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ALADDIN PROJECT: RECONNAISSANCE FLORA AND FAUNA ASSESSMENT

Prepared for Westgold Resorces Limited

March 2017

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REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
V1.0	24/02/2017	Interim Draft Report	LD	MS	PB	PB
V2.0	09/03/2017	Draft Report for comment	LD	MS	PB	PB

Executive Summary

Westgold Resources Limited (Westgold) are currently in the process of expanding their Central Murchison Gold Project. To complement the expansion of the CMGP, Westgold are exploring the option of conducting a cutback to the historic pit at the Aladdin minesite (the Project). The Project is located approximately 33 kilometres south of the town of Meekatharra in the Murchison region of Western Australia. The Study Area considered for this assessment encompasses the Project and its immediate surrounds totalling approximately 213 ha.

The overarching objective of this study was to undertake a Reconnaissance Survey for flora, vegetation and fauna (the Survey), and to assess potential impacts of the Project to the vegetation, flora and fauna occurring, and with the potential to occur, within the Study Area, with particular emphasis on conservation significant flora, vegetation and fauna. The specific objectives of the Survey were to:

- Complete a desktop review of relevant literature and databases for the Study Area;
- Describe vegetation units, fauna habitats and their condition by means of a field survey;
- Delineate and map vegetation units, fauna habitats and their condition, in the Study Area;
- Assess potential impacts of the Project against the Native Vegetation Clearing Principles.

The objectives were addressed by way of a desktop study and a field survey to ground-truth desktop results. The field survey was undertaken over three days from, the 31st of January to 2nd of February 2017. Flora and vegetation was sampled at 17 relevé sites, and opportunistic collections and searches where undertaken while traversing within the Study Area. Terrestrial fauna and fauna habitat was sampled via standardised habitat assessments, active searching and opportunistic sightings.

Vegetation condition ranged from Good to Completely Degraded with the majority considered to be Good. Completely Degraded areas are those associated with the historical mining operations, access tracks and areas where previous clearing has not yet rehabilitated. Poor areas compromised areas disturbed by feral grazing and trampling, presence of weeds, tracks and historically cleared areas. A total of 11 vegetation units were recorded, broadly comprising *Acacia* woodlands and Samphire shrublands, which are representative of the dominant vegetation types associated with Lake Annean. None of the vegetation units recorded are considered analogous to any Threatened or Priority Ecological Communities. Priority 1 PEC Polelle Calcrete, has a boundary that over laps with the eastern portion of the Study Area, however this PEC only relates to subterranean fauna.

A total of 105 vascular flora taxa (including subspecies and variants) from 24 families and 50 genera were recorded within the Study Area. The most frequently occurring families were Chenopodiaceae (22 taxa), Fabaceae (16 taxa), Scrophulariaceae (16 taxa), Malvaceae (7 taxa) and Poaceae (7 taxa). The flora composition recorded is typical of the region and consistent with biological surveys undertaken in close proximity (within 100 km) to the Study Area. No Threatened Flora species were recorded from the desktop study or during the Survey and none are likely to occur based on the results of the field survey. One Priority 3 listed flora species (*Tecticornia cymbiformis*) was confirmed from the Study Area and one Priority

4 listed flora species (*Dodonaea ? amplisemina*) was possibly collected, but could not be confirmed as the specimen was sterile. Additionally, two novel (undescribed) flora taxon, *Tecticornia* sp. nov and *Eremophila* sp. nov were collected from the Study Area. Eleven priority listed taxa, were assessed as very likely or likely to occur within the Study Area. Each of these species was targeted during the Survey but were not recorded. Two introduced taxa, **Cenchrus ciliaris,* and **Cucumis myriocarpus* were recorded within the Study Area. It is anticipated that additional introduced taxa may occur within the disturbed/degraded vegetation and may be recorded following rainfall and/or a more systematic survey.

Five broad fauna habitat types were identified within the Study Area; Drainage line, Quartz Outcrop, Samphire, Stony Plain and Ironstone Hills. One habitat; Samphire is considered Limited Extent and Significant. One Habitat (Quartz Outcrop) was of limited extent in the Study Area, but was not considered significant to fauna of conservation significance.

The Samphire is considered Significant as it broadly aligns with the Lake Annean. Lake Annean Environmentally Sensitive Area and listed on the Directory of Important Wetlands because it supports foraging and breeding habitat for a high number of the migratory, marine and waterbirds after periods of inundation. This has included hundreds of nesting Gull-billed Terns (*Sterna nilotica*) listed as Migratory (EPBC Act) and Schedule 3 (WC Act) along with nesting Whiskered Tern (*Sterna hybrida*) and Black-winged Stilt (*Himantopus himantopus*). Additionally, the lake has been known to support thousands of waterbirds when full.

A total of 22 vertebrate fauna species were recorded during the field survey, comprising six mammals (one native), 12 birds and four reptile species. No fauna of conservation significance were recorded during the survey. Three fauna species of conservation significance were considered Very Likely to occur (Eastern Great Egret (Mi, S5), Gull-billed Tern (Mi, S5) and *Lerista eupoda* (P1)), seven considered Likely to occur, five considered Possible to occur and the remaining Seven were considered Unlikely.

Assessment against the ten Clearing Principles was based on a precautionary approach that assumed all habitats within the Study Area may be exposed to clearing or impact in some form. The assessment indicated that the clearing and development of the Project may be at variance to principle (a), (b), (f), (h) and (i). The development of the Project is not at variance to principles (c), (d), (e), (g) and (j).

Westgold Resorces Limited

Aladdin Project: Reconnaissance Flora and Fauna Assessment

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1 Introduction

1.1 Project Background and Location

Westgold Resources Limited (Westgold) are currently in the process of expanding their Central Murchison Gold Project (CMGP). To complement the expansion of the CMGP, Westgold are exploring the option of conducting a cutback to the historic pit at the Aladdin mine (the Project). Additional infrastructure associated with the Project is likely to include: an access road, laydown, pipeline, waste rock landform and run of mine. The Study Area for this assessment encompasses the proposed expansion and the immediate surrounds for local context (**Figure 1-1**). The Study Area is located 32 km south of Meekatharra and is approximately 213 ha in size.

To assist with environmental approvals of the Project, MWH Australia Pty Ltd (MWH) were contracted to complete a Level 1 Flora, Vegetation and Fauna Assessment over the Study Area, including an assessment against the ten Native Vegetation Clearing Principles (DER 2014) listed under Schedule 5 of the *Environmental Protection Act 1986* (EP Act). The purpose of this report is to support a clearing permit application to support a Mining Proposal associated with their Central Murchison Gold Project

1.2 Report Scope and Objectives

The overarching objectives for the study were to undertake a Level 1 Flora, Vegetation and Fauna assessment (the Survey) and to assess potential impacts of the Project to native flora, vegetation and fauna occurring, and with the potential to occur, within the Study Area. The specific objectives of the Survey were to:

- complete a desktop review of relevant literature and databases for the Study Area;
- describe vegetation types, fauna habitats and their condition by means of a field survey;
- delineate and map vegetation types, fauna habitats and their condition, in the Study Area;
- assess potential impacts of the Project against the ten Native Vegetation Clearing Principles.

The objectives and methods adopted for this survey will be aligned with relevant regulatory guidelines, including:

Environmental Protection Authority (EPA) Position Statement No. 2, *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000)*;*
EPA Position Statement No. 3, *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)*;*
EPA Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b);
EPA Guidance Statement No. 56, Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004a);

EPA and DEC Technical Guide, Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2016a); and

EPA and DPaW Technical Guide, Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b).

Figure 1-1: The Study Area

2 Existing Environment

2.1 Biogeography

The Study Area is located within the Murchison bioregion (**Figure 2-1**), as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) classification system (Thackway and Cresswell 1995). The regional landscape comprises low hills and mesas separated by flat colluvium and alluvial plains. The vegetation is dominated by low Mulga woodlands (*Acacia aneura* complex) on plains reduced to scrub on hills, with tree steppe of *Eucalyptus* sp., *Triodia* sp. on sandplains, saltbush shrubland on calcareous soils and saline areas with samphire (Beard 1990, Thackway and Cresswell 1995). The bioregion is rich and diverse in both its flora and fauna although most species are wide-ranging and usually occur in adjoining regions (McKenzie *et al.* 2003).

The Study Area is located wholly within the Western Murchison subregion, characterised by outcrop and fine textured Quaternary alluvial and eluvial surfaces (extensive hardpan washplains that dominate and characterise the subregion) mantling granitic and greenstone strata of the northern part of the Yilgarn Craton (Desmond *et al.* 2001). Vegetation is dominated by Mulga Shrublands often rich in ephemerals, hummock grasslands, and saltbush shrublands (Desmond *et al.* 2001).

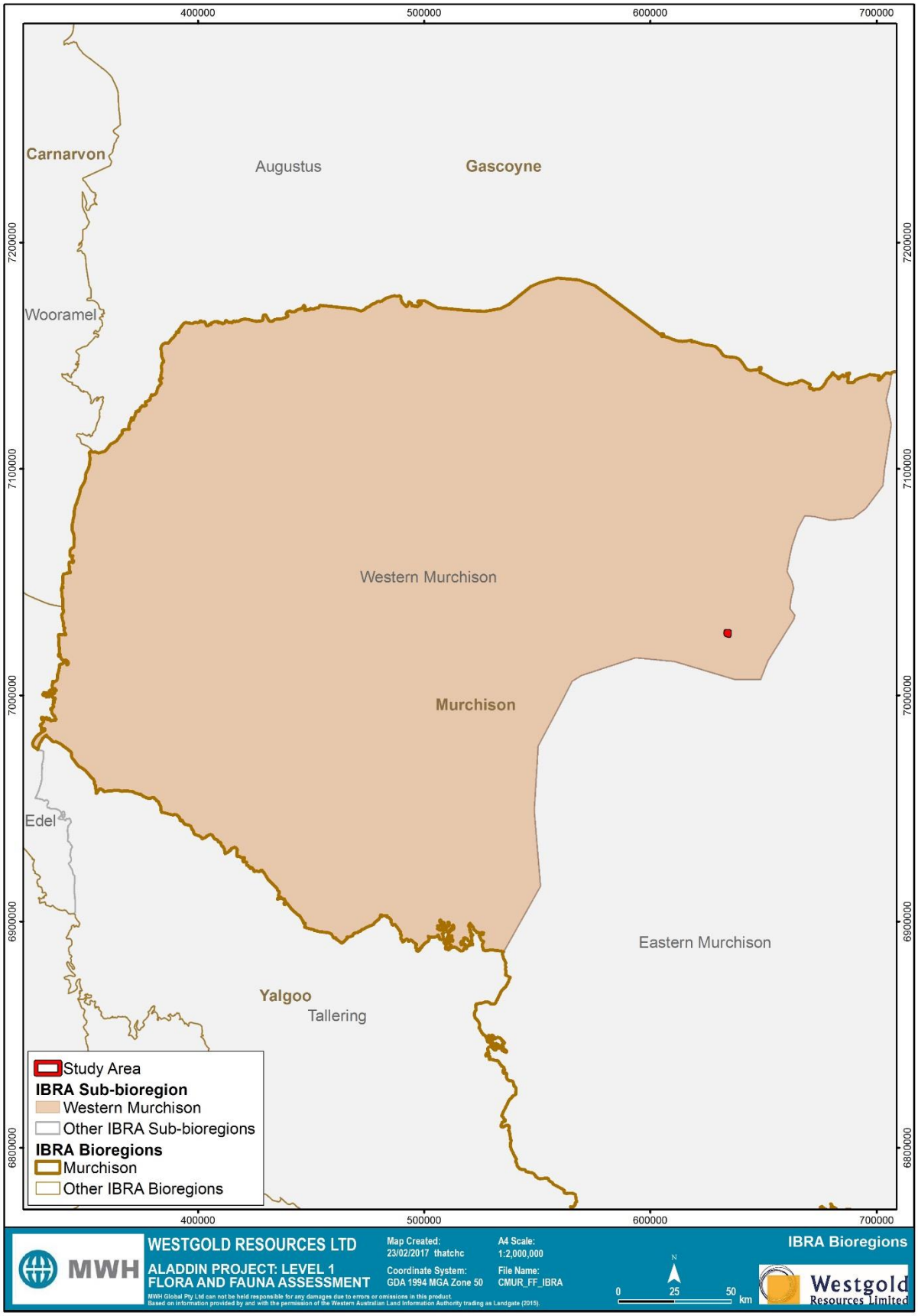

Figure 2-1: Location of the Study Area in relation to IBRA bioregions and Subregions

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 (Curry et al. 1994). Land systems across the Murchison have been mapped by the Natural Resources Assessment Group of the former Department of Agriculture (now Department of Agriculture and Food Western Australia) and provide a comprehensive description of biophysical resources within the area (Curry et al. 1994). The Study Area is located within the Gabanintha System, comprising ridges, hills and foot slopes of various metamorphosed volcanic rocks (greenstones), supporting sparse *Acacia* and other mainly non-halophytic shrub lands (Curry et al. 1994).

2.3 Pre-European Vegetation

Vegetation mapping of Western Australia was completed on a broad scale (1:1,000,000 and 1:250,000) by Beard (1975), who classified vegetation into broad vegetation associations. These vegetation associations were re-assessed by Shepherd *et al.* (2002) to account for clearing in the intensive land use zone, and to divide some larger vegetation units into smaller units. Shepherd *et al.* (2002) developed a series of systems to assist in the removal of mosaics; however, some mosaics still occur. Vegetation system associations described by Shepherd *et al.* (2002) correspond with that of Beard (1975).

The Study Area occurs within the Austin Botanical District of the Eremaean Province (Beard 1990). The Austin Botanical District corresponds broadly to the Murchison region which was mapped by Beard (1976) at a 1:1,000,000 scale. Three vegetation system associations mapped by Beard (1976), and Shepherd *et al.* (2002) intersect the Study Area (**Table 2-1, Figure 2-1**); Upper Murchison 18.2, 39.1 and 1128. The current remaining extent of the vegetation system associations are more than 98% across the four scales (State, bioregion, subregion and Local Government Authority (LGA – Shire of Meekatharra), (**Table 2-2**) (Government of Western Australia 2015); well above the advised threshold for biodiversity conservation of 30% remaining (EPA 2000).

Table 2-1: Pre-European vegetation associations of the Study Area

Vegetation system association	Description	Portion of Study Area	
		ha	%
Upper Murchison 18.2	Low woodland; mulga (*Acacia aneura*)	76.8	36.0
Upper Murchison 39.1	Shrublands; mulga scrub	82.8	38.8
Upper Murchison 1128	Mosaic: Succulent steppe with open scrub; scattered Acacia sclerosperma & bowgada over saltbush & bluebush / Succulent steppe; samphire	53.7	25.2

Table 2-2: Pre-European extent of vegetation associations remaining

Code	Scale	Pre-European extent (ha)	Current extent (ha)	Current extent remaining (%)	Current extent protected (%)
Upper Murchison 18.2	State	1901789	1,897,254	99.76	3.51
	Bioregion	1,900,879	1,896,344	99.76	3.51
	Subregion	1,640,344	1,635,842	99.73	3.92
	LGA	710,099	705,877	99.41	0.96
Upper Murchison 39.1	State	411,827	410,748	99.74	3.28
	Bioregion	411,827	410,748	99.74	3.28
	Subregion	399,337	398,396	99.76	3.38
	LGA	138,862	137,940	99.34	0.00
Upper Murchison 1128	State	18,658	18,349	98.35	0.00
	Bioregion	18,658	18,349	98.35	0.00
	Subregion	18,658	18,349	98.35	0.00
	LGA	18,467	18,159	98.33	0.00

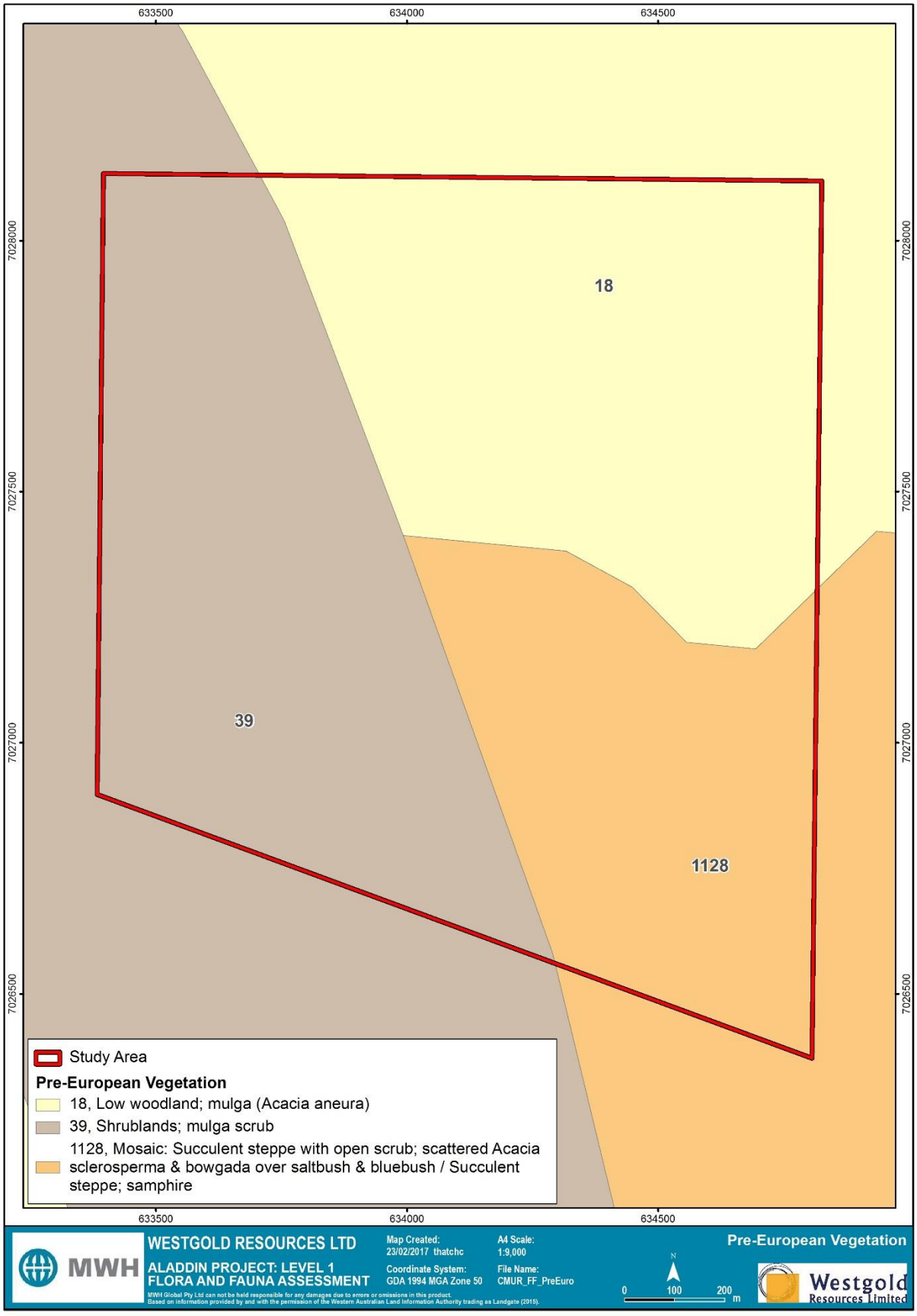

Figure 2-2: Pre-European vegetation associations of the Study Area

2.4 Land Use

Grazing of native pastures accounts for the vast majority of land use within the Western Murchison subregion (~96%), followed by Unallocated Crown Land (UCL) and Crown reserves which comprise approximately 2% combined (Cowan *et al.* 2001). Mining activity within the region is considerable, dominated by nickel and gold mining, most of which are leases upon pastoral lands. Only a small fraction of the subregion is protected within the conservation reserve system (<2%) and the subregion is not considered comprehensive or representative of ecosystems present (Cowan *et al.* 2001). Most conservation reserves are protected as Nature Reserves with only one National Park within the region, Goongarrie National Park, located 450 km south-east of the Study Area.

The nearest national park to the Study Area is Collier National Park, located approximately 200 km north in the Gascoyne bioregion, and the nearest nature reserve is Wanjarri Nature Reserve located 230 km east of the Study Area. The closest conservation managed area is ex-Lakeside station – a former pastoral lease now managed by DPaW, located 90 km south (DPaW 2016).

The Aladdin Project Area is located within the Annean Station and the Norie Station. Both the Annean Station and Norie Station are actively used to farm cattle, and as such, grazing pressures are high.

2.5 Climate

The Study Area is located within the Western Murchison subregion which has an arid climate with bimodal rainfall (Cowan *et al.* 2001). The climate is typical of a semi-desert tropical climate characterised by hot summers and relatively warm, dry winters (BoM 2017).

Meekatharra Airport (station number 007045), is the nearest Bureau of Meteorology (BoM) weather station, which documents long term climate data (BoM 2017). The mean annual rainfall recorded at Meekatharra Airport is 237 mm with the majority received between January and March each year. Peak rainfall is recorded in February with a secondary peak in June (BoM 2017) (**Figure 2-3**). The hottest maximum temperatures occur between November and March, with the coldest minimums occurring between May and August (BoM 2017) **(Figure 2-3**).

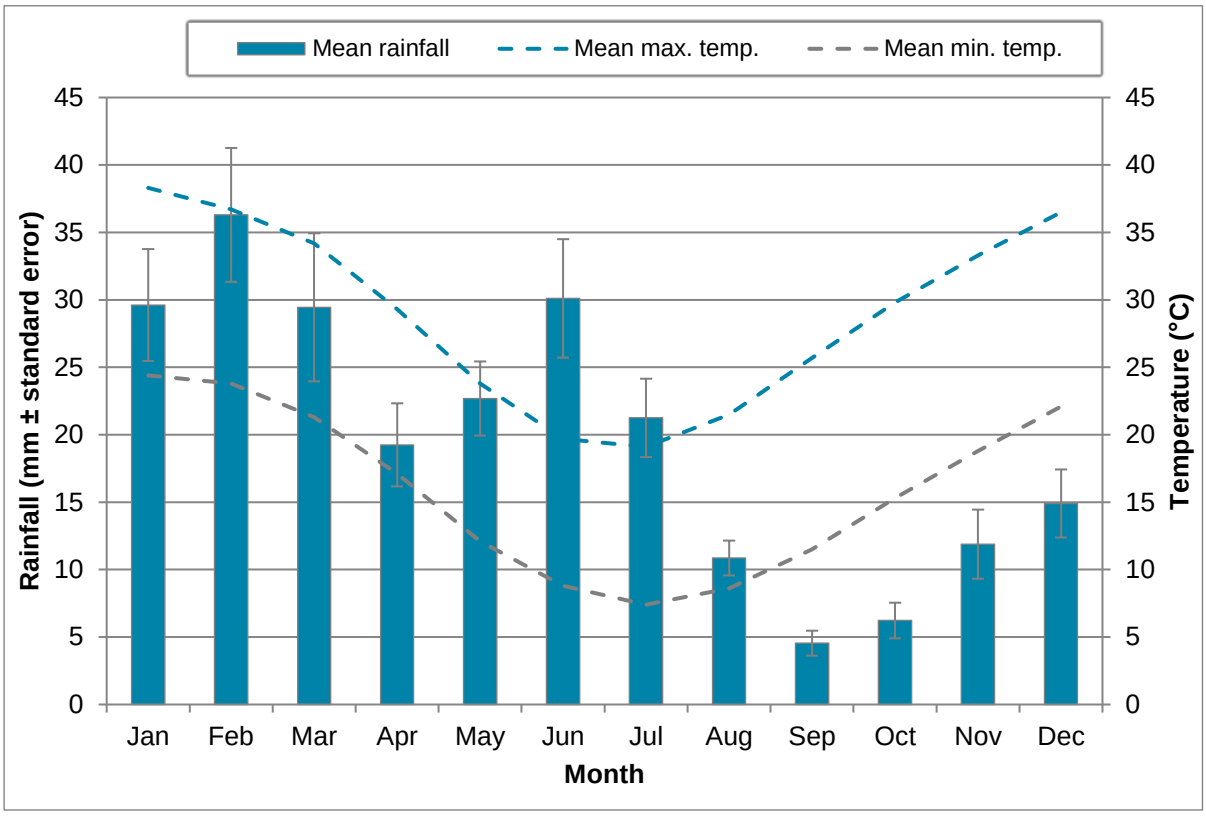

Figure 2-3: Long-term climate data recorded at Meekatharra Airport (BoM 2017)

2.6 Lake Annean Environmentally sensitive Area

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under section 51B of the *Environmental Protection Act 1986*, to prevent incremental degradation of important environmental values. ESAs generally include areas within 50 metres of protected wetlands, within 50 metres of declared rare flora, Bush Forever sites, and those areas containing a threatened ecological community. Lake Annean has been designated as an ESA, and consequently, it is protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. As such, exemptions contained in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 for routine low impact land management practices do not apply and a clearing permit is required.

