

# **APPENDIX ONE**

## **FLORA AND FAUNA SURVEY**

**Intermin Resources**

Report for Teal Gold Project

Biological Survey

October 2010



# Contents

1.	Introduction	1
1.1	Background	1
1.2	Study Area	1
1.3	Scope of Works	1
2.	Desktop Assessment	4
2.1	Previous Studies	4
2.2	Climate	4
2.3	Regional Geology	5
2.4	Topography and Soils	5
2.5	Hydrology	5
2.6	Regional Groundwater	6
2.7	Phytogeography	6
2.8	Reserves and Conservation Areas	7
2.9	Environmentally Sensitive Areas	7
2.10	Pathogens	7
2.11	Vegetation	7
2.12	Flora	9
2.13	Fauna	12
3.	Field Assessment	16
3.1	Field Survey Methods	16
3.2	Vegetation and Flora Results	18
3.3	Vertebrate Fauna Results	25
4.	Assessment of Flora and fauna Impacts	31
4.1	Potential Flora and Fauna Impacts	31
4.2	Management of Issues	31
4.3	Assessment against Clearing Principles	33
5.	Vegetation Monitoring	37
5.1	Site A	37
5.2	Site B	38
5.3	Site C	39
6.	Report Limitations	41



## 7. References 42

### Table Index

Table 1	Climate Data for Kalgoorlie (source: BoM 2010)	5
Table 2	Vegetation Extent and Status in the Coolgardie IBRA Region	8
Table 3	Conservation Categories and Definitions for <i>EPBC Act</i> Listed Flora and Fauna Species	10
Table 4	Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species	11
Table 5	Significant Flora Present within 15 km of the Study Area	12
Table 6	Significant, Rare and Priority Fauna Species Recorded Previously within the Vicinity of the Project Area (20km Search Radius)	14
Table 7	Vegetation Type Description	18
Table 8	Vegetation Condition Rating Scale (after Keighery, 1994)	21
Table 9	Weed Species Recorded within the Study Area	24
Table 10	Department of Agriculture and Food Declared Plant Control Code Category	25
Table 11	Assessment against the 10 Clearing Principles	34
Table 12	Site A Quadrat Data	37
Table 13	Site B Quadrat Data	38
Table 14	Site C Quadrat Data	40
Table 15	Flora Species Recorded during Field Survey of the Study Area – September 2010	47
Table 16	Fauna Species Recorded within the Study Area – September 2010	57

### Appendices

- A Figures
- B Flora
- C Fauna



# 1. Introduction

## 1.1 Background

Intermin Resources is proposing to undertake small scale mine development activities at its Teal Gold Project tenements, located approximately 10 km northwest of Kalgoorlie, Western Australia. The proposed operation will involve mining a single pit using conventional open cut mining methods. The pit will be developed to a depth 60-65 metres with a total estimated material movement of approximately 2 million cubic metres over a 10-month period. Ore mined will be transported to an existing mill within the region for processing.

If required, dewater from the pit will be discharged via a pipeline into a salt lake located approximately 3.8 km to the west of the pit area.

Intermin Resources has commissioned GHD Pty Ltd (GHD) to undertake a baseline flora and fauna assessment of the project area to provide necessary information to support associated clearing permit and mining proposal submissions.

Monitoring quadrats were also established within the vicinity of the proposed discharge site to assist in assessing any impacts to riparian vegetation associated with potential dewatering activities.

## 1.2 Study Area

The Teal Gold Project area is situated approximately 10 km northwest of Kalgoorlie, Western Australia. The study site encompasses both the operational area (including the proposed pit and waste dump) and the proposed dewatering pipeline corridor. The operational area lies within Mining Leases M26/621, M26/499, M26/346 and M26/549 and covers approximately 110 ha. The southern and northern portions of the operational area are intersected by existing tracks (firebreaks) and service corridors. The proposed pipeline corridor straddles an existing track running east-west. The corridor is approximately 3.8 km in length and 40m wide and terminates at the edge of a nearby salt lake, located to the west of the operational area.

Apart from obvious tracks (firebreaks) and service corridors, the site has also been subjected to disturbance from exploration activities (past and current), historical woodline operations and past grazing practices.

