	*Lerista eupoda*			P1	x	x		
Sphenomorphidae	*Lerista muelleri*					x		
Sphenomorphidae	*Lerista nichollsi*					x		
Sphenomorphidae	*Lerista macropisthopus*					x		
Sphenomorphidae	*Lerista timida*					x		
Varanidae	*Varanus caudolineatus*					x		
Varanidae	*Varanus panoptes*	Yellow-spotted Monitor				x		
Amphibians								
Hylidae	*Cyclorana maini*	Sheep Frog				x		