2.7 Wetlands

Lake Annean is listed as a Directory of Important Wetlands in Australia (DIWA), (listed as Anneen Lake (Lake Nannine) Ref no WA056) (DoE 2015b). Lake Annean has been listed as an Environmentally Sensitive Area (ESA) because it supports foraging and breeding habitat for a number of Federally-listed migratory and marine bird species as well as various other water bird species (**Figure 2-4**). Hundreds of Gull-billed Terns (*Sterna nilotica*) listed as Migratory (EPBC Act) and Schedule 5 (WC Act) have been recorded breeding in the western portion of the lake (DoE 2015b). Additionally, similar numbers of the Whiskered Tern (*Sterna hybrida*) have been observed nesting atop inundated samphire and lesser numbers of the Black-winged Stilt (*Himantopus himantopus*) have been observed nesting at the lake (DoE

2015b) Few other locations in Western Australia are known to support as many individuals of this species (DoE 2015b).

Although no systematic surveys of the lake have been undertaken, the lake apparently supports several thousand waterbirds when full, with high abundance of Black Swan (*Cygnus atratus*) (up to 1,500), Banded Stilt (*Cladorhynchus leucocephalus*) (1,000 plus), Australian Shelduck (*Tadorna tadornoides*) (500) and Gull-billed Tern and Whiskered Tern (200-300 each) (DoE 2015b). The Hoary-headed Grebe (*Poliocephalus poliocephalus*) has also been recorded nesting at the lake.

The lake is also a good example of a seasonal/intermittent saline/brackish lake and marsh system (DoE 2015b). The lake plays an important ecological and hydrological role in the landscape and provides habitat and refuge for significant invertebrate and vertebrate fauna.

Lake Annean is a megascale irregular sumpland, with numerous microscale and macroscale elongate islands and peninsulas, while a natural peninsula (ridge) almost separates the wetland into two lakes. An anastomosing creek system enters the north-east corner of the lake with a catchment extending 30 km north to nearby Meekatharra. Additional minor creeks flow from the landscape into the west and north sides of the lake. The catchments are all moderately disturbed from pastoral and mining related activities.

Surface water held in the lake drains northwards via Hope River into the Murchison River. Inundation over parts of the lake occurs periodically in most years, while the whole lake occasionally fills from episodic flooding (probably every five to ten years) caused by large summer-autumn rain events associated with tropical storms moving from the north-west. At its deepest point, the depth of the surface water can reach 1 m after large flooding events.

The Study Area covers 0.35 ha of the Lake Annean Environmentally Sensitive Area.

Figure 2-4: Environmentally Sensitive Area near the Study Area

2.8 Geology and soils

The Murchison region is spread over the northern third of the Yilgarn Craton. The underlying rocks are predominantly Archaean even-grained porphyritic granitic rocks intruded by quartz veins and dolerite dykes. Throughout the Craton are areas of Archaean migmatite and gneiss, common along the western margin, as well as in the north-west where Narryer Terrane and Yarlarweelor Gneiss Complex are located. The latter consists of migmatite, gneiss, schist and quartzite (Tille 2006).

Soils within the region vary, with red loamy earths, red-brown hardpan shallow loams and some red shallow loams present on wash plains, while red sandy earths and red deep sands are found on sandy banks. Red sandy earths and red deep sands, with some red loamy earths and calcareous loamy earth in low lying areas, are found on sandplains. Yellow deep sands are found on sandplains in the south-west. On mesas there are red shallow loams, red shallow sandy duplexes and red shallow sands, with some stony soils and red/brown non-cracking clays also present (Tille 2006).

Hilly terrain contains red shallow loams, stony soils and red shallow sands, with some bare rock and red shallow sandy duplexes. Sandy soils tend to be more common on granitic hills. Red shallow loams with red shallow sandy duplexes are found on stony plains, and red shallow sands occur on gritty plains over granite. Red-brown hardpan shallow loams, calcareous loamy earths and red loamy earths are also present (Tille 2006).

Salt lake soils with some red deep sands occur on valley floors with red deep sandy duplexes, red/brown non-cracking clays, red shallow sandy duplexes and red-brown hardpan shallow loams also present, especially on floodplains in the north-west. Calcareous shallow loams are found on the calcrete platforms (Tille 2006).

3 Desktop Study

A desktop study, comprising database searches and a literature review, was undertaken prior to the field survey. The purpose of the desktop study was to identify flora, vegetation and terrestrial fauna potentially occurring in the Study Area, in particular species of conservation significance. Conservation significance and conservation rankings used under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Wildlife Conservation Act 1950* (WC Act), as well as the Department of Parks and Wildlife's (DPaW) Priority list, are defined in **Appendix A**.

3.1 Database Searches

Database searches were undertaken to generate a list of vascular flora and vertebrate fauna previously recorded within, and nearby the Study Area – with an emphasis on species of conservation significance and introduced species. Six database searches were conducted around a central coordinate (50J, 634123 mE, 7027357 mS). Search buffers differed due to the technical capabilities of individual databases as well as ecological features surrounding the Study Area relevant to different species groups (**Table 3-1**).

Table 3-1: Database searches conducted for the desktop assessment

Custodian	Database	Taxonomic group	Reference	Buffer (km)
DoEE	Protected Matters	• Flora and Fauna	(DoEE 2017)	30
Parks and Wildlife	NatureMap	• Flora and Fauna	(DPaW 2017a)	30
Parks and Wildlife	Threatened and Priority Ecological Communities	• Flora and Fauna	(DPaW 2017b)	30
Parks and Wildlife	Threatened and Priority Flora	• Flora	(DPaW 2017d)	30
Parks and Wildlife	Threatened and Priority Fauna	• Fauna	(DPaW 2017c)	60
Birdlife Australia	Birdlife Birdata	• Fauna	(Birdlife Australia 2017)	40

3.2 Literature Review

The literature review considered nine previous surveys of relevance to the Study Area, comprising seven detailing flora and vegetation (**Table 3-2**), and seven detailing terrestrial fauna (**Table 3-3**). Surveys considered were those that were publically available, recently conducted, and in close proximity to the Study Area.

Table 3-2: Key findings of flora studies conducted within 100 km of the Study Area

Reference	Study Details	Proximity to Study Area	Vegetation unit	Flora recorded	Vegetation condition	Species and communities of conservation significance
MWH (2015b)	Location: Lake Annean Study Type: Level 1 Flora and Vegetation Survey Survey Date: July 2015	Overlaps the southeast corner of Study Area	8 vegetation units including: • *Acacia* shrublands • *Acacia* woodland • *Hakea* shrubland • *Maireana* chenopod shrubland • *Melaleuca* shrubland • *Salsola chenopod* shrubland • *Tecticornia* samphire shrubland	105 taxa 28 families 50 genera	Vegetation condition ranged from 'Excellent' to 'Completely Degraded'. Disturbances feral grazing, weeds, mining exploration	nil
MWH (2016b)	Location: Gibraltar and 5 Mile Well Study Type: Level 1 Flora and Vegetation Survey Survey Date: September 2016	20 km to the north	2 vegetation units including: • *open Mulga (Acacia aneura and close relatives) shrublands* • *low woodlands and open Acacia shrublands*	146 taxa 27 families 47 genera	Vegetation condition ranged from 'Very Good' to 'Completely Degraded'. Disturbances feral grazing, weeds, mining exploration	nil
MWH (2015a)	Location: Reedy Study Type: Level 1 Flora and Vegetation Survey Survey Date: April 2015	13 km to the south	10 vegetation units including: • *Acacia shrubland* • *Acacia/Eremophila shrubland* • *Hakea shrubland*	101 taxa 27 families 53 genera	Vegetation condition ranged from 'Very Good' to 'Degraded'. Disturbances feral grazing, weeds, mining exploration	• *Ptilotus beardii (P3)*
MWH (2016a)	Location: Culculli Study Type: Level 1 Flora and Vegetation Survey Survey Date: April 2016	25 km to the south	13 vegetation units including: • *Acacia shrubland*	83 flora taxa 20 families 39 genera	Vegetation condition ranged from 'Very Good' to 'Degraded'. Disturbances historical mining and mining exploration.	nil

Reference	Study Details	Proximity to Study Area	Vegetation unit	Flora recorded	Vegetation condition	Species and communities of conservation significance
Coffey Environments (2013a)	Location: Silver Lakes Mt Eelya Project Study Type: Level 2 Flora and Vegetation Survey Survey Date: April and August 2012	~60 km to the south	8 vegetation units including: • *Acacia shrublands* • *Acacia woodlands* • *Eremophila shrublands*	225 taxa 43 families 92 genera	Majority of vegetation condition was considered in 'Excellent' condition. Poor condition attributed to exploration	• *Acacia speckii (P4)* • *Baeckea sp. London Bridge (M.E. Trudgen 5393) (P3)* • *Drummondita miniata (P3)* • *Gunniopsis ?propinqua (P3)* • *Hibiscus krichauffianus (P3)* • *Prostanthera petrophila (P3)* • *Sida picklesiana (P3)* • *Stenanthemum mediale (P1)* • *Tribulus adelacanthus (P3)*
Outback Ecology (2012)	Location: Central Murchison Gold Project Study Type: Level 1 Flora and Vegetation Survey Survey Date: November 2011	~83 km to the south-southwest	22 vegetation units including: • *Acacia shrublands* • *Acacia woodlands* • *Eremophila shrublands* • *Melaleuca shrublands* • *Frankenia shrublands* • *Chenopod shrubland* • *Tecticornia shrubland*	151 taxa 41 families 91 genera	Vegetation condition ranged from 'Excellent' to 'Completely Degraded'. Disturbances feral grazing, weeds, mining exploration	nil
Coffey Environments (2013b)	Location: Silver Lakes Lake Austin Project Study Type: Level 2 Flora and Vegetation Survey Survey Date: April and August 2012	~84 km to the south-southwest	11 vegetation units including: • *Acacia shrublands* • *Acacia woodlands* • *Banded Ironstone Formation* • *Gypsum rise* • *Sand dune* • *Hakea shrublands* • *Chenopod heathland*	116 taxa 24 families 55 genera	Majority of vegetation condition ranged from 'Excellent' to 'Very Good'. Disturbances weeds, historical mining and exploration	• *Tecticornia fimbriata (P3)*

Table 3-3: Key findings of fauna studies conducted within 100 km of the Study Area

Reference	Study details	Proximity to Study Area	Broad habitats	Fauna assemblage recorded	Species of conservation significance	Notes
MWH (2015b)	Location: Lake Annean Study Type: Level 1 fauna Survey Survey Date: July 2015	Overlaps the southeast corner of Study Area	7 broad fauna habitats including: • *Dunefields* • *Stony plains* • *Samphire* • *Ironstone hills* • *Lake Playa* • *Quartz outcrop* • *Chenopod shrubland*	29 taxa 5 mammals (incl. 2 introduced) 17 birds 6 reptiles 1 amphibian	*Lerista eupoda* (P1)	Overlaps Study Area and is likely to contain similar habitats and species to those within the Study Area
(MWH 2016b)	Location: Gibraltar and 5 Mile Well Study Type: Level 1 Flora and Vegetation Survey Survey Date: September 2016	20 km to the north	4 broad fauna habitats including: • *Minor Drainage* • *Rocky Outcrop* • *Mulga Plain* • *Stoney rise*	44 taxa 6 mammals (incl. 5 introduced) 35 birds 3 reptiles	nil	Likely to contain similar habitats and species
(MWH 2016a)	Location: Culculli Study Type: Level 1 Fauna Survey Survey Date: April 2016	25 km to the south	3 broad fauna habitats including: • *Mulga Shrubland* • *Low Stony Rise* • *Drainage Line*	33 taxa 3 mammals (incl. 2 introduced) 25 birds 5 reptiles	nil	Likely to contain similar habitats and species
MWH (2015a)	Location: Reedy Study Type: Level 1 Fauna Survey Survey Date: April 2015	13 km to the south	5 broad fauna habitats including: • *Low Open Mulga Woodland* • *Open Eremophila Shrubland* • *Stony Rise* • *Stony Plain* • *Drainage Lines*	n/a	nil	Likely to contain similar habitats and species
Coffey Environments (2013a)	Location: Silver Lakes Mt Eelya Project	~60 km to the south	4 broad fauna habitats including: • *Mulga woodland* • *Minor drainage line* • *Breakaway*	n/a	nil	Likely to contain similar habitats and species to those in the Study Area

Reference	Study details	Proximity to Study Area	Broad habitats	Fauna assemblage recorded	Species of conservation significance	Notes
	Study Type: Level 1 Survey Survey Date: April and September 2012		• *Chenopod shrubland*			
ecologia Environment (2009)	Location: Weld Range Project Study Type: Level 2 Survey Survey Date: September 2007	~78 km to the south-west	17 broad fauna habitats including: • *Banded Ironstone ridge* • *Mulga drainage line* • *Lateritic breakaway* • *Drainage line* • *Acacia sandplain* • *Granite outcrops* • *Eucalypt sandplain* • *Chenopod floodplain* • *Mulga woodland/s*	148 taxa 17 mammals (incl. 6 introduced) 80 birds 44 reptiles 1 amphibian	Malleefowl (Vu, S3) *Lerista eupoda* (P1) Long-tailed Dunnart (P4) Peregrine Falcon (S4)	Project is located on isolated ironstone ridge. Therefore survey area likely to contain habitats and species different to that existing within the Study Area
Outback Ecology (2012)	Location: Central Murchison Gold Project Study Type: Level 1 Survey Survey Date: November 2011	~83 km to the south-southwest	22 broad fauna habitats including: • *Acacia shrublands* • *Acacia woodlands* • *Eremophila shrublands* • *Melaleuca shrublands* • *Frankenia shrublands* • *Chenopod shrubland* • *Tecticornia shrubland*	n/a	nil	Likely to contain similar habitats and species

3.3 Desktop Results

3.3.1 Flora

A total of 43 flora taxa of conservation significance were identified by the database searches (**Table 3-4**), and an additional five priority listed flora taxa were identified from the desktop review of biological studies undertaken in close proximity to the Study Area. No species of conservation significance that are listed as Threatened under the WC Act, or listed under the EPBC Act were recorded. Of the 48 priority listed flora species, 13 are listed as Priority 1, one is listed as Priority 2, 29 are listed as Priority 3 and 5 are listed as Priority 4 (**Table 3-4**).

Table 3-4: Flora species of conservation significance identified during the desktop assessment

Species	Source
Priority 1	
Acacia dilloniorum	A
Angianthus uniflorus	A
Beyeria lapidicola	A
Dampiera plumosa	A
Dicrastylis sp. Cue (A.A. Mitchell 764)	A
Eremophila retropila	A, B
Eremophila rhegos	A
Eremophila sp. Meekatharra (D.J. Edinger 4430)	A
Lepidium xylodes	A
Millotia depauperata	A
Pityrodia canaliculata	A
Rhodanthe sphaerocephala	A
Stenanthemum patens	A, C
Priority 2	
Bergia auriculata	A
Priority 3	
Acacia sclerosperma subsp. *glaucescens*	A, B
Baeckea sp. London Bridge (M.E. Trudgen 5393)	A
Baeckea sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	A
Bossiaea eremaea	A
Calytrix verruculosa	A
Calytrix verruculosa	A, B
Drummondita miniata	C
Eremophila arachnoides subsp. *arachnoides*	A
Eremophila fasciata	A
Euryomyrtus recurva	A
Hemigenia virescens	A, B
Hibiscus krichauffianus	A
Hibiscus krichauffianus	C
Homalocalyx echinulatus	A
Indigofera gilesii	A

Species	Source
Labichea eremaea	A
Maireana prosthecochaeta	A
Menkea draboides	A
Micromyrtus placoides	A
Mirbelia stipitata	A
Petrophile pauciflora	A
Prostanthera petrophila	A, C
Ptilotus beardii	C
Ptilotus crosslandii	A
Ptilotus lazaridis	A, B
Ptilotus luteolus	A, B
Sida picklesiana	C
Tecticornia cymbiformis	A, B
Tribulus adelacanthus	C
Priority 4	
Acacia speckii	A, B
Eremophila pungens	A
Goodenia berringbinensis	A
Grevillea inconspicua	A
Grevillea inconspicua	A, B

* Source:

A –Threatened (Declared Rare) and Priority Flora Database Search (DPaW 2017d)

B – NatureMap (DPaW 2017a)

C – Coffey Environments (2013a)

3.3.2 Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TECs) were identified from the DPaW Threatened and Priority Ecological Community database or the Department of Environment's (DoE) Protected Matters Database Search (DoEE 2017). Four Priority Ecological Communities (PECs) were identified as occurring within 30 km of the Study Area (**Table 3-5; Figure 3-1**). A small portion of the buffered PEC zone of "Polelle Calcrete" is partially located across the eastern section in association with Lake Annean. (**Table 3-5 Figure 3-1**).

Table 3-5: Priority Ecological Communities identififed by desktop study

Community name	Description	Conservation status	Distance from Study Area
Polelle Calcrete	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Priority 1	Overlaps east portion of Study Area
Austin Land System	Saline stony plains with low rises and drainage foci supporting low halophytic shrublands with	Priority 3	2 km southwest

Community name	Description	Conservation status	Distance from Study Area
	scattered mulga; occurs mainly adjacent to lakes Austin and Annean below greenstone hill systems.		
Yagahong Land System	Rough greenstone ridges, hills and cobble-strewn footslopes supporting mulga shrublands	Priority 3	9 km north
Trillbar Land System	Gently sloping stony plains with low rises of metamorphic rocks and gilgaied drainage foci; supports more or less saline shrublands of snakewood, mulga, bluebush and samphire with patches of tussock grassland	Priority 3	25 km northeast

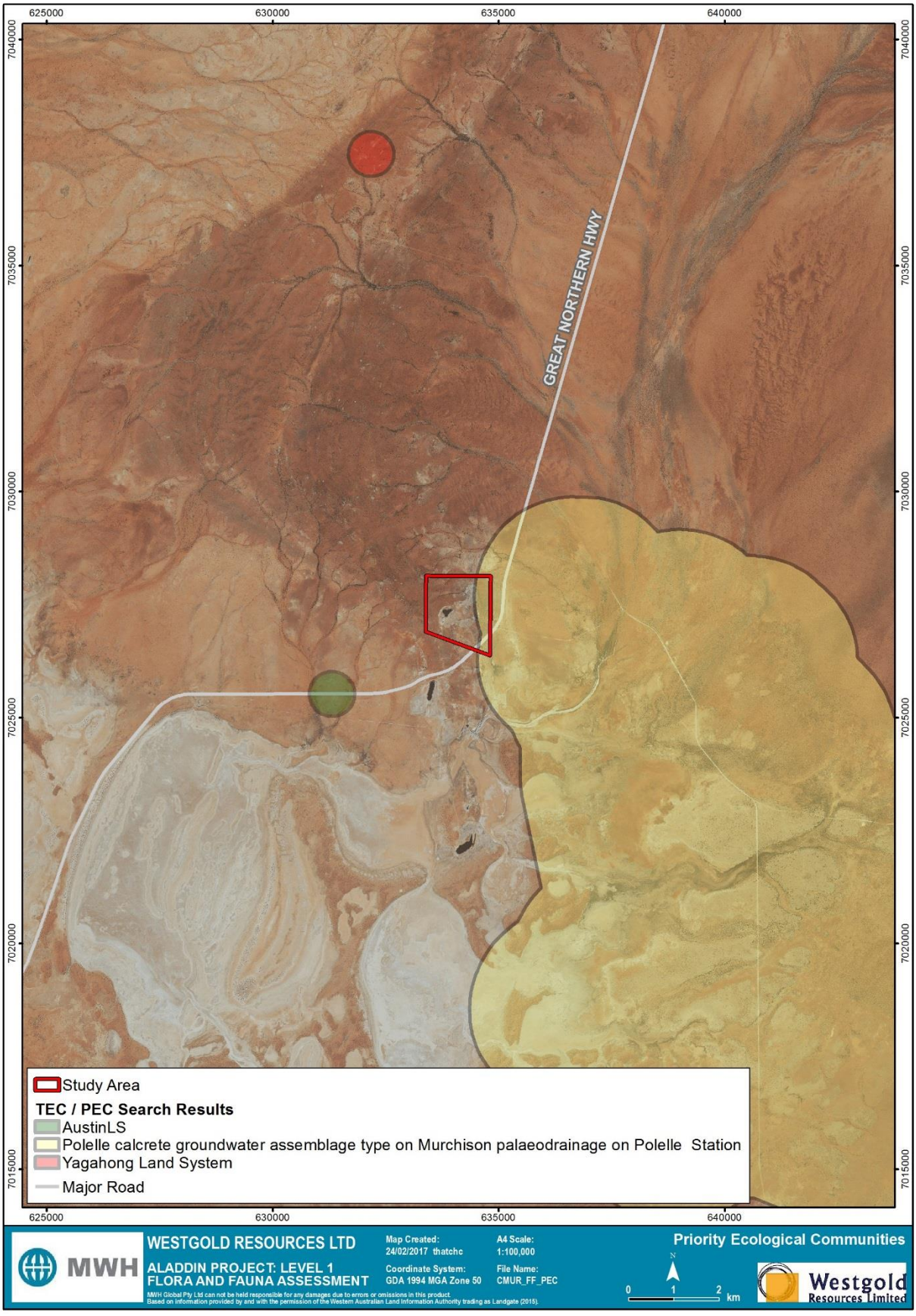

Figure 3-1: Priority Ecological Communities near the Study Area

3.3.3 Fauna

The desktop study identified a total of 229 species of vertebrate fauna, which have been recorded and/or have the potential to occur within the Study Area (**Appendix B**). This total comprises 16 native mammal, eight introduced mammal, 154 native bird, one introduced bird, 47 reptiles and three amphibian species. Many of these species are unlikely to occur in the Study Area because, as leading practice, these records have been collected from a large area encompassing a wide range of habitats, many of which do not occur within the Study Area. Furthermore, some small, common, ground-dwelling reptile and mammal species tend to be patchily distributed even where appropriate habitats are present, and many species of bird can occur as regular migrants, occasional visitors or vagrants.

Of the 229 species of vertebrate fauna identified during the desktop, 22 species are listed as being of conservation significance comprising one mammal, 20 birds and one reptile (**Table 3-6**). In addition, two invertebrate species of conservation significance were identified, the fairy shrimp (*Branchinella simplex*) and the Shield-back Trapdoor Spider (*Idiosoma nigrum*) (**Table 3-6**).