## 1.3 Scope of Works

This flora and fauna assessment involved both desktop and field assessments. The desktop assessment included:

- ▶ A review of existing biological survey information for the area and relevant



information on the existing physical environment;

- ▶ A review of aerial photography to assist in the delineation of vegetation types present in the study area;
- ▶ A review of the local and regional significance of plant communities;
- ▶ A search of the Department of Environment and Conservation's (DEC) Rare and Priority Flora databases;
- ▶ A search of the DEC's Environmentally Sensitive Areas database;
- ▶ A search of the Western Australian Museum (WAM)/DEC Naturemap database for threatened and endangered fauna; and
- ▶ A search of the Department of Environment, Water, Heritage and the Arts' (DEWHA) database for areas listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The field survey verified the findings of the desktop study and provided an assessment of the existing environment within the study area and its relationship to adjoining areas. The field survey included the following:

- ▶ Compiling an inventory of the vascular plant species in the survey area, undertaken through the use of walking transect survey methods;
- ▶ Searching for significant flora species, including Declared Rare Flora (DRF) and Priority Listed Flora (PLF);
- ▶ Compiling an inventory of dominant exotic plants, including declared noxious plants and environmental weed species;
- ▶ Describing and recording locations of plant communities, including GIS mapping and photographs;
- ▶ Rating the condition of the vegetation communities or areas using a published rating scale (Keighery 1994);
- ▶ Reviewing the local and regional significance of the plant communities in terms of their intrinsic value, extent, rarity and condition.
- ▶ Compiling inventory of the vertebrate fauna species in the survey area through targeted searches and opportunistic recording of species;
- ▶ Identifying any habitats of significance;
- ▶ Reviewing fauna species considered to be rare or in need of special protection; and
- ▶ Reviewing the presence and abundance of pest, declared or feral animals.

Vegetation monitoring undertaken at the unnamed salt lake to the west of the operation included the following:



- ▶ Establishing three monitoring sites within areas of lake bed fringing vegetation;
- ▶ Taking photographic records of monitoring sites; and
- ▶ Recording baseline vegetation data at each site (i.e. species diversity and plant cover measures).



## 2. Desktop Assessment

### 2.1 Previous Studies

A number of biological surveys have been undertaken previously in the Eastern Goldfields region, the most notable being the broad scale mapping of vegetation assemblages conducted by Beard as part of the Western Australian mapping project (Beard 1979), and the comprehensive biological survey of the region undertaken by the Biological Surveys Committee during the late 1970s and early 1980's (Biological Survey Committee 1984). The latter study not only described vegetation assemblages present but also recorded vertebrate fauna sampled from all major habitats within the region. Detailed studies of avifauna (Storr 1984) and herpetofauna (Storr *et al.* 1981) have also been undertaken within the Eastern Goldfields and a review of the region's biodiversity significance was recently undertaken by the Wilderness Society (Watson 2008).

No site specific biological studies were readily available for review.

### 2.2 Climate

The Goldfields region experiences an arid to semi-arid climate with hot summers and mild winters with cool nights (Australian Natural Resource Atlas 2008). Rainfall is unreliable, but mean delivery per month tends to be slightly higher during the winter period. Rainfall patterns are typically associated with cold fronts in winter and thunderstorms and rain bearing depressions in summer (McKenzie and Hall 1992). Whilst the intense summer rainfalls are efficient for plant growth, the light more regular winter rains are ineffective for growth other than herbs and grasses (Milewski 1981).

The closest official Bureau of Meteorology (BoM) weather recording station is at the Kalgoorlie Airport where climate data is available for the period from 1939 to 2010. Kalgoorlie's mean annual rainfall is 264.1 mm, with monthly averages ranging from 31.1 mm in February to 14 mm in September (BoM 2010). The evaporation rate is 2665 mm per annum, which is approximately 10 times the annual rainfall.

Seasonal variations in temperature are reasonably large. Summer temperatures may exceed 40°C and winter frosts within the region are not uncommon. Mean maximum temperatures recorded range from 33.7°C in January to 16.7°C in July. Mean minimum temperatures range from 18.2°C in January to 5°C in July.





Table 1 outlines the mean minimum and mean maximum temperatures as well as the mean rainfall for Kalgoorlie (BoM 2010).