Table 3-6: Fauna of conservation significance identified during the desktop assessment

Conservation status		Common name	Species name
EPBC Act	WC Act		
Cr; Mi	S3; S5	Curlew Sandpiper	*Calidris ferruginea*
En	S1	Night Parrot	*Pezoporus occidentalis*
Vu	S1	Shield-backed Trapdoor	*Idiosoma nigrum*
	S3	Malleefowl	*Leipoa ocellata*
Mi	S5	Fork-tailed Swift	*Apus pacificus*
		Sharp-tailed Sandpiper	*Calidris acuminata*
		Pectoral Sandpiper	*Calidris melanotos*
		Red-necked Stint	*Calidris ruficollis*
		Oriental Plover	*Charadrius veredus*
		Grey Wagtail	*Motacilla cinerea*
		Yellow Wagtail	*Motacilla flava*
		Glossy Ibis	*Plegadis falcinellus*
		Gull-billed Tern	*Sterna nilotica*
		Wood Sandpaper	*Tringa glareola*
		Common Greenshank	*Tringa nebularia*
		Marsh Sandpiper	*Tringa stagnatilis*
-	S3	Grey Falcon	*Falco hypoleucos*
	S5	Eastern Great Egret	*Ardea modesta*
		Rainbow Bee-eater	*Merops ornatus*
	S7	Peregrine Falcon	*Falco peregrinus*
	P1	fairy shrimp	*Branchinella simplex*
		Meekatharra Slider	*Lerista eupoda*
	P4	Blue-billed Duck	*Oxyura australis*
		Long-tailed Dunnart	*Sminthopsis longicaudata*

4 Survey Methodology

4.1 Survey Timing and Weather

The optimal timing for surveying flora and fauna in the Eremaean Province (where the Study Area is located) is 6-8 weeks following the season which normally contributes the most rainfall (EPA and DEC 2010, EPA and DPaW 2015). For the Murchison bioregion, the season of highest rainfall is typically summer (**Section 2.5**) (BoM 2017).

The field survey was conducted between the 31st January and 1st - 2nd of February 2017. With average rainfall preceding the survey, the timing was considered adequate to describe and delineate vegetation types and fauna habitats (given the constraints articulated below), and did not unduly compromise the ability to assess the likelihood of species of conservation significance occurring.

In the six months preceding the Survey, Meekatharra Airport received 46.0 mm, comparative to the long term average of 78.0 mm for the same period (**Figure 4-1**). September to November recorded no 0mm of rainfall (BoM 2017). Flowering was not prolific, nor was there a large presence of annuals, suggesting that rainfall locally (i.e. within the Study Area) was low, or sufficient time had not past between the rainfall and the field survey to allow for germination and/or flowering of flora taxa. For the Eremaeum Province, field surveys should occur approximately 4 to 8 weeks after sufficient rainfall (i.e. greater than 15 mm) to allow annuals and ephemerals to germinate, and all flora including perennials to flower (EPA and DPaW 2015). There also needs to be sufficient warming of the soil to promote germination and growth.

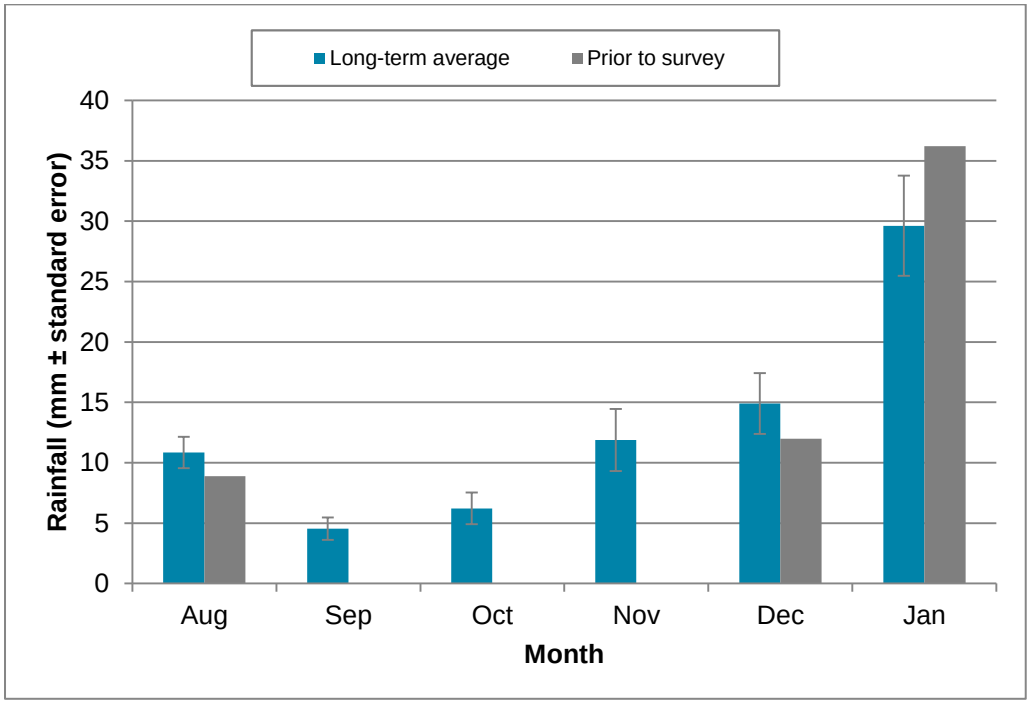

Figure 4-1: Rainfall recorded at Meekatharra Airport six months prior to the Survey (BoM 2017)

Weather experienced during the Survey was considered optimal for sampling fauna. Days were relatively hot and humid with the activity of ground dwelling reptiles restricted to the early morning and late afternoon (**Table 4-1**). The hot conditions also meant that the activity of birds was limited to the cooler times of the day and to the more sheltered habitats. The maximum and minimum temperatures were 38.2°C and 24.4°C, respectively (**Table 4-1**). Approximately 0.4 millimetres (mm) of rain was recorded during the Survey associated with late afternoon thunderstorms. The focus of the Level 1 fauna component was to identify habitats and assess for their likelihood to support fauna of conservation significance. Weather conditions experienced during the Survey meet this section of the scope.

Table 4-1: Daily weather observations at Meekatharra Airport for the Survey period (BoM 2017)

Date	Temperature (°C)		Rainfall (mm)
	Min	Max	
31/01/2017	24.5	38.2	0.2
1/02/2017	24.4	38.0	0.0
2/02/2017	25.3	37.6	0.2

4.2 Survey Team and Licensing

The field Survey was conducted by experienced zoologists/botanists of MWH Australia. The Survey was undertaken by Senior Zoologist Paul Bolton and Botanist Megan Stone. All plant collections were taken under flora collecting permit SL011840 pursuant to the WC Act Section 23C and Section 23F.

4.3 Flora and Vegetation Assessment

Relevés (unbounded floristic sampling sites) were sampled to characterise vegetation types and condition, and ensure appropriate representation of the flora and vegetation present. A total of 17 relevés were surveyed within the Study Area, (**Figure 4-2**). Indicative site locations were identified prior to commencement of the field survey using aerial photography, topographic maps and existing vegetation maps, to ensure that all broad vegetation types and landforms within the Study Area would be sampled. At each relevé the following information was recorded:

- GPS Location (recorded in GDA94 UTM 50J);
- a colour photograph of the vegetation;
- habitat type;
- vegetation condition;
- vegetation description;
- vascular flora taxa present;
- average percentage cover of leaf litter;
- average percentage cover of bare ground; and

- disturbance details including fire history (time since last fire), and physical disturbance including evidence of erosion, grazing and weed invasion.

An inventory of flora within the Study Area was developed by recording vascular flora taxa encountered at each of the 17 relevés and opportunistically between sites within the Study Area. Flora taxa not identified in the field were collected and pressed for identification at the Western Australian Herbarium (WAH). Identifications were carried out by MWH botanists Megan Stone and Lucy Dadour, taxonomist Sharnya Thomson and WAH *Tecticornia* specialist Kelly Shepherd. The nomenclature and taxonomy of all vascular flora taxa in this report follows that of the WAH. All taxa were checked against FloraBase to ensure their currency and validity (WAH 2017).

Broad vegetation mapping was conducted in the field, with vegetation boundaries delineated over aerial photography, and later refined based on survey data. Vegetation condition was assessed based on the Trudgen (1988) vegetation condition scale (**Appendix C**). The vegetation types were described based on the floristic data recorded from the relevés and visual observations while traversing the Study Area. Classifications were completed to National Vegetation Information System (NVIS) hierarchical level V (ESCAVI 2003). Hierarchical level V requires the dominant growth form, cover, height and dominant species (three for each stratum) for each of the three traditional strata (i.e. upper, mid and ground to a maximum of nine taxa) to be detailed, where present.

Prior to the Survey, flora of conservation significance with potential to occur within the Study Area were determined (**Table 3-4**). 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 flora taxa of conservation significance, or species that showed similarities to such species, that were identified in the field were recorded, and detailed.

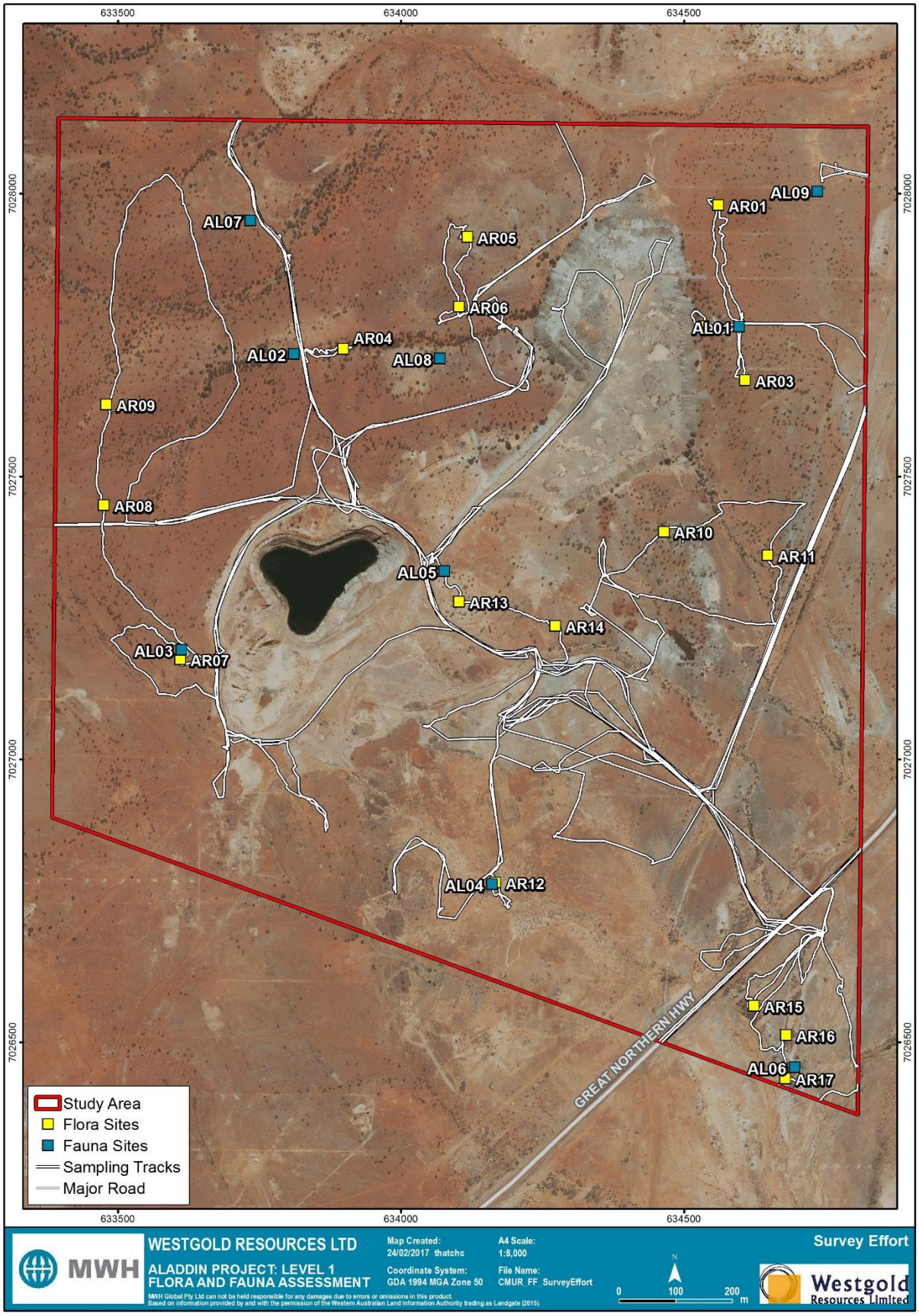

Figure 4-2: Survey effort across the Study Area

4.4 Terrestrial Fauna Assessment

Fauna habitat assessments were undertaken at nine locations throughout the Study Area (**Figure 4-2**). At each location, the following key habitat 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, floodplains, etc.; and
- any nest, 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. Additional survey effort focused on habitat likely to support fauna of conservation significance (**Table 3-6**), such as dense shrublands and thickets potentially supporting Malleefowl, sandy loam substrates potentially supporting *Lerista eupoda*, and any potential wetlands or temporary water bodies with the capacity to support waterbirds or migratory waders, 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 searching for burrows, tracks, diggings, scats, and other signs of fauna. Aural surveys for avifauna were also carried out. All vertebrate fauna seen or heard, or whose presence was inferred from secondary evidence was documented.

The nomenclature and taxonomy of mammals, birds, reptiles and amphibians within this report follow the Checklist of the Vertebrates of Western Australia (WAM 2016). Relevant texts, from which information on habitat preferences and general patterns of distribution are available, were also considered for:

- mammals (van Dyck *et al.* 2013, Woinarski *et al.* 2014);
- birds (Johnstone and Storr 1998, 2004, Morcombe 2003, Pizzey and Knight 2007)
- reptiles (Cogger 2014, Storr *et al.* 1999, Wilson and Swan 2014); and
- amphibians (Cogger 2014, Tyler and Doughty 2009).

4.5 Likelihood of the Occurrence for Flora and Fauna

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

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

Very likely – the Study 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 Study 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 Study 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 Study 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 Study Area lies within the known distribution of the species, but the species is very rare and/or patchily distributed; or
c) the Study 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 Study Area lies outside the known distribution of the species, the Study Area is unlikely to contain suitable habitat, and the species has not been recorded in the area for over 20 years.

5 Results and Discussion

5.1 Vegetation

5.1.1 Vegetation condition

The vegetation condition of the Study Area ranged from Good to Completely Degraded (**Table 5-1**; **Figure 5-1**). The majority of the Study Area was considered to be in Good condition (approximately 53%). Completely Degraded areas were those associated with historical mining operations, access tracks and areas where previous clearing had not yet been rehabilitated. Poor areas compromised areas disturbed by feral grazing and trampling, presence of weeds, tracks and historically cleared areas.

Table 5-1: Vegetation condition in the Study Area

Vegetation Condition	Portion of the Study Area	
	ha	%
Good	112	53
Poor	31	15
Completely Degraded	70	33
Total	213	100

NB: All numbers have been rounded to the nearest whole number

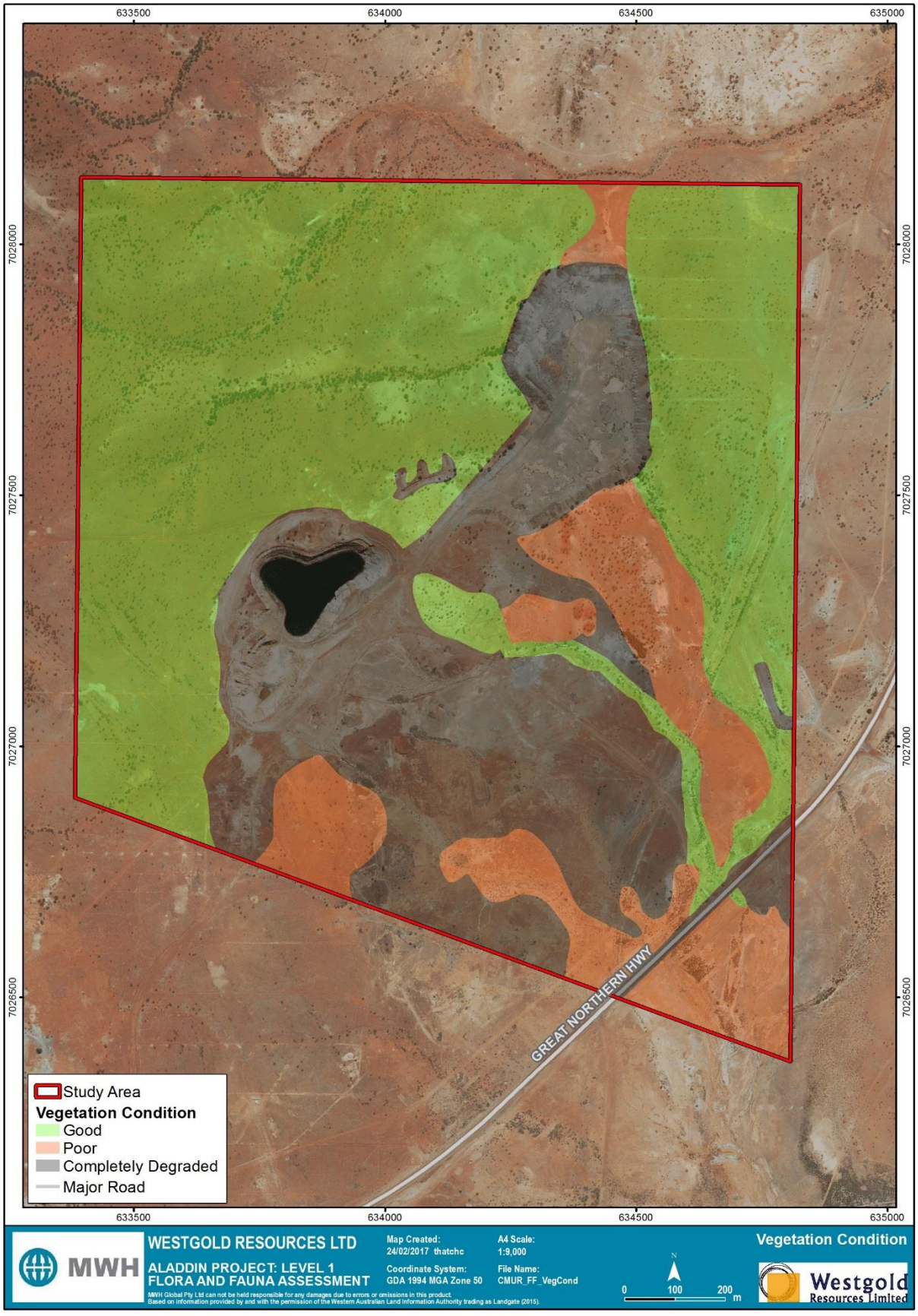

Figure 5-1: Vegetation condition of the Study Area

5.1.2 Vegetation Types

A total of 11 vegetation types were recorded across the Study Area (**Table 5-2; Figure 5-2**). The vegetation broadly comprised samphire shrublands and *Acacia* woodlands. Detailed descriptions for the vegetation recorded at each relevé are provided in **Appendix D**. In addition to the 11 vegetation units described, parts of the Study Area were recorded and mapped as Completely Degraded. These areas were not sampled as the vegetation composition had been severely altered and no longer reflected the native vegetation of the area.

One vegetation unit, VT11 is analogous with VA03 from the Lake Annean Flora and Fauna assessment (MWH 2015b) where the Study Areas overlaps. VA03 is described as Mosaic of mid to tall samphire shrubland dominated by *Tecticornia* species on moist clay.

Table 5-2: Vegetation units recorded within the Study Area

Code	Description	Relevés	Portion of the Study Area (ha / %)	Photograph
VT01	*Acacia fuscaneura* tall sparse shrubland over *Eremophila macmillaniana* and *Senna glutinosa* subsp. x *luerssenii* mid sparse shrubland over *Ptilotus obovatus* and *Senna artemisioides* subsp. *helmsii* low sparse shrubland on low stony hills	AR01 AR02 AR03	20.3 / 9.5	
VT02	*Acacia sclerosperma* subsp. *sclerosperma*, *Acacia synchronicia* and *Acacia fuscanera* tall open shrubland over *Eremophila scoparia* and *Senna artemisioides* subsp. *helmsii* mid sparse shrubland over *Sclerolaena cuneata* and *Sclerolaena diacantha* sparse dwarf chenopod shrubland on stony undulating plains, with *Tecticornia disarticulata* (glaucous form) low sparse samphire shrubland in lower drainage areas	AR11	21.9 / 10.2	

Code	Description	Relevés	Portion of the Study Area (ha / %)	Photograph
VT03	*Acacia fuscaneura*, *Acacia grasbyi* and *Acacia aptaneura* over *Senna* sp. Meekatharra (E. Bailey 1-26) mid sparse shrubland over *Sclerolaena diacantha* and *Sclerolaena cuneata* dwarf chenopod shrubland on undulating stony plains	AR05	26.4 / 12.4	
VT04	*Acacia fuscaneura* and *Acacia grasbyi* tall sparse shrubland over *Eremophila fraseri* subsp. fraseri and *Acacia tetragonophylla* mid sparse shrubland over *Ptilotus obovatus* low sparse shrubland on undulating stony plains	AR09	22.5 / 10.6	

Code	Description	Relevés	Portion of the Study Area (ha / %)	Photograph
VT05	*Acacia fuscaneura* and *Acacia grasbyi* tall sparse shrubland over *Eremophila latrobei* subsp. *latrobei*, *Senna* sp. Meekatharra (E. Bailey 1-26) and *Ptilotus obovatus* mid to low shrubland over *Maireana triptera* and *Sclerolaena diacantha* dwarf chenopod shrubland on rocky ironstone hill	AR07	17.5 / 8.2	
VT06	*Acacia fuscaneura* tall sparse shrubland over *Eremophila spathulata* mid sparse shrubland over *Ptilotus obovatus* low sparse shrubland on quartz and ironstone stony low slopes and plains	AR08	1.6 / 0.7	

Code	Description	Relevés	Portion of the Study Area (ha / %)	Photograph
VT07	*Acacia aptaneura* tall open shrubland over *Eremophila scoparia* and *Senna* sp. Meekatharra (E. Bailey 1-26) mid sparse shrubland on low stony rises	AR10	4.6 / 2.1	
VT08	*Acacia fuscsaneura* tall sparse shrubland over *Eremophila glutinosa* and *Eremophila latrobei* subsp. *latrobe*i mid sparse shrubland over *Senna artemisioides* subsp. *helmsii* and *Ptilotus obovatus* on low rocky quartz hills	AR13	1.9 / 0.9	

Code	Description	Relevés	Portion of the Study Area (ha / %)	Photograph
VT09	*Acacia paraneura* and *Acacia aptaneura* tall shrubland over *Eremophila glutinosa* and *Eremophila latrobei* subsp. *latrobei* mid open shrubland over *Cymbopogon ambiguus* isolated clumps of tussock grasses in narrow drainage channels	AR04	8.0 / 3.7	
VT10	*Hakea preissii* tall open shrubland over *Eremophila scoparia* mid sparse shrubland over *Atriplex codonocarpa*, *Sclerolaena diacantha* and *Sclerolaena cuneata* dwarf *chenopod shrubland* on stony undulating plains adjacent to drainage	AR06	4.9 / 2.3	

Code	Description	Relevés	Portion of the Study Area (ha / %)	Photograph
VT11	Mosaic of mid to tall samphire shrubland dominated by *Tecticornia* species on moist clay. This vegetation comprises a complex array of samphire communities dependant on separate zonation requirements	AR12 AR14 AR15 AR16 AR17	13.7 / 6.4	
Completely Degraded	Disturbed areas including, historical pits, rehabilitated vegetation, waste dumps and exploration activities	N/A	70.1 / 32.9	N/A