**Table 1 Climate Data for Kalgoorlie (source: BoM 2010)**

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean maximum temperature (°C)	33.7	32.1	29.5	25.2	20.7	17.5	16.7	18.6	22.3	25.8	29.0	32.0	25.3
Mean minimum temperature (°C)	18.2	17.8	16.1	12.6	8.7	6.2	5.0	5.5	8.0	11.0	14.1	16.6	11.6
Mean Monthly rainfall (mm)	23.3	31.1	24.1	21.2	26.3	28.5	24.8	21.4	14.0	14.8	17.8	16.5	264.1

Source: (BoM 2010)

### 2.3 Regional Geology

The study area is situated within the Kalgoorlie Province, which is on the central eastern portion of the Yilgarn Craton (Department of Agriculture and Food 2006). The underlying geology of the province consists of Achaean greenstone basement rocks with a north-south strike and steep westerly dip.

This is overlaid with granitic rocks and greenstone of the Yilgarn Craton that have been extensively weathered and laterised (Department of Agriculture and Food 2006). Superficial deposits are typically comprised of colluvial and alluvial sediments.

### 2.4 Topography and Soils

The operational area and the majority of the pipeline corridor lies within the Undulating Plain Landform Unit as mapped by McKenzie and Hall (1992). The unit broadly consists of colluvial flats interspersed with low ridges and hills which have formed from the differential weathering of bedrock.

The study area itself is characterised by a broad plain of little relief. A slight but gradual fall in elevation exists towards the salt lake system to the west. Red sandy clay loams dominate much of the site. The western extent of the pipeline corridor intersects the dunes and margins of the salt lake system to the west.

### 2.5 Hydrology

The pipeline corridor terminates at the periphery of an unnamed salt lake. The lake is part of a broader chain of salt lakes orientated in a southwest direction. The lake is predominately dry but may hold water following heavy rain. Water which ponds in the lake is lost to evaporation and seepage.

Drainage lines present within the vicinity of the study area are poorly defined and are



only likely to flow following major rainfall events. Sheet flow is also likely in areas of subdued terrain following periods of heavy rainfall.

## **2.6 Regional Groundwater**

A description of the main aquifer types in the area is provided below:

- ▶ Fractured basement rocks – minor aquifers commonly formed near the mafic/ultramafic contacts.
- ▶ Weathered and vuggy siliceous cap rock aquifers – developed over some mafics/ultramafics.
- ▶ Tertiary paleochannels - formed where channels are infilled with medium to coarse sediments.
- ▶ Quaternary/Recent alluvium and chemical sediments – sands and calcretes/silicates form aquifers in shallow infilled valleys.

Regional groundwater quality varies from fresh to hypersaline, with most aquifer types yielding brackish to saline water.

GHD has been advised by Intermin Resources that groundwater at the site is saline and estimated to be at 40-50m bgl.

## **2.7 Phytogeography**

The study area lies in the Coolgardie biogeographic region of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995). This is a system of some 85 biogeographic regions covering the whole of Australia and is the result of collaboration between all State conservation agencies with co-ordination by the Australian Nature Conservation Agency (ANCA). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The Coolgardie biogeographic region correlates largely to the Coolgardie Botanical District defined by Beard (1979) and is described broadly as lying within the interzone between mulga/spinifex country and eucalypt environments (Australian Natural Resource Atlas 2008). The Coolgardie bioregion is summarised as supporting diverse Eucalypt woodlands on low greenstone hills, valley floors, broad plains and salt lake surrounds; samphire shrublands on saline valley floors; and Mallees, Acacia thickets and shrub-heaths on sandplains, playas, laterite areas and granite outcrops (Thackway and Cresswell 1995).

Dominant environmental issues for the Coolgardie bioregion include extinction of critical weight range mammals, wildfire, feral animals (in particular cat and fox), weeds, and pastoral and mining activities (Australian Natural Resource Atlas 2008).



## 2.8 Reserves and Conservation Areas

No DEC reserves occur within the immediate vicinity of the study area. The nearest DEC estate is the Kalgoorlie Aboretum (Reserve No. 23840) which lies approximately 7.5 km to the south east of the study corridor. The Reserve is currently vested with the Conservation Commission Western Australia. The Reserve will not be impacted by the proposed project.