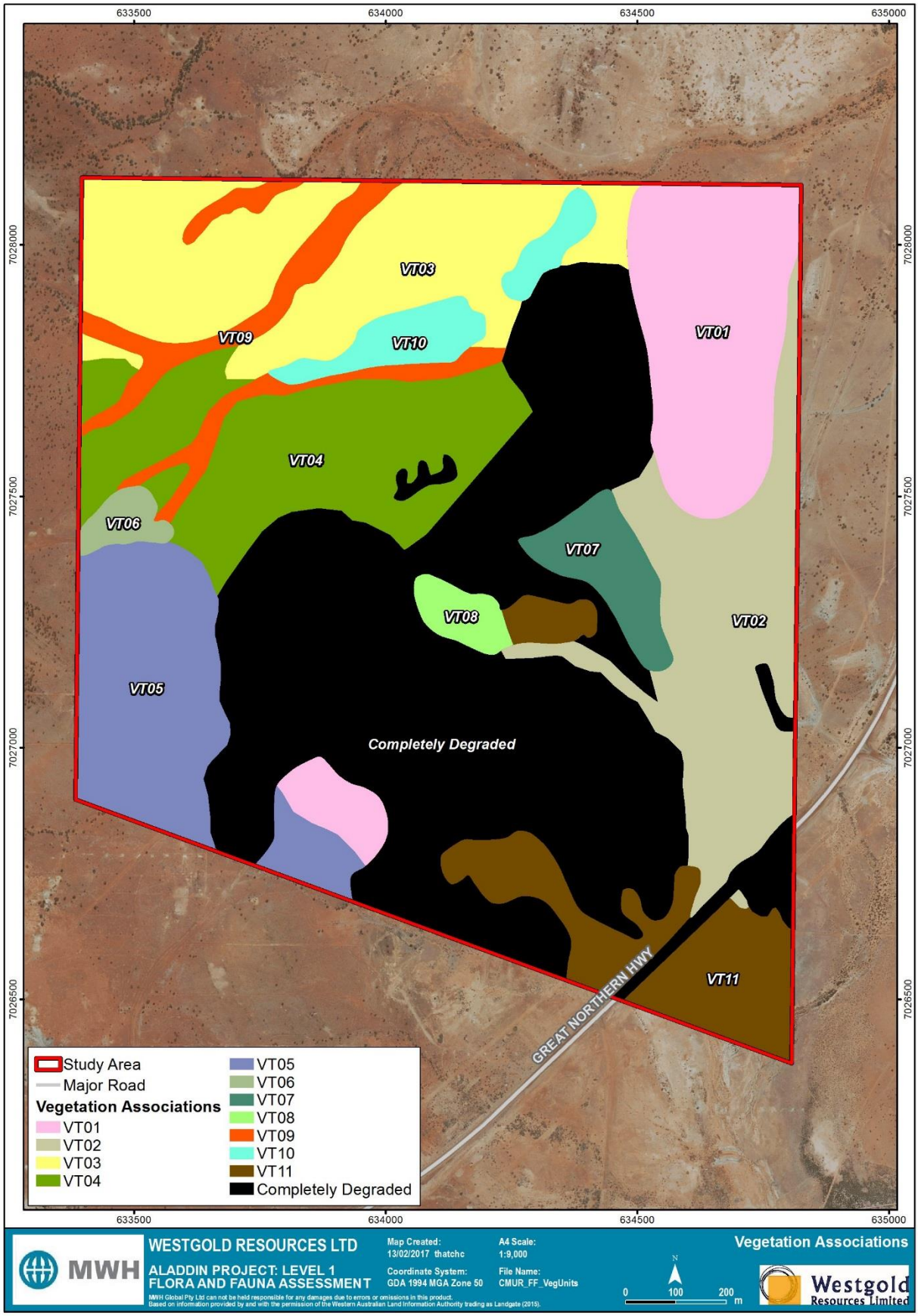

Figure 5-2: Vegetation units within the Study Area

5.1.3 Vegetation of conservation significance

None of the vegetation units within the Study Area are analogous to any TECs under the EPBC Act, or listed by Parks and Wildlife, which qualify for special protection. Furthermore none are expected to occur based on database search results (**Section 3.3.2**)

Potentially threatened ecological communities that do not meet the criteria for a TEC are assigned a PEC status. These communities are not protected under environmental legislation, however it is best practice to avoid disturbance to these areas. There were no PECs recorded within the Study Area. The vegetation units described from the Study Area are not considered to represent any PECs known to occur in the Murchison bioregion.

The EPA (2004b) advises that vegetation may be considered to be of significance for a range of reasons, other than a listing as a TEC or a PEC, including:

- vegetation extent being below a threshold level;
- scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); and/or
- a restricted distribution.

There were no vegetation units recorded from within the Study Area that would be considered to be of regional significance.

The status of native ecosystems and the level of protection they are awarded in the National Reserve System is assessed by the according IBRA bioregion and subregion (NRMMC 2009). IBRA is used to monitor progress in building a Comprehensive, Adequate and Representative (CAR) reserve system (Government of Western Australia 2015). Governments use this information to prioritise allocation of funding to meet national biodiversity protection targets. According to the National Reserve System, the Murchison bioregion is considered to be an under represented bioregion with less than 10% protected (Government of Western Australia 2015, NRMMC 2009). The Murchison bioregion and the Western Murchison subregion have between 5% and 10% of their current area protected within IUCN Class I-IV Reserves (i.e. National Parks, Nature Reserves), respectively.

The Australian and New Zealand Environment and Conservation Council (ANZECC) published the National Objectives and targets for Biodiversity Conservation 2001-2005 which recognises that a retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (ANZECC 2001). EPA (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. In addition to the ANZECC 30% retention target, the EPA has adopted a 10% level of pre-clearing extent as representing 'endangered (EPA 2000).

The vegetation system associations of low woodland of mulga *(Acacia aneura)* (Upper Murchison 18.2) sparse woodland of mulga (Upper Murchison 29) and mosaic of succulent steppe with open scrub (Upper Murchison 1128) occurring within the Study Area (as mapped by Shepherd *et al.* 2002) do not meet the criteria for protection of 10% within IUCN Class I-IV Reserves (**Table 2-2**). Although under represented within the CAR system, greater than 98% of the pre-European extent remains within the Murchison bioregion and the Western Murchison subregion (**Table 2-2**). Therefore, the vegetation associations in the bioregion are not considered to be at threat of exponential biodiversity and species loss.

The Study Area is located within the Western Murchison subregion, which historically, has not been extensively cleared. Clearing and disturbance of vegetation has been concentrated on mineral deposits, townsites, infrastructure corridors, pastoral station and along ephemeral drainage lines. This is evident by greater than 98% of the pre-European extent of the Western Murchison subregion still remaining intact (Government of Western Australia 2015).

5.2 Flora

5.2.1 Flora Assemblages

A total of 105 vascular flora taxa (including subspecies and variants) from 24 families and 50 genera were recorded within the Study Area (**Appendix E**). The most frequently occurring families were Chenopodiaceae (22 taxa), Fabaceae (16 taxa), Scrophulariaceae (16 taxa), Malvaceae (7 taxa) and Poaceae (7 taxa) which together represented 64% of the species recorded (**Table 5-3**). Thirty three of the 50 genera recorded, were represented by a single taxa, while the dominant three genera (*Eremophila* with 16, *Acacia* with 11 and *Tecticornia* with 7) represented 32% of the total taxa recorded from the Study Area.

Table 5-3: Dominant families recorded from the Study Area

Family	Number of species in subregion (WAH 2017)	Species recorded in field survey	
		Number	% of subregion
Chenopodiaceae	118	22	18.6
Fabaceae	216	16	7.4
Scrophulariaceae	89	16	18.0
Malvaceae	231	7	3.0
Poaceae	106	7	6.6

The floral diversity and composition recorded from the Study Area is consistent with the Murchison region, the landforms present, the season of the Survey, and the sampling intensity of the survey (i.e. Level 1, relevés). The flora taxa recorded (**Appendix E**) is consistent with Mulga shrublands of the region. These shrublands consist of a tall shrub layer of *Acacia aneura* complexes over undershrubs (typically *Senna* spp. and/or *Eremophila* spp.) and sparse perennial and annual grasses (Beard 1990). There is also a ground layer of ephemeral herbs, which may be closed in a favourable season (Beard 1990). The condition of the vegetation and the impact of native, feral and stock grazers is evident with many individuals showing signs of grazing stress.

Of the 105 species collected, three specimens were unable to be confidently identified (3%) to family, genera, species or infraspecies level (**Appendix E**) due to the quality of the specimens and a lack of flowering and/or fruiting material. Despite the low amount of rainfall recorded in the months prior to the Survey (**Section 4.1**), flowering and/or fruiting material, required for accurate identifications, was not present. Of the three specimens that were unable to be confidently identified, one was tentatively identified as *Dodonaea* ? *amplisemina* (Priority 4). The other two specimens were not considered to be analogous with any of the 'Likely' or 'Possible' priority flora with potential to occur in the Study Area.

5.2.2 Introduced Flora

Two introduced taxa, **Cenchrus ciliaris,* and **Cucumis myriocarpus,* were recorded from the Study Area during the field survey. The two introduced taxa were recorded sporadically or as isolates across the Completely Degraded portion of Study Area. They were also recorded in small number within vegetation type AR12

The number of introduced flora taxa recorded would likely increase following a higher rainfall season. It is anticipated that introduced annuals and biennials would be present in higher numbers within the disturbed areas (Poor and Completely Degraded).

The two introduced taxa are not considered to be Weeds of National Significance (WONS) or Declared Plant Pests listed under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act).

5.2.3 Flora of Conservation Significance

No threatened flora taxa were identified in the desktop assessment (see **Section 3.3**). No Threatened flora taxa were recorded despite being targeted during the field survey.

Forty eight (48) priority listed flora were identified as having potential to occur within the Study Area. Of these, two taxa were considered Very Likely to occur based on WAH records and the species habitat preferences; *Tecticornia cymbiformis* (P3) and *Acacia sclerosperma* subsp. *glaucescens* (P3), while nine were considered likely, five possible and the remaining 32 were considered unlikely. (**Appendix F**). Each of these species were targeted during the survey. Of these, one priority listed flora taxon, *Tecticornia cymbiformis* (P3) was confirmed as occurring within the Study Area (**Table 5-4**). Another Priority flora taxa not identified by the database search, *Dodonaea ? amplisemina* (P4) was possibly collected during the survey, but could not be confirmed due to the specimen being sterile (**Table 5-4**). In addition two novel (undescribed) flora taxon, *Tecticornia* sp. nov and *Eremophila* sp. nov were collected from the Study Area and have been vouchered with the Western Australian Herbarium for further taxonomic work. None of the other Priority flora were recorded despite targeted searches being undertaken during the survey.

Table 5-4: Flora of conservation significance recorded within the Study Area

Species	Status	Site	GPS Co-ordinate (GDA 94 Zone 51J)	
			Easting	Northing
Tecticornia cymbiformis	P3	AR15	634324	7026564
Dodonaea ? amplisemina	P4	AR01	634561	7027979
Tecticornia sp. Nov	novel taxon	AR15	634624	7026564
		AR17	634678	7026435
Eremophila sp. Nov	novel taxon	AR04	633898	7027725

Tecticornia cymbiformis is a priority 3 taxon known from the Murchison and the fringes of Yalgoo and Gascoyne. *Tecticornia cymbiformis* is known from five occurrences from around Lake Annean with the closest being 5km southwest of the Study Area (DPaW 2017d). It is a perennial erect shrub 0.3 to 0.5 m

high, known to grow in saline soils and along the edge of creeklines (WAH 2017). Within the Study Area this taxon was recorded on the salt lake margin growing on brown light clay, in association with *Tecticornia* sp. nov., *Tecticornia indica* subsp. *bidens* and *Tecticornia* sp. *burnebinmah* (D. Edinger et al. 101) mid to low samphire shrubland.

Dodonaea amplisemina is a priority 4 taxon Known from the Murchison and Yalgoo regions. *Dodonaea amplisemina* is known is occur North and Southwest of Meekatharra and approximately 65km west of the Study Area. The collected specimen was not fertile therefore the species cannot be confirmed thus it is referred to as *Dodonaea ? amplisemina* (P4). It is a dioecious, multi-stemmed shrub 0.3-1 m high, known to grow on red-brown sandy clay on basalt, gabbro, banded ironstone, dolerite or quartzite rocky hills. Within the Study Area this taxon was recorded on a low ironstone ridge in association with *Acacia fuscaneura* tall sparse shrubland over *Eremophila macmillaniana* and *Senna glutinosa* subsp. x *luerssenii* mid sparse shrubland over *Ptilotus obovatus* and *Senna artemisioides* subsp. *helmsii* low sparse shrubland on red clay loam.

Tecticornia sp. nov is a novel flora taxon, meaning that it may represent a new species that has not previously been recorded, and requires further taxonomic work. The specimen was examined by Western Australian Herbarium *Tecticornia* specialist Kelly Shepherd who described it as having affinities to *Tecticornia halocnemoides* with large seed aggregate. In the field it was described as a perennial samphire shrub to 0.4 m, recorded in fringing vegetation between the salt lake margin and the dunes. It was observed growing in association with *Tecticornia indica* subsp. *bidens* and *Tecticornia* sp. Burnebinmah (D. Edinger et al. 101) mid to low samphire shrubland on moist clay.

Eremophila sp. nov is a novel flora taxon, meaning that is may represent a new species that has not previously been recorded, and requires further taxonomic work. The specimen collected was examined by Western Australian Herbarium *Eremophila* specialist Andrew Brown who has determined that it does not match a known species and more material would be required to make a formal determination. In the field it was described as a perennial shrub to 0.4 m, recorded in a minor drainage line. It was observed growing in association with *Acacia paraneura* and *Acacia aptaneura* tall shrubland over *Eremophila glutinosa* and *Eremophila latrobei* subsp. *latrobei* mid open shrubland over *Cymbopogon ambiguus* isolated clumps of tussock grasses in red sandy clay.

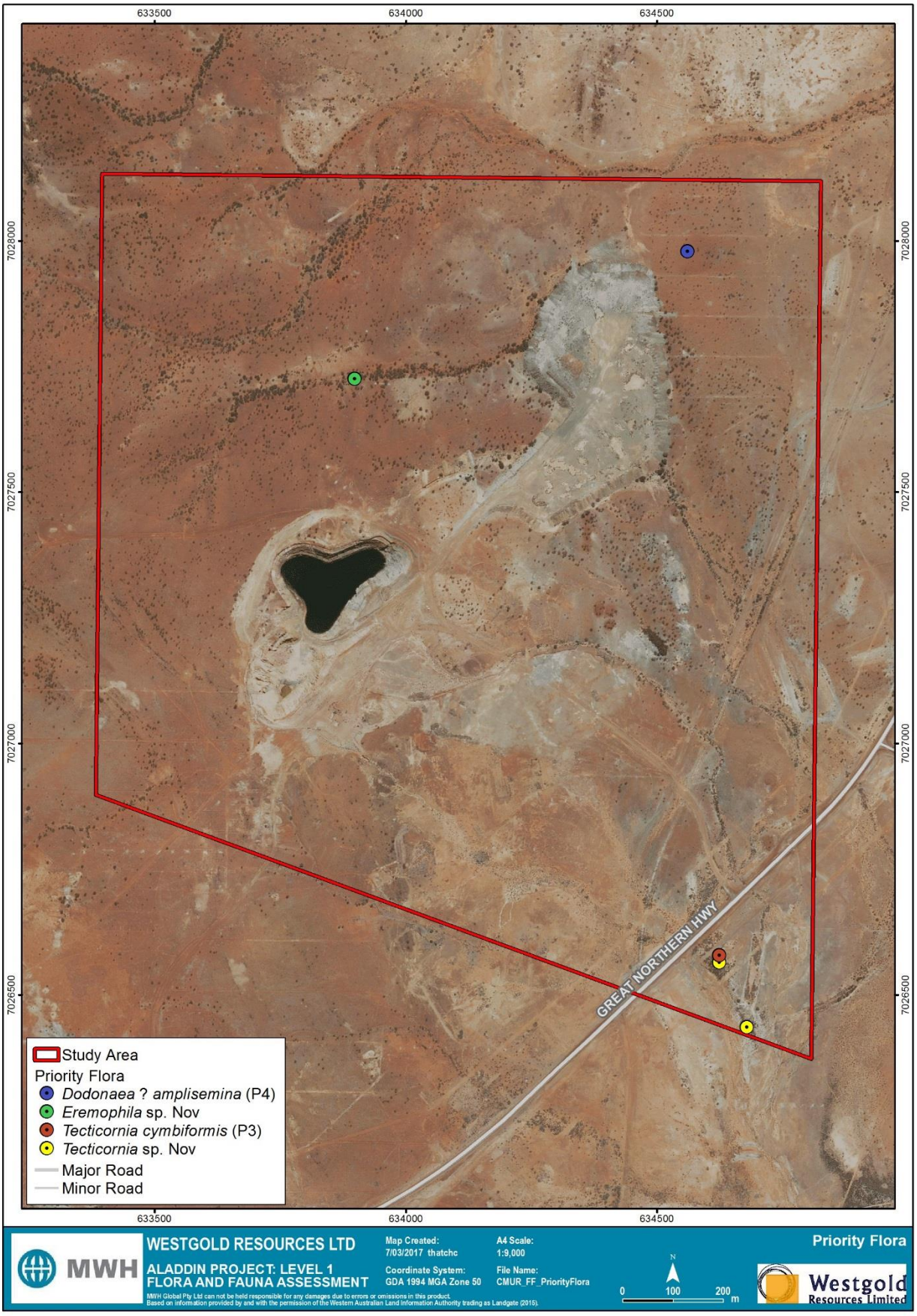

Figure 5-3: Locations of Flora of conservation significance within the Study Area

5.3 Terrestrial Fauna

5.3.1 Fauna Habitats

Five broad fauna habitats were identified and delineated from fauna habitat assessments (**Appendix G**) conducted across the Study Area (**Table 5-5; Figure 5-4**). Additionally, a portion of the Study Area was classified as 'Disturbed'. The five habitats comprised:

- Drainage Line;
- Quartz Outcrop;
- Samphire;
- Stony Plain; and
- Ironstone Hills.

These habitats differed primarily in the composition of the substrate (i.e. rock, sand or alluvial based), as well as vegetation density and structure. No instances of trees suited to providing hollows were recorded. Soil types across the vast majority of the Study Area were consistently comprised of orange sand and sandy loams. Many habitats identified during this survey are analogous with habitats of the same name identified during the Lake Annean Flora and Fauna assessment (MWH 2015b).

The habitat types in the Study Area were assessed on their extents and levels of significance according to the following criteria:

- Distribution: those habitats widespread and common within the surrounding regions were categorised as 'Widespread'; otherwise they were categorised as being of 'Limited Extent'. The Quartz Outcrop and Samphire habitats were considered to be of limited extent, with all others being widespread and common; and
- Significance: those habitats considered important to species of conservation significance or distinct fauna assemblages are deemed 'Significant'; otherwise they were categorised as being of Limited Significance'. The Samphire habitat was considered to be significant habitat, with all others of limited significance.

Table 5-5: Fauna habitats recorded within the Study Area

Habitat type	Total ha / %	Vegetation units	Disturbance and condition	Value to fauna
Drainage line • Widespread • Limited Significance	8 / 3.7	VT09	Good Feral Grazing, Feral scats, Feral trampling Cattle, Goat and Rabbit	The Drainage Line habitat intersects the Stony Plain habitat. This habitat differed from the surrounding habitats due to the high density of vegetation, generally comprised of Mulga and a mixture of smaller shrubs. The substrate which was 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. *Lerista eupoda* may also occur in the sandy margins of this habitat.
Quartz Outcrop • Limited • Limited significance	1.9 / 0.9	VT08	Good Grazing, Feral scats, Cattle, Goat and Rabbit	The Quartz Outcrop habitat consists a tall sparse *Acacia fuscsanneura* shrubland over *Eremophila glutinosa* and *Eremophila latrobei* subsp. *latrobei* mid sparse shrubland over *Senna artemisioides* subsp. helmsii and *Ptilotus obovatus*. Substrate comprised of low rocky quartz hills. This habitat was of limited extent in the Study Area, occurring in the central portion of the Study Area. The habitat is also of limited extent in the region. The habitat has varying degrees of exposed bedrock containing cracks crevices for saxicolous species. However, the limited extent of the habitat and the level of surrounding disturbance means that this habitat is unlikely to be of importance to species of conservation significance.
Samphire • Limited • significant	13.7 / 6.4	VT11	Poor Clearing, Feral scats, Feral trampling Cattle, Goat, Rabbit	The samphire habitat is restricted to the vegetated portions of the salt lake and the lake margins. This habitat is limited in then landscape as it only occurs in association with salt lakes. Vegetation consisted of a *Tecticornia* spp shrubland on a clay loam substrate. This habitat is prone to flooding and waterlogging. This habitat has limited potential to support fauna due to limited cover in the form of woody debris, hollows or crevices, however after periods of inundation, this habitat is likely to support foraging migratory wading birds and is likely to provide nesting habitat for marine bird species.
Stony Plain • Widespread • Limited Significance	77.3 / 36.2	VT02, VT03, VT04, VT06, VT10	Good to Poor Grazing, Feral scats, Feral trampling Cattle, Goat, Rabbit	The Stony Plain habitat consisted of open Acacia Woodlands or open Hakea shrubland over an open shrubland *Eremophila* Species, over a sparse tussock grassland or chenopod shrubland. This habitat was undulating within the Study Area, with a substrate of quartz and ironstone on compact soils. There was low burrowing potential within this habitat and limited woody debris, hollows or crevices suitable for providing shelter for smaller mammals or reptiles.

Habitat type	Total ha / %	Vegetation units	Disturbance and condition	Value to fauna
				This habitat has limited potential to support fauna species of conservation significance.
Ironstone Hills • Widespread • Limited significance	42.3 / 19.8	VT01, VT05, VT07	Good to Poor Changed hydrology, Clearing, Feral scats, Feral trampling Grazing Cattle, Goat	The Ironstone Hills occured across portions of the Study Area. Much of this habitat had been disturbed by historic mining. Vegetation was sparse and comprised of Mulga (*Acacia aneura*) species complex open woodland over a sparse shrubland of *Senna glutinosa*, *Eremophila* sp., and *Ptilotus obovardua*, over *Maireana* sp. and *Sclerolaena diacantha*. The surface and substrate consisted of a high proportion (>90%) of stony fragments (20-200mm) which provided low suitability for burrowing species. The degree of disturbance to this habitat combined with the limited shelter means that this habitat is unlikely to support species of conservation significance.

Figure 5-4: Fauna habitats within the Study Area

5.3.2 Fauna Assemblages

A total of 22 vertebrate fauna species were recorded during the field survey **(Table 5-6**), comprising six mammals (one native), 12 birds and four reptile species. Five introduced vertebrate fauna species were recorded during the Survey; Dog (*Canis lupus*), Cat (*Felis catus*), Rabbit (*Oryctolagus cuniculus*), Goat (*Capra hircus*) and European Cattle (*Bos taurus*). All species recorded during the Survey were identified during the desktop study as having been recorded within the vicinity of the Study Area and/or expected to occur within the region (**Appendix B**). No fauna of conservation significance were recorded during the survey.