## 2.9 Environmentally Sensitive Areas

The DEC's online Native Vegetation Viewer provides information on the location of Environmentally Sensitive Areas (ESAs), as declared by a Notice under section 51B of the *Environmental Protection Act 1986 (EP Act)*. These databases also indicate areas where low impact mineral and petroleum activities cannot occur without a Native Vegetation Clearing Permit, as defined under Schedule One of the *Environmental Protection (Clearing of native Vegetation) Regulations 2004*.

The DEC's online Native Vegetation Viewer was searched to determine the location of any ESAs or Schedule One areas within the immediate area and surrounds. No ESAs or Schedule One areas were identified within the vicinity of the study area.

## 2.10 Pathogens

*Phytophthora cinnamomi* threatens over 2,300 (40%) of different plant species in Western Australia. Introduced following European settlement, *Phytophthora cinnamomi* is a soil-borne pathogen that kills a wide range of native plant species in the south west of Western Australia by attacking their root system.

*Phytophthora cinnamomi* can also survive and reproduce on a wide range of native plant species without killing them. It has a widespread but discontinuous range in areas of the south west with an annual rainfall above 400 mm (Dieback Working Group 2005).

The study area is not considered to occur in an area susceptible to the development of the pathogen.

## 2.11 Vegetation

### 2.11.1 Vegetation Description, Extent and Status

A vegetation type is considered underrepresented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (Environmental Protection Authority 2000).

- ▶ The "threshold level" below which species loss appears to accelerate exponentially



at an ecosystem level is regarded as being at 30% of the pre-European / pre-1750 extent for the vegetation type;

- ▶ A level of 10% of the original extent is regarded as being a level representing *Endangered*; and
- ▶ Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five classes, where:

- ▶ *Presumed Extinct*: Probably no longer present in the bioregion
- ▶ *Endangered\**: <10% of pre-European extent remains
- ▶ *Vulnerable\**: 10-30% of pre-European extent exists
- ▶ *Depleted\**: >30% and up to 50% of pre-European extent exists
- ▶ *Least Concern*: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

\* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

The native vegetation associations represented in the survey area; their regional extent and reservation status are drawn from Shepherd, *et al.* (2002) and Shepherd *pers. comm.* (2005) (refer Table 2).

**Table 2 Vegetation Extent and Status in the Coolgardie IBRA Region**

Vegetation Association Number	Association Description	Pre-European Extent (ha) in Coolgardie IBRA region	Current Extent (ha) in Coolgardie IBRA region	% Remaining	% Pre-European Extent in IUCN Class I-IV Reserves
125	Bare areas; salt lakes	545718.752	542553.651	99.4	4.4
468	Medium Woodland; salmon gum and goldfields blackbutt	482364.14	482364.14	100	0.1
540	Succulent steppe with open low woodland; sheoak over saltbush	75810.337	75810.337	100	0.0

Vegetation within the study area (as mapped by Beard) is considered to be of *Least Concern* in terms of its regional extent with only a slight reduction in area recorded for Vegetation Association No.125 from its pre-European extent.



### **2.11.2 Threatened Ecological Communities (TECs)**

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable.

Some TECs are protected under the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Although TECs are not formally protected under the *State Wildlife Conservation Act 1950*, the loss of, or disturbance to, some TECs trigger the *EPBC Act*. The Environmental Protection Authority's (EPA's) position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

There are no known occurrences of TECs or PECs recorded within 15km of the study area.

## **2.12 Flora**

### **2.12.1 Significant Flora**

#### ***Commonwealth***

Species of significant flora are protected under both Commonwealth and State Acts. Any activities that are deemed to have a significant impact on species that are recognised by the *EPBC Act* and the *Wildlife Conservation Act 1950 (WC Act)* can trigger referral to the Department of Environment, Water, Heritage and the Arts (DEWHA) and/or the EPA.



A description of Conservation Categories delineated under the *EPBC Act* is detailed in Table 3. These are applicable to threatened flora and fauna species.

**Table 3 Conservation Categories and Definitions for *EPBC Act* Listed Flora and Fauna Species**

<b>Conservation Category</b>	<b>Definition</b>
<i>Extinct</i>	Taxa not definitely located in the wild during the past 50 years.
<i>Extinct in the Wild</i>	Taxa known to survive only in captivity.
<i>Critically Endangered</i>	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
<i>Endangered</i>	Taxa facing a very high risk of extinction in the wild in the near future.
<i>Vulnerable</i>	Taxa facing a high risk of extinction in the wild in the medium-term.
<i>Near Threatened</i>	Taxa that risk becoming Vulnerable in the wild.
<i>Conservation Dependent</i>	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
<i>Data Deficient (Insufficiently Known)</i>	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
<i>Least Concern</i>	Taxa that are not considered Threatened.

A search of the *EPBC Act* Protected Matters Search Tool was undertaken to identify Commonwealth protected flora species which may be present within 10 km of the study corridor. ***Gastrolobium graniticum*** (Granite Poison) was the only species of significance recorded. It is currently listed as 'Endangered'.

### **State**

In addition to the *EPBC Act*, significant flora in Western Australia is protected by the *WC Act*. This *Act*, which is administered by the DEC, protects DRF species. The DEC also maintains a list of PLF species. Conservation codes for flora species are assigned by the DEC to define the level of conservation significance. Priority Flora are not currently protected under the *WC Act 1950*. Priority Flora may be rare or threatened, but cannot be considered for declaration as rare flora until adequate surveys have been undertaken of known sites and the degree of threat to these populations clarified. Special consideration is often given to sites that contain Priority Flora, despite them not having formal legislative protection. A description of the DEC's



Conservation Codes that relate to flora species is provided in Table 4.

**Table 4 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species**

Conservation Code	Description
X: Declared Rare Flora – Presumed Extinct	Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

A search of the DEC's Rare Flora databases and the Western Australian Herbarium (WAHERB) records was performed. No significant flora species were recorded within the study area; however, seven Priority Flora species were recorded within 10 km of the study area, with one record immediately adjacent to the proposed corridor. The approximate locations of those flora species occurring within the vicinity of study area have been mapped and are shown in Figure 2, Appendix A.

The WAM/DEC's *NatureMap* database was also queried for records of significant flora occurring within 15 km of the study area. No DRF species were recorded. Priority



Flora species recorded from combined database searches are listed in Table 5.

**Table 5 Significant Flora Present within 15 km of the Study Area**

Species	Conservation Code	Description <sup>1</sup>
<i>Alyxia tetanifolia</i>	P3	Erect, rigid, pungent shrub, 1–2 m high, to 2.5 m wide. Fl. white, cream, May–Jun/Nov. Occurs in drainage lines, near lakes.
<i>Arstarea</i> sp. <i>Bungalbin Hill</i> (KR Newbey 8989)	P3	Spreading shrub, 0.1–0.4(–0.6) m high, to 0.65 m wide. Fl. white, pink, Sep–Dec/Mar. Deep yellow sand. Sandplains
<i>Elachanthus pusillus</i>	P2	Ascending or decumbent annual, herb, to 0.15 m high. Fl. yellow, green, Aug–Oct.
<i>Eremophila praecox</i>	P1	Broom-like shrub, 1.5–3 m high. Fl. purple, Oct–Dec. Red/brown sandy loam. Occurs on undulating plains.
<i>Eucalyptus x brachyphylla</i>	P4	Mallee or tree, to 4 m high, bark rough, flaky. Fl. white, Jun. Sandy loam. Granite outcrops.
<i>Gnephosis intonsa</i>	P1	Prostrate to ascending annual, herb, 0.01–0.04 m high. Fl. yellow, brown, Sep–Oct. Red/brown clay, stony saline loam
<i>Lepidium fasciculatum</i>	P3	Erect annual, herb, (0.1–)0.3–0.6 m high
<i>Melaleuca coccinea</i>	P3	Much branched shrub, 1.5–2.6 m high, leaf blade elliptic to ovate, 1.5–2.2 times as long as wide. Fl. red, Sep–Jan. Sandy loam over granite. Granite outcrops, sandplain, river valleys.
<i>Ptilotus procumbens</i>	P1	Spreading procumbent annual, herb, ca 0.1 m high. Fl. pink, white, Nov. Red clay

<sup>1</sup> Data Source: Department of Environment and Conservation (2010) Florabase accessed on line at <http://florabase.calm.wa.gov.au/> in September 2010.

## 2.13 Fauna

### 2.13.1 Potential Fauna Species

A Western Australian Museum (WAM)/DEC *NatureMap* online search was conducted for the study area and surrounds (20km radius). The search identifies terrestrial vertebrate species recorded in various databases including collections from the WAM. The search identified the potential presence of four amphibian species, 20 mammal, 168 bird and 44 reptile species.