Table 5-6: Vertebrate fauna species recorded during the survey

Species	Common name	Conservation Status	
		EPBC Act	In WA
Mammals			
Macropodidae			
Osphranter robustus	Euro	–	–
Leporidae			
Oryctolagus cuniculus	*Rabbit	–	–
Canidae			
Canis lupus	*Dog	–	–
Felidae			
Felis catus	*Cat	–	–
Bovidae			
Bos taurus	*European Cattle	–	–
Capra hircus	*Goat	–	–
Birds			
Dromaiidae			
Dromaius novaehollandiae	Emu	–	–
Accipitridae			
Aquila audax	Wedge-tailed Eagle	–	–
Columbidae			
Ocyphaps lophotes	Crested Pigeon	–	–
Psittacidae			
Platycercus zonarius	Australian Ringneck	–	–
Maluridae			
Malurus leucopterus	White-winged Fairy-wren	–	–
Meliphagidae			
Gavicalis virescens	Singing Honeyeater	–	–
Manorina flavigula	Yellow-throated Miner	–	–
Pomatostomidae			

Species	Common name	Conservation Status	
		EPBC Act	In WA
Pomatostomus superciliosus	White-browed Babbler	–	–
Artamidae			
Artamus minor	Little Woodswallow	–	–
Oreoicidae			
Oreoica gutturalis	Crested Bellbird	–	–
Rhipiduridae			
Rhipidura leucophrys	Willie Wagtail	–	–
Estrildidae			
Taeniopygia guttata	Zebra Finch	–	–
Reptiles			
Gekkonidae			
Gehyra variegata	Variegated Dtella	–	–
Heteronotia binoei	Bynoe's Gecko	–	–
Agamidae			
Ctenophorus caudicinctus	Ring-tailed Dragon	–	–
Varanidae			
Varanus gouldii	Sand Monitor	–	–

5.3.3 Fauna of Conservation Significance

Of the 229 species of vertebrate fauna identified during the desktop, 22 species are listed as being of conservation significance, comprising, one mammal, 20 birds and one reptile (**Table 5-7**). In addition, two invertebrate species of conservation significance were identified, the fairy shrimp *Branchinella simplex* and the Shield-back Trapdoor Spider. (**Table 5-7**). Of the 22 vertebrate species recorded from the desktop study:

- Four species are listed as Threatened under the EPBC Act and/or WC Act (**Table 5-7**). 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 A**);
- 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 A**);
- One species is listed as recognised by state (WC Act) to be in need of special protection; and
- Fifteen species are listed as Migratory under the EPBC Act and/or Schedule 5 under the WC Act. Many species of migratory bird are listed under the EPBC Act, the WC Act and international agreements (**Appendix A**).

Some of the species referred to above, listed as Threatened, Migratory and/or Priority fauna, may be included in multiple groups. Shield-backed Trapdoor (*Idiosoma nigrum*) has recently undergone taxonomic revision, confirming that *I. nigrum* does not occur in Murchison region. Specimens from region belong to an undescribed species *Idiosoma* 'MYG018' (T Moulds *pers. comm.*), which currently has no formal protection, as such it will no longer be discussed.

The Study Area is located partially within buffered PEC boundary of Polelle Calcrete, consisting of a unique assemblage of invertebrates that persist in the groundwater calcretes of Porlell Lake, with small portions of the PEC located within the Study Area in the east. Hydrogeological investigations would be required to confirm if the Study Area interacts with the PEC. Although the PEC was considered likely to occur based on proximity, potential impacts to subterranean fauna are not discussed further in this report as impacts to subterranean fauna are more appropriately covered under Guidance Statement T*echnical Guidance Subterranean Fauna Survey* (EPA 2016c).

The likelihood for each of the remaining species of conservation significance occurring in the Study Area was assessed and ranked (**Table 5-7**). The rankings were assigned following definitions described in the desktop study methodology (**Section 4.5**). Three vertebrate fauna species of conservation significance were considered Very Likely to occur, seven species were considered Likely to occur, five species were considered Possible to occur and the remaining seven were assessed as Unlikely. Additionally, the invertebrate fairy shrimp *Branchinella simplex* was considered Likely to occur.

Table 5-7: Fauna of conservation significance potentially occuring within the Study Area

Common name (*Scientific name*)	Conservation status		Broad habitat type	Likelihood of occurrence Reason for likelihood
	EPBC Act	In WA		
Mammals				
Long-tailed Dunnart (*Sminthopsis longicaudata*)	-	P4	Rocky, hilly areas, occasionally open areas with a stony, rocky mantle (van Dyck and Strahan 2008).	**Unlikely** One record of the species is known near Meekatharra (36km North), with the record located between Gibraltar North and Five Mile Well (from 1981). Species prefers rocky habitats exclusive to BIF ranges of the region and is unlikely to be supported by habitats present within the Study Area (DoEE 2017, DPaW 2017c).
Birds				
Curlew Sandpiper *(Calidris ferruginea)*	Cr	Vu	Commonly inhabits coastal areas namely exposed tidal mudflats, and less frequently on inland freshwater wetlands (Geering *et al.* 2007).	**Possible** Species recorded approximately 10 km southwest of Study Area in 1980 (Birdlife Australia 2017), this records represents one of the few inland DPaW (2017c) 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) occurs present within the Study Area.
Night parrot (*Pezoporus occidentalis*)	En	S1	Known to inhabit treeless or sparsely wooded long unburnt spinifex hummock plains often interspersed with chenopods (Pyke and Ehrlich 2014).	**Unlikely** Species only identified by (DoEE 2017) because 'species habitat may occur within area'. Species unknown from the Murchison region and suitable habitat not present within Study Area.
Malleefowl (*Leipoa ocellata*)	Vu	S3	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 (DPaW 2017a). The species is only thought to be scattered throughout the region (Benshemesh 2007) with the majority of records occurring further to the south (DoEE 2017). 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 (DoEE 2017). Species sparsely distributed in Murchison region and suitable habitat is not present within Study Area. Targeted searches over a large proportion of this habitat did not find any evidence of the species.

Common name (*Scientific name*)	Conservation status		Broad habitat type	Likelihood of occurrence Reason for likelihood
	EPBC Act	In WA		
Fork-tailed Swift (*Apus pacificus*)	Mi	S5	Aerial species, which forages high above the tree canopy and rarely lower (Johnstone and Storr 1998).	**Possible** Species previously recorded approximately 5 km southwest of the Study Area in 1980 and 60 km southwest of the Study Area in 2001 (Birdlife Australia 2017) (DPaW 2017a). The Study Area is located within the species distribution. The species is a migratory aerial species not common within the Murchison (Johnstone and Storr 1998). 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.
Oriental Plover (*Charadrius veredus*)	Mi	S5	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 DoEE (2017) 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 in the form of the lake Playa habitat occurs within the Study Area.
Rainbow Bee-eater (*Merops ornatus)*	Mi	S5	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 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 claypans that occur in association with the Samphire habitats or along the Drainage Line habitat.
Grey Wagtail (*Motacilla cinerea*)	Mi	S5	Grey Wagtails are listed as rare vagrants to the Australian continent from the North.	**Unlikely** Species identified by (DoEE 2017) because 'species habitat may occur within area'. Species sparsely distributed in Murchison region and suitable habitat not present within Study Area.
Yellow Wagtail (*Motacilla flava*)	Mi	S5	Yellow Wagtails are listed as rare vagrants to the Australian continent from the North.	**Unlikely** Species identified by (DoEE 2017) because 'species habitat may occur within area'. Species sparsely distributed in Murchison region and suitable habitat not present within Study Area.

Common name (*Scientific name*)	Conservation status		Broad habitat type	Likelihood of occurrence Reason for likelihood
	EPBC Act	In WA		
Sharp-tailed Sandpiper *(Calidris acuminata)*	Mi	S5	Coastal and inland areas saline and freshwater but prefers non-tidal fresh or brackish wetlands (Geering *et al.* 2007)	**Likely** This species has been recorded at approximately 10 km south of the Study Area from 1980 (Birdlife Australia 2017) (DPaW 2017c). 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 Playa habitat within the Study Area after periods of inundation.
Wood Sandpiper *(Tringa glareola)*	Mi	S5	Freshwater wetlands and occasional brackish intertidal mudflats (Geering *et al.* 2007).	**Likely** The species has previously been recorded 10 km southwest of the Study Area from 1980 (Birdlife Australia 2017) (DPaW 2017c). 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 likely to occur within the Samphire habitats in the Study Area during periods of inundation.
Pectoral Sandpiper (*Calidris melanotos*)	Mi	S5	Mainly freshwaters but also samphires and around saltlakes (Johnstone and Storr 1998).	**Unlikely** There are few inland records of the species (Birdlife Australia 2017) (DPaW 2017c). The Study Area occurs beyond its normal distribution.
Common Greenshank *(Tringa nebularia)*	Mi	S5	Intertidal mudflats, as well as fresh and saltwater wetlands of the coast or inland (Johnstone and Storr 1998).	**Likely** The species has previously been recorded 10.5 km southwest of the Study Area in 1980 and has been recorded numerous times as recently as 2013 at Lake Nallan located 50km southwest of the Study Area (Birdlife Australia 2017) (DPaW 2017c). 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 likely to occur within the Samphire habitats in the Study Area during periods of inundation.
Eastern Great Egret	Mi	S5	Shallow freshwater, riverpools, claypans, swamps, lagoons, inundated pastures and wheatfields, ephemeral pools, dams and sewage ponds (Johnstone and Storr 1998).	**Very Likely** This species has been recorded approximately 2.5 km to the east of the Study Area in 2011 and there are numerous records from Lake Austin approximately 50 km southwest of the Study Area (Birdlife Australia 2017) (DPaW 2017c). 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 very likely to occur within the Samphire habitats for foraging when these habitats are inundated with water.

Common name (*Scientific name*)	Conservation status		Broad habitat type	Likelihood of occurrence Reason for likelihood
	EPBC Act	In WA		
Gull-billed Tern (*Sterna nilotica*)	Mi	S5	Shallow sheltered seas close to land, estuaries, tidal creeks; and inundated samphire flats, flooded saltlakes, claypans and watercourses in the interior (Johnstone and Storr 1998).	**Very Likely** 200-300 individuals of this species have previously been recorded nesting in the western portion of Lake Annean (DoEE 2017). It is highly likely that this species occurs within the Study Area when the lake fills with water.
Red-necked Stint (Calidris ruficollis)	Mi	S5	Edge of sheltered salt, brackish or fresh waters, mainly estuaries and near coastal wetlands (Johnstone and Storr 1998).	**Likely** The species has previously been recorded 50 km southwest of the Study Area at Lake Nallan (Birdlife Australia 2017) (DPaW 2017a). 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 likely to occur within Samphire habitats in the Study Area during periods of inundation.
Marsh Sandpiper (Tringa stagnatilis)	Mi	S5	It inhabits freshwater or saltwater wetlands but avoids open beaches and mudflats unless well protected (Geering *et al.* 2007) (Johnstone and Storr 1998).	**Likely** The species has previously been recorded 50 km southwest of the Study Area at Lake Nallan as recently as 2013 (Birdlife Australia 2017) (DPaW 2017c). 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 likely to occur within the Samphire habitats in the Study Area during periods of inundation.
Glossy Ibis (Plegadis falcinellus)	Mi	S5	Freshwater wetlands, irrigated areas, margins of dams, floodplains, brackish and saline wetlands, tidal mudflats, pastures, lawns and public gardens (Johnstone *et al.* 2013)	**Likely** The species has previously been recorded 50 km southwest of the Study Area at Lake Nallan as recently as 2005 (Birdlife Australia 2017) (DPaW 2017c). 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 Samphire habitats in the Study Area during periods of inundation.

Common name (*Scientific name*)	Conservation status		Broad habitat type	Likelihood of occurrence Reason for likelihood
	EPBC Act	In WA		
Peregrine Falcon (*Falco peregrinus*)	-	S7	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 4 km south of the Study Area in 2000 and there are an additional six records within 50 km from 1999-2013 (Birdlife Australia 2017) (DPaW 2017c). The Species may fly-over the Study Area infrequently while dispersing or during foraging but is unlikely to breed due to a lack of habitat.
Grey Falcon (*Falco hypoleucos*)	-	S3	Mainly lightly wooded coastal and riverine plains (Johnstone and Storr 1998).	**Possible** The species was recorded 17 km southwest of the Study Area in 2003 (Birdlife Australia 2017) (DPaW 2017a). 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). . Species is not common in the Murchison region, and is more likely to occur in the central deserts of Australia. However, there has been a recent record in vicinity of the Study Area and 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.
Blue-billed Duck (*Oxyura australis*)	-	P4	A diving duck of the south-west that prefers deep freshwater swamps and lakes, but occasionally saltlakes and estuaries freshened by floodwaters (Johnstone and Storr 1998).	**Possible** Lake Annean is outside the range of the freshwater south-west species however, there has been a single record 50 km southwest of the Study Area at Lake Nallan in 2000. The vast majority of this species records occur in the southwest of WA (Birdlife Australia 2017) (DPaW 2017c). The species prefers deep waterbodies, but may occasionally visit the salt lakes surrounding the Study Area after periods of inundation. The species may possibly occur within the Samphire habitat within the Study Area after periods of inundation.
Reptiles				
Lerista eupoda	-	P1	Open Mulga areas on loamy soils (Wilson and Swan 2014).	**Very Likely** The species was recorded 170 m from the Study Area from an unknown date (DPaW 2017c). Additionally, there are 12 records within the 30km of the Study Area (DPaW 2017c). The Survey conducted by MWH (2015b) on Lake Annean which overlaps the Study Area also identified this species. Possible habitat occurs in the sandy substrate that is moderately common along margins of the Drainage Line habitat.

Common name (*Scientific name*)	Conservation status		Broad habitat type	Likelihood of occurrence Reason for likelihood
	EPBC Act	In WA		
Invertebrates				
Branchinella simplex (fairy shrimp)	-	P1	Ephemeral claypans associated with larger saltlakes (Gooderham and Tsyrlin 2002).	**Likely** This species of fairy shrimp was recorded within a claypan 3 km from the Study Area in 1978 (DPaW 2017a). The species has scattered records across WA as far east as Laverton and as far south as Corrigin (DPaW 2017a). Given that the close proximity of the record and the suitability and well connected nature of habitats associated with Lake Annean in the southern portion of the Study Area, it is likely that this species occurs within the Study Area after periods of inundation.

5.4 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). These are discussed below (**Table 5-8**), with respect to the Survey of the Study Area.

Table 5-8: Potential limitations and constraints of the filed survey

Factor	Constraint	Comments
Competency and experience of consultants	No	The field personal, Paul Bolton and Megan Stone have appropriate qualifications and several years' experience undertaking flora and fauna surveys of this nature within this region.
Scope	No	The scope was well defined. Flora, fauna and their habitats were surveyed using standardised and well-established techniques. Relevant databases and previous studies surrounding the Study Area were reviewed.
Proportion of species identified	No	The desktop and field species inventories are comparable to counts obtained during previous surveys of a similar size and scope. Of the 105 specimens collected during this survey, 3 (or 3%) specimens could not be identified with confidence, largely due to the lack of reproductive material. None of the unidentifiable species are unlikely to represent taxa of conservation significance or represent species of local significance. All vertebrate fauna encountered were identified. Although a comprehensive fauna inventory is not a vital component for this level of survey (Level 1).
Information sources (e.g. historic or recent)	No	The Study Area is located in a relatively well-surveyed region in which MWH Australia has substantial experience. Previous studies were available for review during the assessment.
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	yes	Rainfall prior to the Survey was sub-optimal. Very few flora taxa were flowering and there was a lack of annual species - suggesting the Study Area has not received sufficient rainfall or sufficient time has not passed between the rainfall and the field survey to allow germination and/or flowering. Targeted searches for flora taxa of conservation significance may have been hampered. The weather at the time of the survey was considered sub-optimal for sampling fauna. Days were relatively hot which limited the activity of species to the early morning or late afternoon. Identifying species was however not the focus of this assessment, which was to identify fauna habitats and habitats suitable for fauna of conservation significance. Mapping and interpretation of suitable fauna habitat was not hampered by the weather experienced during the survey.
Disturbances	No	The majority of the vegetation within the Study Area was considered to be 'Good' condition, with disturbance primarily due to historic mining operations.
Intensity	No	Seventeen flora sites and nine habitat assessments were completed ensuring there was at least one relevé sampled in each vegetation type. This level of on-ground survey effort is appropriate for a Level 1 flora, vegetation and fauna

Factor	Constraint	Comments
		assessment given the size of the Study Area, the region being surveyed and the level of previous disturbance.
Completeness	No	The survey was conducted at 17 relevé sites and at nine habitat assessment sites chosen to ensure adequate representative coverage of the Study Area. A large proportion of the Study Area was sampled on foot.
Resources	No	Resources were adequate to carry out the survey and the survey participants were competent in identification of species present. WAH specimens, taxonomic guides, DPaW database searches and the FloraBase database were all used to prepare for the survey and used for the confirmation of any flora species where identification was uncertain.
Remoteness / access problems	No	All survey sites were easily accessible by vehicle and on foot.
Availability of contextual information	No	The data available for the Western Murchison subregion was adequate for the level of survey work undertaken during this assessment.

5.5 Assessment against the Native Vegetation Clearing

Assessment against the ten Clearing Principles listed under Schedule 5 of the EP Act was based on a precautionary approach that assumed all habitats within the Study Area may be exposed to clearing.

Principle (a) Native vegetation should not be cleared if it comprises a high level of biological diversity

A total of 105 flora taxa (including subspecies and variants) were recorded from five vegetation units within the Study Area. The floral diversity and composition recorded from the Study Area is consistent with the Murchison bioregion, the landforms, the season of Survey, and the level of sampling intensity. Native vegetation of the Study Area comprised open *Acacia* woodlands and Samphire (*Tecticornia*) shrublands, and is considered to contain a low level of biological diversity. The Study Area occurs within Beard vegetation associations, Upper Murchison 18.2, 39.1 and 1128 which are widespread and well represented within the Murchison bioregion.

The Study Area is located partially within buffered Priority 1 PEC boundary of Polelle Calcrete, consisting of a unique assemblage of invertebrates that persist in the groundwater calcretes of Porlell Lake. Hydrogeological investigations would be required to confirm if the Study Area interacts with the PEC. Clearing of native vegetation is unlikely to directly affect the Priority 1 PEC.

The desktop study identified 49 Parks and Wildlife listed Priority flora taxa. Of these two taxa were considered very likely, nine were considered likely. One priority listed flora taxon, *Tecticornia cymbiformis* (P3) was confirmed as occurring within the Study Area. *Dodonaea ? amplisemina* (P4) possibly occurs in the Study Area, but was unable to be confirmed due to the specimen being sterile. In addition two novel (undescribed) flora taxon, *Tecticornia* sp. nov and *Eremophila* sp. nov were collected from the Study Area.

A total of 22 vertebrate fauna species were recorded from five broad fauna habitats within the Study Area. The faunal habitats and assemblage recorded from the Study Area are consistent with the Murchison bioregion, the landforms present, the season of Survey, and the level of sampling intensity. Two habitats; Samphire and Quartz Outcrop were of Limited Extent. The Samphire habitat was also considered a Significant habitat due to its association with Lake Annean, which is listed as an ESA and as an Important Wetland (DoE 2015b).

The majority of the Study Area has low biodiversity, with the exception of the Samphire habitat which has potential for a high level of diversity associated with migratory bird species within Lake Annean. The Priority and new flora taxon also account for biodiversity. The avoidance of Samphire habitat and further delineation of known populations of priority or new flora taxon would mean the proposal would not be at variance.

The proposed clearing *may* be at variance with this principle

Principle (b) ***Native vegetation should not be cleared if it comprises the whole, or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia***

Five habitat types were recorded within the Study Area. One habitat; Samphire is considered of Limited Extent in the region and a Significant habitat due to its association with Lake Annean, which is listed as an ESA and as an Important Wetland (DoE 2015b).

The desktop assessment identified three species of conservation significance Very Likely to occur (Eastern Great Egret (Mi, S5), Gull-billed Tern (Mi, S5) and Lerista eupoda (P1). The Eastern Great Egret and Gull-billed are considered an uncommon to very common visitor to flooded claypans or flooded samphire after periods of rain. These species are very likely to occur within the Samphire habitats for foraging when these habitats are inundated with water. *Lerista eupoda* has been recorded 170 m from the Study Area. Possible habitat occurs in the sandy substrate that is moderately common along margins of the Drainage Line habitat.

Seven species were considered Likely to occur (Rainbow bee-eater (Mi, S5), Glossy Ibis (Mi, S5), Sharp-tailed Sandpiper (Mi, S5), Wood Sandpiper (Mi, S5), Common Greenshank (Mi, S5), Red-necked Stint (Mi, S5) and Marsh Sandpiper (Mi, S5)). The Rainbow Bee-eater is a common migratory bird that occupies numerous habitats including open woodlands with sandy loamy soil, sandridges, sandpits, riverbanks, and is therefore not dependent on the habitats within the Study Area. The other migratory birds Likely to occur within the Study Area are often associated with coastal habitats, but may occur inland after substantial rainfall events, consequently, these species may visit the large open water bodies including parts of Lake Annean after flooding.

The clearing of native vegetation within the majority of the Study Area will not impact habitat considered important for fauna of conservation significance. The portion of Samphire habitat which may be of importance for conservation significant species, particularly migratory birds, comprises only a minor portion of the Study Area that may be subjected to clearing.

The proposed clearing *may* be at variance with this principle.

Principle (c) ***Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.***

No Threatened flora listed under the WC Act 1950, or listed under the EPBC Act 1999, have previously been recorded within a 30km buffer of the Study Area, nor were any recorded during the Survey. No species listed as Threatened flora taxa are Likely to occur within the Study Area.

The proposed clearing is *not* at variance with this principle.

Principle (d) ***Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.***

No Threatened Ecological Communities listed under the WC Act 1950, or Threatened under the EPBC Act 1999 were recorded during the survey nor are any likely to occur. No Threatened Ecological Communities, relevant to terrestrial environments, were identified as occurring within 30 km of the Study Area

The proposed clearing is *not* at variance with this principle.

Principle (e) ***Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.***

The Project may require the clearing of native vegetation consistent with Beard's vegetation association Upper Murchison 18.2, 39.1 and 1128. These associations are well represented in Western Australia (DPaW 2014), with greater than 98% of the pre-European extent remaining within both the Murchison bioregion, Western Murchison subregion and the Shire of Meekatharra (Government of Western Australia 2015). If it is assumed that the entire Study Area will be cleared or indirectly impacted, the current extent of the vegetation association will not fall below the 30% threshold where species loss increases exponentially as determined by EPA (2000).

The proposed clearing is *not* at variance with this principle.

Principle (f) ***Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.***

This principle aims to conserve vegetated watercourses and wetlands and their buffers. The wetland buffer generally commences from the outside edge of the native vegetation dependent on seasonally or intermittently waterlogged soil. Under this principle, vegetation dependent on seasonally or intermittently waterlogged soils is considered to be part of a wetland, or buffer (e.g. damplands) and would be protected. Therefore, the fringing vegetation within the Study Area, comprising vegetation types VT11 constitute wetland and would be protected under this principle. Lake Annean is an ESA and is located in the southeast corner of the Study Area.

If disturbance (including clearing and push up areas) to the associated fringing vegetation (VT11) within the Study Area were to be avoided, then clearing may not impact any native vegetation associated with the wetland, however suitable buffers would need to be incorporated.

There is also minor drainage habitat present within the Study Area comprised by vegetation types VT09 and portions of VT02. The Minor Drainage habitat did not contain vegetation communities or species that are confined to watercourses or wetlands, or are groundwater dependent. The drainage lines within the Study Area are not considered regionally prominent and are not listed within the *Directory of Important Wetlands in Australia* (DoE 2015a) or listed as an Environmentally Sensitive Area (ESA) under *the Environmental Protection Act 1986*. Drainage lines within the Study Area may be related to hydrological regimes of this area. If the natural hydrological regimes are maintained during and following vegetation clearing, then the Project would not to be at variance to this principle in regards to minor drainage lines.

The proposed clearing *may be* at variance with this principle.

Principle (g) ***Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.***

The Project is unlikely to cause appreciable land degradation. Much of the clearing associated with the Project will be located within parts of the Study Area that are already Completely Degraded or Poor in condition. The terrain of the Study Area comprises rocky hills, stony plains, drainage and salt flats. Clearing of native vegetation within the Study Area, is likely to be restricted to the stony plains and rocky hills and possibly minor drainage lines. Thus clearing is not likely to increase soil erosion and nutrient export within the landscape due to the firm soil substrate and continuous gravel to maintain structure in these areas.

The proposed clearing *is not* at variance with this principle.

Principle (h) ***Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area***

No areas managed for conservation purposes such as conservation parks, national parks, nature reserves, marine nature reserves, marine parks or marine management areas occur in the vicinity. However, the southeast corner of the Study Area is located within a nationally important wetland (WA056) and an ESA; Lake Annean. The clearing is considered unlikely to have a high impact on the ESA as it will be restricted to a small portion in the southwest corner, although avoidance of clearing vegetation within the ESA may mean that the proposal would not be at variance.

The proposed clearing *may* be at variance with this principle.

Principle (i) ***Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water***

One permanent surface water feature was observed in the Study Area which is associated with an old mining pit and is not considered natural. The small section in the southeast corner of the Study Area, does become temporarily inundated with water.

Depending on the existing water quality within the mining pit, and soil potentially present as in the soil from historical mining, clearing and associated impacts including erosion and changed water levels could result in the deterioration in the quality of surface or underground water should it enter the surrounding areas. However clearing and/or construction should not impact on drainage or surface water quality, provided sediments are controlled during construction and operation by implementing standard management procedures.

The proposed clearing *may* be at variance with this principle.

Principle (j) ***Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding***

The incidence of flooding in the Study Area is not anticipated to be exacerbated by clearing of the vegetation due to the fact that the Study Area occurs on free draining soils and is relatively flat in terrain, with only low hills and undulating plains. The implementation of standard surface water management strategies during construction and operations will mitigate any likelihood of flooding.

The proposed clearing is *not* at variance with this principle.

6 Conclusions

Vegetation condition ranged from Good to Completely Degraded, with the majority considered Good. Completely Degraded and Poor areas were associated historical mining operations, access tracks feral grazing and trampling, presence of weeds and tracks.

A total of 11 vegetation units were recorded across the Study Area broadly comprising *Acacia* woodlands and Samphire shrublands, typical of dominant vegetation types surrounding salt lakes in the region. No vegetation units are considered analogous to any TEC or PEC's, or to be of regional significance. One Priority 1 PEC Polelle Calcrete, has a boundary that over laps with the eastern portion of the Study Area, however this PEC only relates to subterranean fauna.

The floristic composition and diversity recorded from the Study Area was typical of the Western Murchison subregion. Species diversity was slightly lower than expected, however this was likely influenced by the timing of the survey, evident by the low number of ephemeral flora taxa recorded.

No Threatened flora taxa were identified by the desktop assessment, nor were any recorded during the field survey. The desktop assessment identified 11 Priority taxa as Very Likely or Likely to occur within the Study Area. One Priority listed flora taxon, *Tecticornia cymbiformis* (P3) was confirmed as occurring east of Great Northern Hwy from site AR15. One unconfirmed potential Priority 4 listed flora species *Dodonaea ? amplisemina* was collected from site AR01 in the northeast corner of the Study Area. In addition two novel (undescribed) flora taxon, *Tecticornia* sp. Nov (site AR15 and AR17) and *Eremophila* sp. Nov (site AR04) were identified within the Study Area and has been vouchered with the Western Australian Herbarium for further taxonomic work.

Five broad fauna habitat types were identified within the Study Area; Drainage line; Quartz Outcrop, Samphire, Stony Plain and Ironstone Hills. One habitat; Samphire is considered Limited Extent and Significant due to its association with Lake Annean which is an ESA and listed in the Directory of Important Wetlands.

Three fauna species of conservation significance is considered Very Likely to occur (Eastern Great Egret (Mi, S5), Gull-billed Tern (Mi, S5) and *Lerista eupoda* (P1). The Eastern Great Egret and Gull-billed Tern are considered an uncommon to very common visitor to flooded claypans or flooded samphire after periods of rain. These species are very likely to occur within the 13.7 ha of Samphire habitats for foraging when these habitats are inundated with water. A record of *Lerista eupoda* occurs 170 m from the Study Area. Possible habitat occurs in the sandy substrate that is moderately common along margins of the Drainage Line habitat.

Seven species were considered Likely to occur (Rainbow bee-eater (Mi, S5), Glossy Ibis (Mi, S5), Sharp-tailed Sandpiper (Mi, S5), Wood Sandpiper (Mi, S5), Common Greenshank (Mi, S5), Red-necked Stint (Mi, S5) and Marsh Sandpiper (Mi, S5)). The Rainbow Bee-eater is a common migratory bird that occupies numerous habitats including open woodlands with sandy loamy soil, sandridges, sandpits, riverbanks, and is therefore not dependent on the habitats within the Study Area. The other migratory birds Likely to occur

within the Study Area are more often associated with coastal habitats, but may occur inland after substantial rainfall events, consequently, these species may visit the large open water bodies including parts of Lake Annean and are associated with 13.7ha of Samphire habitat.

Assessment against the ten Clearing Principles was based on a precautionary approach that assumed all habitats within the Study Area may be exposed to clearing. Based on this assumption, the proposed Project is not at variance to principles, (c), (d), (e), (g) and (j). However, clearing may be at variance with principle (a), (b), (f), (h) and (i).

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Appendices

Appendix A Codes and Terms used to describe species of conservation significance

Flora and fauna may be accorded legislative protection by being listed under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth) (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 flora and fauna of conservation significance

Categories used under the EPBC Act		
Status	**Code**	**Description**
Critically Endangered	**Cr**	Taxa that is considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	**En**	Taxa that is considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	**Vu**	Taxa that is considered to be facing a high risk of extinction in the wild in the medium-term future
Migratory	**Mi**	Species that migrate to, over and within Australia and its external territories

Schedules used under the WC Act			
Status	**Code**	**Schedule**	**Description**
Critically Endangered	**Cr**	**S1**	Taxa that is rare or likely to become extinct, as critically endangered taxa
Endangered	**En**	**S2**	Taxa that is rare or likely to become extinct, as endangered taxa
Vulnerable	**Vu**	**S3**	Taxa that is rare or likely to become extinct, as vulnerable taxa
Presumed Extinct	**Ex**	**S4**	Taxa that is presumed to be extinct
Migratory	**Mi**	**S5**	Birds that are subject to international agreements relating to the protection of migratory birds
Conservation Dependent	**CD**	**S6**	Taxa that are of special conservation need being species dependent on ongoing conservation intervention
Special Protection	**SP**	**S7**	Taxa that is in need of special protection

Priorities assigned under the DPaW Priority Taxa List		
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, e.g. 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 taxa
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, e.g. 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 taxa
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 taxa
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 B Vertebrate Fauna Identified from the Desktop Assessment

Code	Source
a.	Aladdin project (2017)
b.	DPaW Threatened Fauna
c.	DPaW NatureMap
d.	DoE Protected Matters Search
e.	Birdlife Australia
f.	Lake Annean Flora and Fauna Assessment (2015)
g.	Gibraltar and Five Mile Well (2016)
h.	Culculli Flora and Fauna (2016)
i.	Weld Range Vertebrate Fauna Assessment (2009)

Taxon	Common name	Conservation status		a	b	c	d	e	f	g	h	i
		EPBC Act	WA Act									
Mammals												
Tachyglossidae												
Tachyglossus aculeatus	Short-beaked Echidna								x			x
Dasyuridae												
Antechinomys laniger	Kultarr					x						x
Pseudantechinus woolleyae	Woolley's Pseudantechinus											x
Sminthopsis dolichura	Little long-tailed Dunnart											x
Sminthopsis longicaudata	Long-tailed Dunnart		P4									x
Sminthopsis macroura	Stripe-faced Dunnart											x
Potoroidae												
Bettongia lesueur (Barrow Island form')	Barrow Island Burrowing Bettong	Vu	S6			x						
Macropodidae												
Osphranter robustus	Euro			x					x	x	x	
Osphranter rufus	Red Kangaroo										x	
Muridae												
Mus musculus	*House Mouse											x
Notomys alexis	Spinifex Hopping-mouse											x
Pseudomys hermannsburgensis	Sandy Inland Mouse											x
Leporidae												
Oryctolagus cuniculus	*Rabbit			x			x		x	x		x
Emballonuridae												
Taphozous hilli	Hill's Sheathtail-bat											x
Vespertilionidae												
Chalinolobus gouldii	Gould's Wattled Bat											x

Nyctophilus geoffroyi	Lesser Long-eared Bat					x						x
Scotorepens balstoni	Inland Broad-nosed Bat											x
Vespadelus finlaysoni	Finlayson's Cave Bat					x						x
Canidae												
Canis dingo	Dingo								x			x
Canis lupus	*Dog			x						x		
Vulpes vulpes	*Red Fox						x					x
Felidae												
Felis catus	*Cat			x			x			x	x	x
Camelidae												
Camelus dromedarius	*Camel						x					
Bovidae												
Bos taurus	*European Cattle			x					x	x	x	x
Capra hircus	*Goat			x			x			x		x
Birds												
Dromaiidae												
Dromaius novaehollandiae	Emu			x		x		x	x			x
Anatidae												
Anas gracilis	Grey Teal					x		x				
Anas rhynchotis	Australasian Shoveler					x		x				
Anas superciliosa	Pacific Black Duck					x		x				
Aythya australis	Hardhead					x		x				
Biziura lobata	Musk Duck					x		x				
Chenonetta jubata	Australian Wood Duck					x		x				
Cygnus atratus	Black Swan					x		x	x			
Malacorhynchus membranaceus	Pink-eared Duck					x		x				
Oxyura australis	Blue-billed Duck		P4		x							
Stictonetta naevosa	Freckled Duck					x		x				

Tadorna tadornoides	Australian Shelduck					x		x	x			
Megapodiidae												
Leipoa ocellata	Malleefowl	Vu	S3				x					
Podicipedidae												
Poliocephalus poliocephalus	Hoary-headed Grebe					x		x	x			
Tachybaptus novaehollandiae	Australasian Grebe					x		x				
Threskiornithidae												
Platalea flavipes	Yellow-billed Spoonbill					x		x				x
Plegadis falcinellus	Glossy Ibis	Mi	S5		x							
Threskiornis molucca	Australian White Ibis					x		x				
Threskiornis spinicollis	Straw-necked Ibis					x		x				
Ardeidae												
Ardea modesta	Eastern Great Egret		S5		x	x	x	x				
Ardea novaehollandiae	White-faced Heron					x		x				
Ardea pacifica	White-necked Heron					x		x				
Pelecanidae												
Pelecanus conspicillatus	Australian Pelican					x		x	x			
Phalacrocoracidae												
Phalacrocorax melanoleucos	Little Pied Cormorant					x		x				
Phalacrocorax sulcirostris	Little Black Cormorant					x		x				
Accipitridae												
Accipiter cirrocephalus	Collared Sparrowhawk					x		x				x
Accipiter fasciatus	Brown Goshawk					x		x				x
Aquila audax	Wedge-tailed Eagle			x		x		x				x
Circus approximans	Swamp Harrier					x		x				
Circus assimilis	Spotted Harrier					x		x				
Elanus axillaris	Black-shouldered Kite					x		x				
Haliastur sphenurus	Whistling Kite					x		x		x		x

Hamirostra melanosternon	Black-breasted Buzzard					x		x				x
Hieraaetus morphnoides	Little Eagle							x				
Milvus migrans	Black Kite					x		x				
Otididae												
Ardeotis australis	Australian Bustard					x		x				
Rallidae												
Fulica atra	Eurasian Coot					x		x				
Porzana fluminea	Australian Spotted Crake							x				
Tribonyx ventralis	Black-tailed Native-hen					x		x				
Turnicidae												
Turnix velox	Little Button-quail					x		x	x			x
Burhinidae												
Burhinus grallarius	Bush Stone-curlew											x
Recurvirostridae												
Cladorhynchus leucocephalus	Banded Stilt					x		x				
Himantopus himantopus	Black-winged Stilt					x		x				
Recurvirostra novaehollandiae	Red-necked Avocet					x		x				
Charadriidae												
Charadrius melanops	Black-fronted Dotterel					x		x				
Charadrius ruficapillus	Red-capped Plover					x		x	x			
Charadrius veredus	Oriental Plover	Mi	S5				x					
Erythrogonys cinctus	Red-kneed Dotterel					x		x				
Peltohyas australis	Inland Dotterel					x						
Vanellus tricolor	Banded Lapwing							x				
Scolopacidae												
Calidris acuminata	Sharp-tailed Sandpiper	Mi	S5		x							
Calidris ferruginea	Curlew Sandpiper	Cr; Mi	S3; S5		x		x					
Calidris melanotos	Pectoral Sandpiper	Mi	S5					x				

Calidris ruficollis	Red-necked Stint	Mi	S5		x							
Tringa glareola	Wood Sandpaper	Mi	S5		x			x				
Tringa nebularia	Common Greenshank	Mi	S5		x		x					
Tringa stagnatilis	Marsh Sandpiper	Mi	S5		x							
Laridae												
Larus novaehollandiae	Silver Gull					x		x				
Sterna hybrida	Whiskered Tern					x		x				
Sterna nilotica	Gull-billed Tern	Mi	S5			x		x				
Columbidae												
Columba livia	*Domestic Pigeon						x	x				
Geopelia cuneata	Diamond Dove					x		x				x
Geopelia striata	Peaceful Dove					x		x				
Ocyphaps lophotes	Crested Pigeon			x		x		x		x		x
Phaps chalcoptera	Common Bronzewing					x		x				x
Cuculidae												
Cacomantis pallidus	Pallid Cuckoo					x		x				x
Chrysococcyx basalis	Horsfield's Bronze Cuckoo							x				x
Chrysococcyx osculans	Black-eared Cuckoo							x				x
Strigidae												
Ninox boobook	Boobook Owl							x				x
Podargidae												
Podargus strigoides	Tawny Frogmouth					x						x
Caprimulgidae												
Eurostopodus argus	Spotted Nightjar					x		x			x	x
Aegothelidae												
Aegotheles cristatus	Australian Owlet-nightjar					x		x				x
Apodidae												

Apus pacificus	Fork-tailed Swift	Mi	S5				x					
Alcedinidae												
Todiramphus pyrrhopygius	Red-backed Kingfisher					x		x				
Todiramphus sanctus	Sacred Kingfisher					x		x				
Meropidae												
Merops ornatus	Rainbow Bee-eater		S5		x		x					
Falconidae												
Falco berigora	Brown Falcon					x		x		x		x
Falco cenchroides	Australian Kestrel					x		x	x	x		x
Falco hypoleucos	Grey Falcon		S3			x		x				
Falco longipennis	Australian Hobby					x		x				x
Falco peregrinus	Peregrine Falcon		S7		x	x		x				x
Cacatuidae												
Cacatua roseicapilla	Galah					x		x				x
Cacatua sanguinea	Little Corella					x		x				
Nymphicus hollandicus	Cockatiel					x		x				x
Psittacidae												
Melopsittacus undulatus	Budgerigar					x		x				x
Neophema bourkii	Bourke's Parrot					x		x				x
Neophema elegans	Elegant Parrot											x
Pezoporus occidentalis	Night Parrot	En	S1				x					
Platycercus varius	Mulga Parrot							x		x	x	x
Platycercus zonarius	Australian Ringneck			x		x		x				x
Platycercus zonarius zonarius	Port Lincoln Parrot					x						
Ptilonorhynchidae												
Ptilonorhynchus maculatus guttatus	Western Bowerbird					x		x			x	x
Maluridae												
Malurus lamberti	Variegated Fairy-wren					x		x				x

Malurus leucopterus	White-winged Fairy-wren			x		x		x	x			x
Malurus splendens	Splendid Fairy-wren					x		x		x		x
Meliphagidae												
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					x		x		x		x
Certhionyx variegatus	Pied Honeyeater					x		x				
Epthianura aurifrons	Orange Chat					x		x	x			x
Epthianura tricolor	Crimson Chat					x		x		x		x
Gavicalis virescens	Singing Honeyeater			x				x	x	x	x	x
Lacustroica whitei	Grey Honeyeater											x
Lichmera indistincta	Brown Honeyeater					x		x				
Manorina flavigula	Yellow-throated Miner			x		x		x		x	x	x
Ptilotula penicillatus	White-plumed Honeyeater							x		x		x
Purnella albifrons	White-fronted Honeyeater					x		x				
Sugomel niger	Black Honeyeater					x		x				
Pardalotidae												
Pardalotus rubricatus	Red-browed Pardalote							x				
Pardalotus striatus	Striated Pardalote					x		x				x
Acanthizidae												
Acanthiza apicalis	Inland Thornbill							x		x	x	x
Acanthiza chrysorrhoa	Yellow-rumped Thornbill					x		x				x
Acanthiza iredalei	Slender-billed Thornbill											x
Acanthiza robustirostris	Slaty-backed Thornbill							x		x	x	x
Acanthiza uropygialis	Chestnut-rumped Thornbill					x		x		x	x	x
Aphelocephala leucopsis	Southern Whiteface					x		x				x
Aphelocephala nigricincta	Banded Whiteface					x						
Gerygone fusca	Western Gerygone					x		x				x

Pyrrholaemus brunneus	Redthroat					x		x				x
Smicrornis brevirostris	Weebill											x
Pomatostomidae												
Pomatostomus superciliosus	White-browed Babbler			x		x		x		x	x	x
Pomatostomus temporalis	Grey-crowned Babbler					x		x		x		x
Psophodidae												
Cinclosoma clarum	Western Chestnut Quail-thrush					x		x			x	x
Psophodes occidentalis	Western Wedgebill							x			x	
Artamidae												
Artamus cinereus	Black-faced Woodswallow					x		x		x	x	x
Artamus cyanopterus	Dusky Woodswallow					x		x				
Artamus minor	Little Woodswallow			x				x		x		x
Artamus personatus	Masked Woodswallow					x		x				x
Cracticidae												
Cracticus nigrogularis	Pied Butcherbird					x		x		x	x	x
Cracticus tibicen	Australian Magpie					x		x		x	x	x
Cracticus torquatus	Grey Butcherbird					x		x				x
Campephagidae												
Coracina maxima	Ground Cuckoo-shrike									x		x
Coracina novaehollandiae	Black-faced Cuckoo-shrike					x		x				x
Lalage tricolor	White-winged Triller							x				x
Neosittidae												
Daphoenositta chrysoptera	Varied Sittella										x	
Oreoicidae												
Oreoica gutturalis	Crested Bellbird			x		x		x	x	x	x	x
Pachycephalidae												

Colluricincla harmonica	Grey Shrike-thrush					x		x		x		x
Pachycephala rufiventris	Rufous Whistler					x		x		x	x	x
Rhipiduridae												
Rhipidura albiscapa	Grey Fantail							x				x
Rhipidura leucophrys	Willie Wagtail			x		x		x	x	x	x	x
Monarchidae												
Grallina cyanoleuca	Magpie-lark					x		x		x		x
Corvidae												
Corvus bennetti	Little Crow					x		x		x	x	x
Corvus orru	Torresian Crow					x		x	x			x
Petroicidae												
Melanodryas cucullata	Hooded Robin							x		x	x	x
Microeca fascinans	Jacky Winter									x	x	
Petroica goodenovii	Red-capped Robin					x		x		x	x	x
Hirundinidae												
Cheramoeca leucosternus	White-backed Swallow					x		x		x		x
Hirundo neoxena	Welcome Swallow					x		x	x	x	x	x
Petrochelidon ariel	Fairy Martin							x				x
Petrochelidon nigricans	Tree Martin							x				
Locustellidae												
Megalurus cruralis	Brown Songlark					x		x				
Megalurus mathewsi	Rufous Songlark					x		x				x
Dicaeidae												
Dicaeum hirundinaceum	Mistletoebird					x		x		x		x
Estrildidae												
Taeniopygia guttata	Zebra Finch			x		x		x	x	x	x	x
Motacillidae												
Anthus australis	Australian Pipit							x	x	x	x	x

Motacilla cinerea	Grey Wagtail	Mi	S5				x					
Motacilla flava	Yellow Wagtail	Mi	S5				x					
Reptiles												
Cheluidae												
Chelodina steindachneri	Flat-shelled Turtle											x
Carphodactylidae												
Nephrurus vertebralis												x
Diplodactylidae												
Diplodactylus pulcher						x						x
Lucasium squarrosum												x
Strophurus wellingtonae												x
Gekkonidae												
Christinus marmoratus	Marbled Gecko											x
Gehyra punctata												x
Gehyra variegata				x		x			x	x	x	x
Heteronotia binoei	Bynoe's Gecko			x		x						x
Pygopodidae												
Delma australis												x
Pygopus nigriceps												x
Agamidae												
Ctenophorus caudicinctus	Ring-tailed Dragon			x		x			x			x
Ctenophorus nuchalis	Central Netted Dragon					x						x
Ctenophorus reticulatus	Western Netted Dragon					x					x	x
Ctenophorus salinarum	Salt Pan Dragon					x			x			
Ctenophorus scutulatus											x	x
Diporiphora amphiboluroides												x
Gowidon longirostris	Long-nosed Dragon											x
Moloch horridus	Thorny Devil											x

Pogona minor												x
Tympanocryptis cephalus	Coastal Pebble-mimic dragons											x
Scincidae												
Cryptoblepharus buchananii												x
Ctenotus leonhardii						x						x
Ctenotus schomburgkii												x
Ctenotus severus												x
Ctenotus uber												x
Egernia depressa	Southern Pygmy Spiny-tailed Skink								x	x		x
Eremiascincus richardsonii	Broad-banded Sand Swimmer											x
Lerista bipes						x						
Lerista eupoda			P1			x			x			x
Lerista nichollsi												x
Lerista timida						x					x	x
Menetia greyii						x			x			x
Varanidae												
Varanus caudolineatus												x
Varanus giganteus	Perentie											x
Varanus gouldii	Sand Monitor			x								
Varanus panoptes	Yellow-spotted Monitor					x				x	x	x
Varanus tristis	Racehorse Monitor											x
Typhlopidae												
Anilios hamatus												x
Pythonidae												
Antaresia perthensis	Pygmy Python											x

Elapidae												
Brachyurophis approximans												x
Furina ornata	Moon Snake											x
Parasuta monachus												x
Pseudechis butleri	Spotted Mulga Snake											x
Pseudonaja modesta	Ringed Brown Snake					x						x
Simoselaps bertholdi	Jan's Banded Snake					x						x
Suta fasciata	Rosen's Snake											x
Amphibians												
Hylidae												
Cyclorana maini	Sheep Frog					x						
Cyclorana platycephala	Western Water-holding Frog					x						
Litoria rubella	Little Red Tree Frog								x			x

Appendix C Vegetation Condition Scale

Adapted from Trudgen (1988)Trudgen (1988)

Code	Description
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix D Flora Relevés

Aladdin Level 2 – AR01

Described by: Megan Stone Date: 31/01/2017 Type: Relevé
MGA Zone: 50 634561 mE 7027979 mN

Landform: Low Ridge
Slope: Moderately inclined (5-15°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone

Coarse Surface Particles

Site Coverage: >90 %
Size: 2-600 mm
Outcropping: 2-10 %

Ground Cover

Bare Soil: 3 %
Litter: 0.1 %
Perennial Ground Cover: 5 %

Vegetation: *Acacia fuscaneura* tall sparse shrubland over *Eremophila macmillaniana* and *Senna glutinosa* subsp. x *luerssenii* mid sparse shrubland over *Ptilotus obovatus* and *Senna artemisioides* subsp. *helmsii* low sparse shrubland on low stony hills

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia fuscaneura	2	1
Dodonaea ? amplisemina	0.4	0.1
Eremophila forrestii subsp. *forrestii*	0.5	0.1
Eremophila jucunda	0.3	0.1
Eremophila macmillaniana	1.5	1
Indigofera monophylla	0.1	0.1
Maireana tomentosa	0.3	0.1
Ptilotus obovatus	0.6	1
Ptilotus rotundifolius	1.4	0.1
Sclerolaena diacantha	0.1	0.1
Senna artemisioides subsp. *helmsii*	1.2	0.1
Senna glutinosa subsp. *x luerssenii*	1.5	1
Sida sp. *dark green fruits* (S. van Leeuwen 2260)	0.2	0.1
Solanum lasiophyllum	0.1	0.1

Aladdin Level 2 – AR02

Described by: Megan Stone Date: 31/01/2017 Type: Relevé
MGA Zone: 50 634535 mE 7027765 mN

Landform: Drainage Line
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Clay loam
Soil Colour: Orange
Rock Type: Greenstone

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-200 mm
Outcropping: 2-10 %

Ground Cover

Bare Soil: 0 %
Litter: 0.1 %
Perennial Ground Cover: 20 %

Vegetation: *Acacia fuscaneura*, *Acacia effusifolia* and *Acacia fuscaneura* tall open shrubland over *Senna glutinosa* subsp. x *luerssenii* mid open shrubland over *Ptilotus obovatus* low sparse shrubland

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia effusifolia	3	5
Acacia fuscaneura	2	0.1
Acacia grasbyi	2.5	0.1
Acacia paraneura	4	5
Acacia synchronicia	0.3	0.1
Acacia tetragonophylla	3	0.1
Atriplex codonocarpa	0.3	0.1
Cymbopogon ambiguus	1.2	0.1
Enchylaena tomentosa	0.8	0.1
Eremophila longifolia	1.6	0.1
Hakea recurva	0.6	0.1
Ptilotus nobilis	0.1	0.1
Ptilotus obovatus	0.6	0.1
Ptilotus rotundifolius	0.3	0.1
Scaevola spinescens	0.6	0.1
Sclerolaena cuneata	0.1	0.1
Sclerolaena diacantha	0.1	0.1

Species Name	Height (m)	Cover (%)
Senna glutinosa subsp. *x luerssenii*	1.6	5
Solanum lasiophyllum	0.3	0.1

Aladdin Level 2 – AR03

Described by: Megan Stone Date: 31/01/2017 Type: Relevé
MGA Zone: 50 634608 mE 7027670 mN

Landform: Low ridge
Slope: Moderately inclined (5-15°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-200 mm
Outcropping: 2-10 %

Ground Cover

Bare Soil: 1 %
Litter: 0.1 %
Perennial Ground Cover: 10 %

Vegetation: *Acacia fuscaneura* tall open shrubland over *Senna glutinosa* subsp. x *luerssenii* mid sparse shrubland

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia fuscaneura	3	5
Acacia grasbyi	2	0.1
Acacia synchronicia	1.8	0.1
Acacia tetragonophylla	1.4	0.1
Codonocarpus cotinifolius	2	0.1
Eremophila jucunda	1.2	0.1
Maireana triptera	0.2	0.1
Ptilotus obovatus	0.6	0.1
Scaevola spinescens	1.4	0.1
Senna glutinosa subsp. *x luerssenii*	1.4	2

Aladdin Level 2 – AR04

Described by: Megan Stone Date: 31/01/2017 Type: Relevé
MGA Zone: 50 633898 mE 7027725 mN

Landform: Drainage Line
Slope: Level (0-3°)

Soils

Soil Texture: Sandy clay loam
Soil Colour: Red
Rock Type: Ironstone

Coarse Surface Particles

Site Coverage: 10-20 %
Size: 2-200 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 20 %
Litter: 2 %
Perennial Ground Cover: 30 %

Vegetation: *Acacia paraneura* and *Acacia aptaneura* tall shrubland over *Eremophila glutinosa* and *Eremophila latrobei* subsp. *latrobei* mid open shrubland over *Cymbopogon ambiguus* isolated clumps of tussock grasses in narrow drainage channels

Condition: Good **Fire Age:** > 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Abutilon otocarpum	0.2	0.1
Acacia aptaneura	4	15
Acacia paraneura	4	2
Acacia ramulosa var. *ramulosa*	4	0.1
Acacia tetragonophylla	3	1
Cymbopogon ambiguus	0.6	0.1
Enchylaena tomentosa	0.6	0.1
Eremophila fraseri subsp. *fraseri*	1.6	0.1
Eremophila glutinosa	1.4	5
Eremophila latrobei	0.6	0.1
Eremophila scoparia	1.6	0.1
Eremophila sp. *Nov*	0.3	0.1
Eriochiton sclerolaenoides	0.3	0.1
Euphorbia sp.	0.1	0.1
Hibiscus sturtii var. *grandiflorus*	0.4	0.1
Indigofera monophylla	0.1	0.2

Species Name	Height (m)	Cover (%)
Lepidium platypetalum	0.1	0.1
Prostanthera albiflora	0.6	0.1
Psydrax rigidula	3.5	0.1
Ptilotus obovatus	0.6	0.1
Rhagodia drummondii	0.4	0.1
Rhyncharrhena linearis	0.1	0.1
Scaevola spinescens	1.2	0.1
Senna artemisioides subsp. *helmsii*	0.5	0.1
Senna sp. *Meekatharra* (E. Bailey 1-26)	0.6	0.1
Sida sp. *dark green fruits* (S. van Leeuwen 2260)	0.6	0.1
Solanum lasiophyllum	0.6	0.1
Spartothamnella teucriiflora	1	0.1
Thyridolepis multiculmis	0.6	0.1

Aladdin Level 2 – AR05

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 634118 mE 7027923 mN

Landform: Undulating plain
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Greenstone, Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-200 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 15 %
Litter: 1 %
Perennial Ground Cover: 10 %

Vegetation: *Acacia aptaneura*, *Acacia fuscaneura* and *Acacia grasbyi* tall sparse shrubland over *Senna* sp. Meekatharra (E. Bailey 1-26) mid sparse shrubland over mixed dwarf chenopod shrubland

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia aptaneura	4	2
Acacia fuscaneura	3.5	0.1
Acacia grasbyi	3	1
Acacia synchronicia	1.2	0.1
Acacia tetragonophylla	0.8	0.1
Eremophila fraseri subsp. *fraseri*	1.3	0.1
Eremophila glutinosa	0.6	0.1
Eremophila latrobei	1.6	0.1
Eremophila macmillaniana	1.2	0.1
Hakea preissii	3	1
Maireana triptera	0.3	0.1
Ptilotus obovatus	0.6	0.1
Sclerolaena cuneata	0.1	0.1
Sclerolaena diacantha	0.1	1
Senna sp. *Meekatharra* (E. Bailey 1-26)	0.8	2
Solanum lasiophyllum	0.3	0.1

Aladdin Level 2 – AR06

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 634103 mE 7027800 mN

Landform: Plain
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-60 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 10 %
Litter: 2 %
Perennial Ground Cover: 10 %

Vegetation: *Hakea preissii* tall open shrubland over *Eremophila scoparia* mid sparse shrubland over *Atriplex codonocarpa*, *Sclerolaena diacantha* and *Sclerolaena cuneata* dwarf chenopod shrubland on stony undulating plains adjacent to drainage

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia synchronicia	0.8	0.1
Atriplex codonocarpa	0.1	0.1
Eremophila scoparia	1.2	1
Hakea preissii	3	2
Lepidium platypetalum	0.6	2
Maireana tomentosa	0.2	0.1
Maireana tomentosa	0.2	0.1
Maireana trichoptera	0.3	0.1
Ptilotus nobilis	0.1	0.1
Ptilotus obovatus	0.6	0.1
Scaevola spinescens	1.2	0.1
Sclerolaena cuneata	0.1	0.1
Sclerolaena diacantha	0.1	1
Senna sp. *Meekatharra* (E. Bailey 1-26)	0.6	0.1
Solanum lasiophyllum	0.3	0.1

Aladdin Level 2 – AR07

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 633610 mE 7027176 mN

Landform: Ridge
Slope: Moderately inclined (5-15°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-600 mm
Outcropping: 2-10 %

Ground Cover

Bare Soil: 10 %
Litter: 1 %
Perennial Ground Cover: 10 %

Vegetation: *Acacia fuscaneura* and *Acacia grasbyi* tall sparse shrubland over *Eremophila latrobei* subsp. *latrobei*, *Senna* sp. Meekatharra (E. Bailey 1-26) and *Ptilotus obovatus* mid to low shrubland over *Maireana triptera* and *Sclerolaena diacantha* dwarf chenopod shrubland on rocky ironstone hill

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia fuscaneura	3	2
Acacia grasbyi	2	2
Acacia synchronicia	2.5	0.1
Acacia tetragonophylla	0.8	0.1
Cratystylis subspinescens	0.7	0.1
Cynanchum floribundum	0.1	0.1
Eremophila flabellata	0.5	0.1
Eremophila fraseri	1.2	0.1
Eremophila latrobei	0.5	0.1
Keraudrenia velutina	0.3	0.1
Lepidium oxytrichum	0.1	0.1
Lepidium phlebopetalum	0.1	0.1
Maireana trichoptera	0.3	0.5
Ptilotus obovatus	0.6	10
Salsola australis	0.1	0.1
Sclerolaena diacantha	0.1	1

Species Name	Height (m)	Cover (%)
Senna artemisioides subsp. *helmsii*	0.2	0.1
Senna glutinosa subsp. *x luerssenii*	0.4	0.1
Senna sp. *Meekatharra* (E. Bailey 1-26)	0.8	1
Sida sp. *dark green fruits* (S. van Leeuwen 2260)	0.3	0.1
Solanum lasiophyllum	0.3	0.1
Spartothamnella teucriiflora	0.6	0.1

Aladdin Level 2 – AR08

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 633475 mE 7027449 mN

Landform: Slope
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-200 mm
Outcropping: 2-10 %

Ground Cover

Bare Soil: 20 %
Litter: 1 %
Perennial Ground Cover: 5 %

Vegetation: *Acacia fuscaneura* tall sparse shrubland over *Eremophila spathulata* mid sparse shrubland over *Ptilotus obovatus* low sparse shrubland on quartz and ironstone stony low slopes and plains

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia fuscaneura	3	1
Acacia tetragonophylla	1.6	0.1
Eremophila fraseri	1.4	0.1
Eremophila spathulata	1.2	2
Keraudrenia velutina subsp. *elliptica*	0.8	0.1
Ptilotus obovatus	0.6	1
Senna sp. *Meekatharra* (E. Bailey 1-26)	1.2	0.1
Solanum lasiophyllum	0.3	0.1

Aladdin Level 2 – AR09

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 633479 mE 7027627 mN

Landform: Plain
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-600 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 15 %
Litter: 1 %
Perennial Ground Cover: 10 %

Vegetation: *Acacia fuscaneura* and *Acacia grasbyi* tall sparse shrubland over *Eremophila fraseri* subsp. *fraseri* and *Acacia tetragonophylla* mid sparse shrubland over *Ptilotus obovatus* low sparse shrubland on undulating stony plains

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia fuscaneura	4	2
Acacia grasbyi	3	1
Acacia tetragonophylla	2	1
Eremophila fraseri	2	1
Maireana trichoptera	0.3	0.1
Ptilotus obovatus	0.6	1
Senna artemisioides subsp. *helmsii*	1.4	0.1
Solanum lasiophyllum	0.3	0.1

Aladdin Level 2 – AR10

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 634465 mE 7027402 mN

Landform: Plain
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Granite

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-60 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 2 %
Litter: 1 %
Perennial Ground Cover: 10 %

Vegetation: *Acacia aptaneura* tall open shrubland over *Eremophila scoparia* and *Senna* sp. Meekatharra (E. Bailey 1-26) mid sparse shrubland on low stony rises

Condition: Poor **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia aptaneura	4	10
Acacia grasbyi	1.8	0.1
Acacia synchronicia	0.5	0.1
Codonocarpus cotinifolius	3	0.1
Eremophila jucunda subsp. *jucunda*	0.6	0.1
Eremophila scoparia	1.6	0.1
Hakea preissii	1.8	0.1
Maireana tomentosa	0.3	0.1
Maireana trichoptera	0.3	0.1
Ptilotus obovatus	0.6	0.1
Sclerolaena cuneata	0.1	0.1
Sclerolaena diacantha	0.1	0.1
Senna artemisioides subsp. *helmsii*	0.5	0.1
Senna sp. *Meekatharra* (E. Bailey 1-26)	0.4	0.1
Solanum lasiophyllum	0.3	0.1

Aladdin Level 2 – AR11

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 634648 mE 7027360 mN

Landform: Plain
Slope: Level (0-3°)

Soils

Soil Texture: Clay loam
Soil Colour: Orange
Rock Type: Calcrete, Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 10-20 %
Size: 2-20 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 50 %
Litter: 10 %
Perennial Ground Cover: 20 %

Vegetation: *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia synchronicia* and *Acacia fuscanera* tall open shrubland over *Eremophila scoparia* and *Senna artemisioides* subsp. *helmsii* mid sparse shrubland over *Sclerolaena cuneata* and *Sclerolaena diacantha* sparse dwarf chenopod shrubland on stony undulating plains, with *Tecticornia disarticulata* (glaucous form) low sparse samphire shrubland in lower drainage areas

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia cuthbertsonii subsp. *cuthbertsonii*	2	0.1
Acacia fuscaneura	4	5
Acacia sclerosperma subsp. *sclerosperma*	3	1
Acacia synchronicia	4	10
Enchylaena tomentosa	0.5	0.1
Eremophila scoparia	1.5	1
Eriochiton sclerolaenoides	0.1	0.1
Hakea arida	1.7	0.1
Hibiscus sturtii var. *grandiflorus*	0.1	0.1
Maireana georgei	0.4	0.1
Pittosporum angustifolium	0.7	0.1
Santalum lanceolatum	2.5	0.1
Scaevola spinescens	1.2	0.1
Sclerolaena cuneata	0.1	1
Sclerolaena diacantha	0.1	1

Species Name	Height (m)	Cover (%)
Senna artemisioides subsp. *helmsii*	0.5	0.1
Solanum lasiophyllum	0.3	0.1

Aladdin Level 2 – AR12

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 634167 mE 7026782 mN

Landform: Drainage Line
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Medium clay
Soil Colour: Orange
Rock Type: Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 10-20 %
Size: 2-60 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 60 %
Litter: 2 %
Perennial Ground Cover: 30 %

Vegetation: *Atriplex bunburyana* open shrubland *Tecticornia disarticulata* (glaucous form) mid to low samphire shrubland

Condition: Poor **Fire Age:** Unknown (no evidence) **Disturbance:** Cucumis myriocarpus

Species List

Species Name	Height (m)	Cover (%)
Acacia sclerosperma subsp. *sclerosperma*	2	0.1
Acacia synchronicia	1.6	0.1
Acacia synchronicia	1.8	0.1
Atriplex bunburyana	1.4	25
Cenchrus ciliaris	0.3	0.1
Cucumis myriocarpus	0.1	0.1
Maireana georgei	0.3	0.1
Maireana tomentosa	0.2	0.1
Maireana triptera	0.3	0.1
Poaceae sp.	0.2	0.1
Pterocaulon sphacelatum	0.2	0.1
Solanum lasiophyllum	0.3	0.1
Tecticornia disarticulata (glaucous form)	0.8	2

Aladdin Level 2 – AR13

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 634103 mE 7027278 mN

Landform: Hill
Slope: Moderately inclined (5-15°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-600 mm
Outcropping: 2-10 %

Ground Cover

Bare Soil: 35 %
Litter: 2 %
Perennial Ground Cover: 15 %

Vegetation: *Acacia fuscsanneura* tall sparse shrubland over *Eremophila glutinosa* and *Eremophila latrobei* subsp. *latrobei* mid sparse shrubland over *Senna artemisioides* subsp. *helmsii* and *Ptilotus obovatus* on low rocky quartz hills

Condition: Good **Fire Age:** 5 to 15 years **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Acacia fuscaneura	3	3
Cynanchum floribundum	0.2	0.1
Eremophila exilifolia	0.6	0.1
Eremophila glutinosa	0.6	0.1
Eremophila latrobei subsp. *latrobei*	0.6	0.1
Lepidium oxytrichum	0.1	0.1
Maireana triptera	0.2	0.1
Ptilotus obovatus	0.3	0.1
Ptilotus schwartzii	0.3	0.1
Scaevola spinescens	0.8	0.1
Sclerolaena cuneata	0.1	0.1
Sclerolaena diacantha	0.1	0.1
Senna artemisioides subsp. *helmsii*	0.3	0.1
Sida ammophila	0.4	0.1
Sida sp. *dark green fruits* (S. van Leeuwen 2260)	0.3	0.1

Species Name	Height (m)	Cover (%)
Solanum lasiophyllum	0.3	0.1
Spartothamnella teucriiflora	0.5	0.1

Aladdin Level 2 – AR14

Described by: Megan Stone Date: 1/02/2017 Type: Relevé
MGA Zone: 50 634273 mE 7027235 mN

Landform: Slope
Slope: Gently inclined (3-5°)

Soils

Soil Texture: Clay loam
Soil Colour: Red
Rock Type: Ironstone, Quartzite

Coarse Surface Particles

Site Coverage: 50-90 %
Size: 2-200 mm
Outcropping: 0 %

Ground Cover

Bare Soil: 10 %
Litter: 1 %
Perennial Ground Cover: 10 %

Vegetation: *Tecticornia disarticulata* (glaucous form) mid to low open samphire shrubland on moist clay

Condition: Good **Fire Age:** Unknown (no evidence) **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Maireana tomentosa	0.3	0.1
Solanum lasiophyllum	0.3	0.1
Tecticornia disarticulata (glaucous form)	0.4	10

Aladdin Level 2 – AR15

Described by: Megan Stone Date: 2/02/2017 Type: Relevé
MGA Zone: 50 634324 mE 7026564 mN

Landform: Wetland
Slope: Level (0-3°)

Soils

Soil Texture: Light clay
Soil Colour: Brown
Rock Type: N/A

Coarse Surface Particles

Site Coverage: 0 %
Size: N/A
Outcropping: 0 %

Ground Cover

Bare Soil: 30 %
Litter: 5 %
Perennial Ground Cover: 65 %

Vegetation: *Tecticornia* sp. nov. mid sparse shrubland over *Tecticornia indica* subsp. *bidens* and *Tecticornia* sp. Burnebinmah (D. Edinger et al. 101) mid to low samphire shrubland on moist clay

Condition: Good **Fire Age:** Unknown (no evidence) **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Atriplex vesicaria	1.2	0.1
Cratystylis subspinescens	1.4	0.1
Dissocarpus paradoxus	0.2	0.1
Eragrostis falcata	0.1	1
Frankenia laxiflora	0.2	0.1
Salsola australis	0.2	0.1
Tecticornia cymbiformis		
Tecticornia disarticulata (glaucous form)		
Tecticornia indica subsp. *bidens*	0.6	50
Tecticornia sp. *Burnerbinmah* (D. Edinger et al. 101)	0.6	5
Tecticornia sp. *Nov*	1.4	10

Aladdin Level 2 – AR16

Described by: Megan Stone Date: 2/02/2017 Type: Relevé
MGA Zone: 50 634273 mE 7027235 mN

Landform: Drainage Line
Slope: Level (0-3°)

Soils

Soil Texture: Cracking clay
Soil Colour: Brown
Rock Type: N/A

Coarse Surface Particles

Site Coverage: 0 %
Size: N/A
Outcropping: 0 %

Ground Cover

Bare Soil: 40 %
Litter: 1 %
Perennial Ground Cover: 60 %

Vegetation: *Tecticornia indica* subsp. *bidens* mid to low samphire shrubland on cracking clay

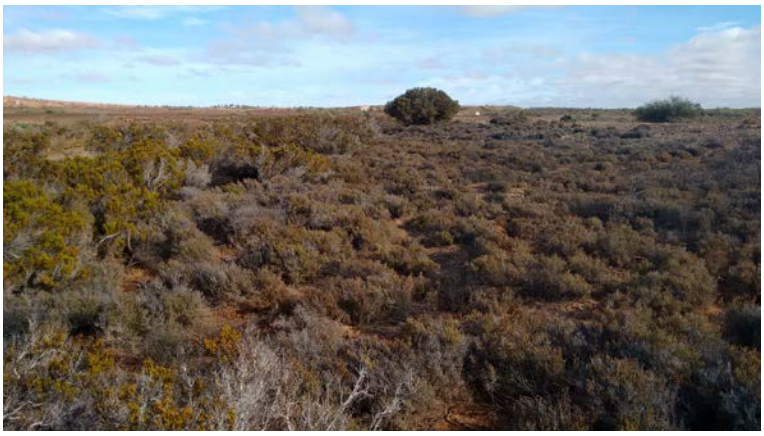
Condition: Good **Fire Age:** Unknown (no evidence) **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Atriplex vesicaria	1	0.1
Cratystylis subspinescens	1.4	0.1
Cymbopogon ambiguus	0.4	0.1
Eragrostis falcata	0.1	0.1
Lycium australe	1.4	0.1
Melaleuca xerophila	2.5	0.1
Solanum lasiophyllum	0.6	0.1
Tecticornia indica subsp. *bidens*	0.6	60

Aladdin Level 2 – AR17

Described by: Megan Stone Date: 2/02/2017 Type: Relevé
MGA Zone: 50 634679 mE 7026435 mN



Landform: Drainage Line
Slope: Level (0-3°)

Soils

Soil Texture: Medium clay
Soil Colour: Brown
Rock Type: N/A

Coarse Surface Particles

Site Coverage: 0 %
Size: N/A
Outcropping: 0 %

Ground Cover

Bare Soil: 20 %
Litter: 2 %
Perennial Ground Cover: 20 %

Vegetation: *Tecticornia* sp. Nov mid sparse shrubland over *Tecticornia undulata* low closed samphire shrubland on clay

Condition: Good **Fire Age:** Unknown (no evidence) **Disturbance:** None

Species List

Species Name	Height (m)	Cover (%)
Tecticornia sp. *Nov*	1.2	5
Tecticornia undulata	0.4	75

Aladdin Level 2 – Opcol
Described by: Megan Stone

Type: Opportunistic Observations

Species List

Species Name	Height (m)	Cover (%)
Abutilon otocarpum		
Acacia fuscaneura		
Acacia grasbyi		
Acacia pruinocarpa		
Acacia synchronicia		
Acacia tetragonophylla		
Aristida contorta		
Aristida holathera var. *holathera*		
Atriplex codonocarpa		
Cheilanthes brownii		
Cymbopogon ambiguus		
Duperreya commixta		
Eremophila fraseri subsp. *fraseri*		
Eremophila glutinosa		
Eremophila jucunda subsp. *jucunda*		
Eremophila latrobei subsp. *latrobei*		
Eremophila longifolia		
Eremophila macmillaniana		
Eremophila spathulata		
Eremophila youngii subsp. *youngii*		
Eriochiton sclerolaenoides		
Euphorbia drummondii		
Exocarpos aphyllus		
Hakea preissii		
Hibiscus sturtii var. *grandiflorus*		
Indigofera monophylla		
Lepidium oxytrichum		
Lepidium phlebopetalum		
Lepidium platypetalum		
Podotheca wilsonii		
Psydrax latifolia		
Psydrax rigidula		
Ptilotus obovatus		
Ptilotus rotundifolius		
Ptilotus schwartzii		
Rhagodia drummondii		
Salsola australis		
Santalum lanceolatum		
Scaevola spinescens		
Sclerolaena cuneata		
Sclerolaena diacantha		
Sclerolaena eriacantha		
Senna artemisioides subsp. *helmsii*		
Senna glutinosa subsp. *luerssenii*		
Senna sp. *Meekatharra* (E. Bailey 1-26)		
Sida ammophila		
Sida fibulifera		
Solanum lasiophyllum		
Stenopetalum anfractum		
Stenopetalum pedicellare		
Tecticornia aff. *undulata*		
Tecticornia indica subsp. *bidens*		
Thyridolepis multiculmis		
Waitzia acuminata var. *acuminata*		

Appendix E Inventory of Vascular Flora

Family	Taxon	Conservation Status
Amaranthaceae	*Ptilotus nobilis*	
	Ptilotus obovatus	
	Ptilotus rotundifolius	
	Ptilotus schwartzii	
Apocynaceae	*Cynanchum floribundum*	
	Rhyncharrhena linearis	
Asteraceae	*Cratystylis subspinescens*	
	Podotheca wilsonii	
	Pterocaulon sphacelatum	
	Waitzia acuminata var. *acuminata*	
Brassicaceae	*Lepidium oxytrichum*	
	Lepidium phlebopetalum	
	Lepidium platypetalum	
	Stenopetalum anfractum	
	Stenopetalum pedicellare	
Chenopodiaceae	*Atriplex bunburyana*	
	Atriplex codonocarpa	
	Atriplex vesicaria	
	Dissocarpus paradoxus	
	Enchylaena tomentosa	
	Eriochiton sclerolaenoides	
	Maireana georgei	
	Maireana tomentosa	
	Maireana trichoptera	
	Maireana triptera	
	Rhagodia drummondii	
	Salsola australis	
	Sclerolaena cuneata	
	Sclerolaena diacantha	
	Sclerolaena eriacantha	
	Tecticornia aff. *undulata*	
	Tecticornia cymbiformis	P3
	Tecticornia disarticulata (glaucous form)	
	Tecticornia indica subsp. *bidens*	
	Tecticornia sp. Burnerbinmah (D. Edinger et al. 101)	
	Tecticornia sp. Nov	
	Tecticornia undulata	
Convolvulaceae	*Duperreya commixta*	
Cucurbitaceae	**Cucumis myriocarpus*	
Euphorbiaceae	*Euphorbia drummondii*	
	Euphorbia sp.	

Family	Taxon	Conservation Status
Fabaceae	*Acacia aptaneura*	
	Acacia cuthbertsonii subsp. *cuthbertsonii*	
	Acacia effusifolia	
	Acacia fuscaneura	
	Acacia grasbyi	
	Acacia paraneura	
	Acacia pruinocarpa	
	Acacia ramulosa var. *ramulosa*	
	Acacia sclerosperma subsp. *sclerosperma*	
	Acacia synchronicia	
	Acacia tetragonophylla	
	Indigofera monophylla	
	Senna artemisioides subsp. *helmsii*	
	Senna glutinosa subsp. *luerssenii*	
	Senna glutinosa subsp. x *luerssenii*	
	Senna sp. Meekatharra (E. Bailey 1-26)	
Frankeniaceae	*Frankenia laxiflora*	
Goodeniaceae	*Scaevola spinescens*	
Gyrostemonaceae	*Codonocarpus cotinifolius*	
Lamiaceae	*Prostanthera albiflora*	
	Spartothamnella teucriiflora	
Malvaceae	*Abutilon otocarpum*	
	Hibiscus sturtii var. *grandiflorus*	
	Keraudrenia velutina	
	Keraudrenia velutina subsp. *elliptica*	
	Sida ammophila	
	Sida fibulifera	
	Sida sp. dark green fruits (S. van Leeuwen 2260)	
Myrtaceae	*Melaleuca xerophila*	
Pittosporaceae	*Pittosporum angustifolium*	
Poaceae	*Aristida contorta*	
	Aristida holathera var. *holathera*	
	**Cenchrus ciliaris*	
	Cymbopogon ambiguus	
	Eragrostis falcata	
	Poaceae sp.	
	Thyridolepis multiculmis	
Proteaceae	*Hakea arida*	
	Hakea preissii	
	Hakea recurva	
Pteridaceae	*Cheilanthes brownii*	

Family	Taxon	Conservation Status
Rubiaceae	*Psydrax latifolia*	
	Psydrax rigidula	
Santalaceae	*Exocarpos aphyllus*	
	Santalum lanceolatum	
Sapindaceae	*Dodonaea ? Amplisemina*	P4
Scrophulariaceae	*Eremophila exilifolia*	
	Eremophila flabellata	
	Eremophila forrestii subsp. *forrestii*	
	Eremophila fraseri	
	Eremophila fraseri subsp. *fraseri*	
	Eremophila glutinosa	
	Eremophila jucunda	
	Eremophila jucunda subsp. *jucunda*	
	Eremophila latrobei	
	Eremophila latrobei subsp. *latrobei*	
	Eremophila longifolia	
	Eremophila macmillaniana	
	Eremophila scoparia	
	Eremophila sp. Nov	
	Eremophila spathulata	
	Eremophila youngii subsp. *youngii*	
Solanaceae	*Lycium australe*	
	Solanum lasiophyllum	

Appendix F Threatened and Priority Flora Likelihood

Species	Conservation Code			Habit and Habitat*	Flowering Period	Nearest Locality (km)	Likelihood of occurrence and reason
	EPBC Act	WC Act	DPaW				
Acacia dilloniorum	–	–	P1	Red clay-loam over exposed dolerite outcropping. Gully. Dry fluviatile gravel. Granite boulder.	–	70 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Angianthus uniflorus	–	–	P1	Erect or ascending annual, herb, to 0.07 m high. Margin of calcrete rise near gypseous salt lake.	–	~90 S	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Beyeria lapidicola	–	–	P1	–		55 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Dampiera plumosa	–	–	P1	Erect perennial, herb, 0.15-0.2 m high. Red sandy soils	Oct	~130 SE	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area.
Dicrastylis sp. Cue (A.A. Mitchell 764)	–	–	P1	Shrub, 1-3 m high. Drainage area, near granite.	Sep to Oct.	~80 S	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Eremophila retropila	–	–	P1	Spreading shrub, 0.7-1.7 m high, to 4.2 m wide. Gravelly loam. Stony flats	Aug to Sep.	20 N	**Likely** The Study Area lies within the known distribution of the species, and contains suitable habitat
Eremophila rhegos	–	–	P1	Erect shrub, ca 1 m high. Skeletal stony loam over granite	Sep.	72 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area

Species	Conservation Code			Habit and Habitat*	Flowering Period	Nearest Locality (km)	Likelihood of occurrence and reason
	EPBC Act	WC Act	DPaW				
Eremophila sp. Meekatharra (D.J. Edinger 4430)	–	–	P1	–	–	~120 N	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area.
Lepidium xylodes	–	–	P1	Erect shrub, 0.4-1.5 m high, stems becoming spinescent Gravelly loam, clayey sand.	Aug or Nov.	70 NW	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area.
Millotia depauperata	–	–	P1	Slender annual, herb, to 0.2 m high. Sandy loam. Granite outcrops.	Aug to Sep.	95 SW	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area and does not contain suitable habitat.
Pityrodia canaliculata	–	–	P1	Many stemmed shrub, (0.6-)1-2.5 m high. Red sand.	Jun to Sep.	~100 SE	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Rhodanthe sphaerocephala	–	–	P1	Erect annual, herb, to 0.25 m high, with ascending branches. Clayey loam. On flats.	Oct.	55 NW	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Stenanthemum patens	–	–	P1	Shrub, ca 0.5 m high. Rocky hillside.		65 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area and does not contain suitable habitat.
Eremophila retropila	–	–	P1	Spreading shrub, 0.7-1.7 m high, to 4.2 m wide. Gravelly loam. Stony flats.	Aug to Sep.	23 N	**Unlikely** The Study Area does not contain suitable habitat.

Species	Conservation Code			Habit and Habitat*	Flowering Period	Nearest Locality (km)	Likelihood of occurrence and reason
	EPBC Act	WC Act	DPaW				
Bergia auriculata	–	–	P2	Prostrate perennial, herb. Clay soils. Mud flats.	–	60 SW	**Possible** The Study Area may contain suitable habitat and is in known distribution of this taxon
Baeckea sp. London Bridge (M.E. Trudgen 5393)	–	–	P3	Rounded shrub, 0.3-0.5 m high. Gravel, sandstone. Rocky breakaways & hills.	Oct to Nov.	~130 SE	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area and does not contain suitable habitat.
Baeckea sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	–	–	P3	Upright shrub, ca 1 m high. Orange sand. Flats.	Oct.	~140 E	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Bossiaea eremaea	–	–	P3	Divaricately-bramnched, spreading shrub, to 1.2 m high. Deep red sand.	Jul to Sep.	~140 E	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Calytrix verruculosa	–	–	P3	Shrub, 0.4-0.75 m high. Sandy clay.	Aug or Oct.	17 N	**Likely** The Study Area lies within the known distribution of the species, and contains suitable habitat
Eremophila arachnoides subsp. *arachnoides*	–	–	P3	Broom-like shrub, to 3 m high, branches with circular, discrete tubercles. Shallow loam over limestone.	Sep.	67 SE	**Possible** The Study Area may contain suitable habitat and is in known distribution of this taxon
Eremophila fasciata	–	–	P3	Erect shrub, 0.6-0.9 m high.	Aug.	35 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Euryomyrtus recurva	–	–	P3	Shrub, 0.3-1 m high. Yellow/red sand, brown/yellow sandy clay. Gravel pits, catchment slopes.	Jul to Sep.	~110 S	**Unlikely** The Study Area is outside the distribution of this taxon and there

Species	Conservation Code			Habit and Habitat*	Flowering Period	Nearest Locality (km)	Likelihood of occurrence and reason
	EPBC Act	WC Act	DPaW				
							are no records within 30 km of the Study Area
Hibiscus krichauffianus	–	–	P3	Low or ascending shrub, (0.03-)0.2-0.7 m high. Red sandy soils.	Mar or Oct.	80 SW	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Homalocalyx echinulatus	–	–	P3	Shrub, 0.45-1 m high. Laterite. Breakaways, sandstone hills.	Jun to Sep.	30 NE	**Possible** The Study Area may contain suitable habitat and is in known distribution of this taxon
Indigofera gilesii	–	–	P3	Shrub, to 1.5 m high. Pebbly loam. Amongst boulders & outcrops, hills.	May or Aug.	~110 NE	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area and does not contain suitable habitat.
Labichea eremaea	–	–	P3	Compact, rigid shrub, 0.3-0.8 m high, 0.3-1 m wide. Red sand.	Aug to Sep.	~120 SE	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Maireana prosthecochaeta	–	–	P3	Open, densely-leaved shrub, 0.3-0.6 m high. Laterite. Hills, salty places.	–	~75 S	**Possible** The Study Area may contain suitable habitat and is in known distribution of this taxon
Menkea draboides	–	–	P3	Prostrate, spreading annual, herb, to 0.6 m wide. Red sand or clay, granite.	Aug to Sep	~75 N	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Micromyrtus placoides	–	–	P3	Shrub, 0.5-2.3 m high, sometimes widely spreading with several stems or branches from the base. Red-orange sandy clay, orange-yellow sandy clay to clayey loam, coarse gravel, banded ironstone, laterite,	–	53 W	**Possible** The Study Area may contain suitable habitat and is in known distribution of this taxon

Species	Conservation Code			Habit and Habitat*	Flowering Period	Nearest Locality (km)	Likelihood of occurrence and reason
	EPBC Act	WC Act	DPaW				
				quartz, basalt. Gently undulating plains, dry creek beds, hillcrests, ridges.			
Mirbelia stipitata	–	–	P3	Spiny shrub, ca 0.6 m high. Red sandy loam.	Aug.	~150 E	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Petrophile pauciflora	–	–	P3	Shrub, ca 1 m high. Decaying & dissected granite breakaways.	Sep.	44 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area and does not contain suitable habitat.
Prostanthera petrophila	–	–	P3	Spreading shrub, 0.6-1.5 m high. Lateritic soils.	Aug.	52 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area and does not contain suitable habitat.
Ptilotus crosslandii	–	–	P3	Prostrate herb. Sandy soils. Colluvial plains.	Sep to Oct.	~185 W	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area.
Acacia sclerosperma subsp. *Glaucescens*	–	–	P3	Spreading shrub, 1-3 m high, branchlets puberulous, sometimes glabrous. Sand, sandy loam, stony soils.	Jul to Aug.	2 SW	**Very Likely** Known records are immediately adjacent to the Study Area, and suitable habitat may be present within the Study Area.
Calytrix verruculosa	–	–	P3	Shrub, 0.4-0.75 m high. Sandy clay.	Aug or Oct.	19 N	**Likely** The Study Area lies within the known distribution of the species, and may contain suitable habitat
Hemigenia virescens	–	–	P3	Brown very rocky sand. Hillside. Rangeland. Brown ironstone gravel. Yellow-red sandy clay. Shallow loam.	–	17 W	**Likely**

Species	Conservation Code			Habit and Habitat*	Flowering Period	Nearest Locality (km)	Likelihood of occurrence and reason
	EPBC Act	WC Act	DPaW				
							The Study Area lies within the known distribution of the species, and may contain suitable habitat
Ptilotus lazaridis	–	–	P3	Herb or shrub, to 0.6 m high. Clay loam. Floodplains.	Jul or Oct.	7 E	**Likely** The Study Area lies within the known distribution of the species, and may contain suitable habitat
Ptilotus luteolus	–	–	P3	Compact, perennial shrub	Mar to May or Jul to Oct	19 N	**Likely** The Study Area lies within the known distribution of the species, and may contain suitable habitat
Tecticornia cymbiformis	–	–	P3	Erect, perennial shrub, 0.3-0.5 m high. Saline soils. Along the edge of creeklines.	–	5 SW	**Very Likely** Known records are immediately adjacent to the Study Area, and the Study area may contain suitable habitat
Drummondita miniata	–	–	P3	Divaricately branched shrub, 0.5-2 m high. Laterite. Breakaways.	Jul to Aug or Nov.	32 N	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area and does not contain suitable habitat.
Hibiscus krichauffianus	–	–	P3	Low or ascending shrub, (0.03-)0.2-0.7 m high. Red sandy soils.	Mar or Oct.	62 NW	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Sida picklesiana	–	–	P3	Herb or shrub	Apr, Aug or Nov	42 S	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Tribulus adelacanthus	–	–	P3	Prostrate herb, plants villous; leaflet pairs 3-6; fruits 5-winged, lacking spines, 10-14 mm high.	–	~140 S	**Unlikely** The Study Area is outside the distribution of this taxon and there

Species	Conservation Code			Habit and Habitat*	Flowering Period	Nearest Locality (km)	Likelihood of occurrence and reason
	EPBC Act	WC Act	DPaW				
							are no records within 30 km of the Study Area
Ptilotus beardii	–	–	P3	Compact, perennial shrub, 0.15-0.5 m high. Clayey soils. Saline flats, low breakaways.	Aug to Oct.	63 SW	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Eremophila pungens	–	–	P4	Erect, viscid shrub, 0.5-1.5 m high. Sandy loam, clayey sand over laterite. Plains, ridges, breakaways.	Jun to Aug.	~115 E	**Unlikely** The Study Area is outside the distribution of this taxon and there are no records within 30 km of the Study Area
Goodenia berringbinensis	–	–	P4	Ascending annual, herb, 0.1-0.3 m high. Red sandy loam. Along watercourses.	Oct.	32 S	**Likely** The Study Area lies within the known distribution of the species, and may contain suitable habitat
Acacia speckii	–	–	P4	Bushy, rounded shrub or tree, 1.5-3 m high. Rocky soils over granite, basalt or dolerite. Rocky hills or rises.	–	10 N	**Likely** The Study Area lies within the known distribution of the species, and may contain suitable habitat
Grevillea inconspicua	–	–	P4	Intricately branched, spreading shrub, 0.6-2 m high. Loam, gravel. Along drainage lines on rocky outcrops, creeklines.	Jun to Aug.	23 NE	**Likely** The Study Area lies within the known distribution of the species, and may contain suitable habitat

* Information has been obtained from FloraBase (WAH 2017)

Appendix G Terrestrial Fauna Habitat Assessments

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL01	Ironstone Hills	Hill	South	Moderately inclined (5-15)	634598	7027764

Condition	**Condition**	Good
	Disturbance Type	Clearing, Feral grazing, Logging, Tracks
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	85
	Soil	11
	Leaf Litter	2
	Vegetation	2
Rocks	**Type**	Basalt
	Size (mm)	6–20,20–60,60–200
	Abundance (%)	>90
	Exposed Bedrock (%)	10–20
Soil	**Type**	Sandy loam
	Colour	Red
Habitat Features	**Water**	No - Never
	Termite Presence	Rare
	Woody Debris	Rare
	Peeling Bark	Rare
	Rock Crevices	Moderate
	Burrowing Suitability	Low
	Tree Hollows (<10 cm)	Rare
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	6	< 10	Mulga
Middle	Shrub	1	< 10	Senna, Eremophila
Lower	Shrub	0.3	< 1	Ptilotus

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL02	Drainage Line	Drainage Line	East	Gently inclined (3-5)	633811	7027716

Condition	**Condition**	Very Good
	Disturbance Type	Feral grazing, Logging
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	40
	Soil	53
	Leaf Litter	5
	Vegetation	2
Rocks	**Type**	Ironstone, Quartzite
	Size (mm)	2–6,6–20,20–60,60–200
	Abundance (%)	20–50
	Exposed Bedrock (%)	0
Soil	**Type**	Sandy loam
	Colour	Brown
Habitat Features	**Water**	No - Prone to Flooding
	Termite Presence	None
	Woody Debris	Moderate
	Peeling Bark	Moderate
	Rock Crevices	None
	Burrowing Suitability	Moderate
	Tree Hollows (<10 cm)	Rare
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	6	30–70	Mulga
Middle	Shrub	1.5	< 10	Eremophila, Senna
Lower	Shrub	0.3	< 10	Ptilotus

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL03	Ironstone Hills	Hill	East	Moderately inclined (5-15)	633612	7027193

Condition	**Condition**	Very Good
	Disturbance Type	Logging, Tracks
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	70
	Soil	26
	Leaf Litter	2
	Vegetation	2
Rocks	**Type**	Ironstone
	Size (mm)	6–20,20–60,60–200,200–600
	Abundance (%)	50–90
	Exposed Bedrock (%)	10–20
Soil	**Type**	Sandy loam
	Colour	Brown
Habitat Features	**Water**	No - Never
	Termite Presence	None
	Woody Debris	Rare
	Peeling Bark	Rare
	Rock Crevices	Rare
	Burrowing Suitability	Low
	Tree Hollows (<10 cm)	Rare
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	5	< 10	Mulga
Middle	Shrub	2.5	< 10	Acacia grasbyi
Lower	Shrub, Hummock grass	0.3	0–5 (isolated clumps)	Ptilotus

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL04	Samphire	Drainage Line	South	Gently inclined (3-5)	634161	7026779

Condition	**Condition**	Degraded
	Disturbance Type	Changed hydrology, Clearing, Tracks
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	0
	Soil	70
	Leaf Litter	5
	Vegetation	25
Rocks	**Type**	Ironstone
	Size (mm)	20–60,60–200
	Abundance (%)	10–20
	Exposed Bedrock (%)	0
Soil	**Type**	Silty loam
	Colour	Brown
Habitat Features	**Water**	No - Prone to Flooding
	Termite Presence	None
	Woody Debris	Rare
	Peeling Bark	None
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10 cm)	None
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	2	< 1	Acacia
Middle	Shrub	1	10–30	Atriplex
Lower	Shrub	0.2	< 1	Atriplex, mariana

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL05	Quartz Outcrop	Outcrop	East	Moderately inclined (5-15)	634077	7027332

Condition	**Condition**	Very Good
	Disturbance Type	Clearing
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	60
	Soil	33
	Leaf Litter	2
	Vegetation	5
Rocks	**Type**	Quartzite
	Size (mm)	20–60,60–200,200–600,600–2000
	Abundance (%)	>90
	Exposed Bedrock (%)	10–20
Soil	**Type**	Sandy loam
	Colour	Brown
Habitat Features	**Water**	No - Never
	Termite Presence	None
	Woody Debris	Rare
	Peeling Bark	Rare
	Rock Crevices	Common
	Burrowing Suitability	Low
	Tree Hollows (<10 cm)	Rare
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	4	< 10	Mulga
Middle	Shrub	1	< 10	Acacia grasbyi
Lower	Shrub	0.5	< 10	Eremophila glutinosa, Ptilotus

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL06	Minor Drainage Line	Drainage Line	East	Gently inclined (3-5)	634696	7026455

Condition	**Condition**	Good
	Disturbance Type	Changed hydrology, Clearing, Feral trampling
	Fire Age	> 15 years
% Ground Cover	**Rock**	0
	Soil	98
	Leaf Litter	2
	Vegetation	0
Rocks	**Type**	N/A
	Size (mm)	N/A
	Abundance (%)	0
	Exposed Bedrock (%)	0
Soil	**Type**	Sand
	Colour	Brown
Habitat Features	**Water**	No - Prone to Ponding
	Termite Presence	None
	Woody Debris	Moderate
	Peeling Bark	None
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10 cm)	None
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	3	< 1	Melaleuca
Middle	Shrub	1.5	10–30	Tecticornia
Lower	Shrub	0.2	< 10	Tecticornia

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL07	Stony Plain	Plain	North	Gently inclined (3-5)	633734	7027952

Condition	**Condition**	Very Good
	Disturbance Type	Logging, Tracks
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	65
	Soil	33
	Leaf Litter	1
	Vegetation	2
Rocks	**Type**	Ironstone, Quartzite
	Size (mm)	6–20,20–60,60–200
	Abundance (%)	50–90
	Exposed Bedrock (%)	0
Soil	**Type**	Sandy loam
	Colour	Red
Habitat Features	**Water**	No - Never
	Termite Presence	None
	Woody Debris	Rare
	Peeling Bark	Rare
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10 cm)	Rare
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	6	< 10	Mulga
Middle	Shrub	2.5	< 10	Acacia grasbyi, Eremophila
Lower	Shrub	0.5	< 10	Senna sp meekatharra, solanum

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL08	Stony Plain	Plain	East	Gently inclined (3-5)	634069	7027708

Condition	**Condition**	Good
	Disturbance Type	Clearing, Feral grazing, Logging, Tracks
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	90
	Soil	8
	Leaf Litter	1
	Vegetation	1
Rocks	**Type**	Ironstone
	Size (mm)	20–60,60–200
	Abundance (%)	>90
	Exposed Bedrock (%)	0
Soil	**Type**	Silty loam
	Colour	Brown
Habitat Features	**Water**	No - Never
	Termite Presence	None
	Woody Debris	Rare
	Peeling Bark	Rare
	Rock Crevices	None
	Burrowing Suitability	Low
	Tree Hollows (<10 cm)	Rare
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	5	< 10	Mulga
Middle	Shrub	2.5	< 10	Hakea, Eremophila, Acacia grasbyi
Lower	Shrub	1	< 1	Acacia Victoria, Eremophila glomerata

Name	Habitat Type	Landform	Aspect	Slope (degrees)	Easting	Northing
AL09	Stony Plain	Plain	East	Level (0-3)	634736	7028004

Condition	**Condition**	Degraded
	Disturbance Type	Clearing, Logging
	Fire Age	Unknown (no evidence)
% Ground Cover	**Rock**	5
	Soil	78
	Leaf Litter	2
	Vegetation	5
Rocks	**Type**	Ironstone
	Size (mm)	6–20,20–60
	Abundance (%)	10–20
	Exposed Bedrock (%)	0
Soil	**Type**	Sandy loam
	Colour	Brown
Habitat Features	**Water**	No - Never
	Termite Presence	None
	Woody Debris	Rare
	Peeling Bark	Rare
	Rock Crevices	None
	Burrowing Suitability	Moderate
	Tree Hollows (<10 cm)	Rare
	Tree Hollows (>10 cm)	None

Vegetation

Stratum	Form/s	Height (m)	Cover (%)	Species
Upper	Tree	3	< 1	Hakea
Middle	Shrub	0.5	< 1	Eremophila
Lower	Shrub	0.2	< 1	Senna

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