It should be noted that some of the records of the WAM are historical and some of the recorded species may now be locally extinct. Additionally, these records may include





species (particularly bird species) that are vagrants or present in the general area but not present within the study area due to lack of suitable habitat.

### **2.13.2 Threatened Fauna Searches**

The DEWHA maintains a database of matters of national environmental significance that are protected under the *EPBC Act*. An *EPBC Act* Protected Matters Report was generated (from the website of the DEWHA), in September 2010 for the matters of significance that may occur in, or may relate to, the study area. Marine species listed in this search were included in the list. A search of the WAM/DEC's *NatureMap* database for any rare and priority species that may occur in the study area was also undertaken at that time.

Protected fauna species identified from WAM/DEC and DEWHA databases as potentially occurring within the study area are listed in Table 6.

It should be noted that some species that appear in the *EPBC Act* Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the WAM/DEC search provide more accurate information for the general area; however, some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.



**Table 6 Significant, Rare and Priority Fauna Species Recorded Previously within the Vicinity of the Project Area (20km Search Radius)**

Genus	Species	Common Name	Listing under WC Act or DEC Priority List	Listing under EPBC Act	DEC/WAM NatureMap Database	EPBC Protected Matters Search Tool
<b>Birds</b>						
<i>Acanthiza</i>	<i>iredalei iredalei</i>	Slender-billed Thornbill (western)		Vulnerable		+
<i>Apus</i>	<i>pacificus</i>	Fork-tailed Swift		Migratory, Marine		+
<i>Ardea</i>	<i>alba</i>	Great Egret, White Egret		Migratory, Marine		+
<i>Ardea</i>	<i>ibis</i>	Cattle Egret		Migratory, Marine		+
<i>Ardeotis</i>	<i>australis</i>	Australian Bustard	Priority 4		+	
<i>Charadrius</i>	<i>rubricollis</i>	Hooded Plover	Priority 4		+	
<i>Hylacola</i>	<i>cauta</i> subsp. <i>whitlocki</i>	Shy Heathwren (western ssp)	Priority 4		+	
<i>Leipoa</i>	<i>ocellata</i>	Malleefowl	Schedule 1	Vulnerable	+	+
<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater		Migratory, Marine		+
<i>Oreoica</i>	<i>gutturalis</i> subsp. <i>gutturalis</i>	Crested Bellbird (southern)	Priority 4		+	
<i>Pomatostomus</i>	<i>Supercilliosus</i> subsp. <i>ashbyi</i>	White-browed Babbler (western wheatbelt)	Priority 4		+	



Genus	Species	Common Name	Listing under WC Act or DEC Priority List	Listing under EPBC Act	DEC/WAM NatureMap Database	EPBC Protected Matters Search Tool
<b>Reptiles</b>						
<i>Morelia</i>	<i>spilota</i> subsp. <i>imbricata</i>	Carpet Python	Schedule 4, Priority 4		+	
<b>Mammals</b>						
<i>Macrotis</i>	<i>lagotis</i>	Bilby, Dalgyte	Schedule 1	Vulnerable	+	+
<i>Myrmecobius</i>	<i>fasciatus</i>	Numbat, Walpurti	Schedule 1	Vulnerable	+	



## 3. Field Assessment

### 3.1 Field Survey Methods

#### 3.1.1 Vegetation and Flora

GHD's qualified ecologist (Peter Moonie) conducted the field flora survey on 24 and 27 September 2010. The survey was conducted with regards to the EPA's Guidance Statement No. 51, *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004a), where possible.

A combination of vehicle and walking traverses was deemed to be the most appropriate survey method. Data collected from walking traverses included information on substrate, vegetation condition (including weed status), vascular flora species present and the dominant species within each vegetation type. Vehicle traverses were undertaken across the site to assist in vegetation type and condition mapping. Any areas considered suitable to host significant flora taxa were surveyed thoroughly.

A list of flora species recorded from the survey was generated for the Study Area. Where identification of flora species was uncertain, confirmation was made at the Western Australian State Herbarium (WAHERB). The presence of significant flora and/or potential TECs within the Study Area was assessed and aerial photography was used to assist in the delineation of vegetation types.

#### 3.1.2 Vegetation Monitoring

Three separate monitoring sites were established at the unnamed lake to the west of the project area to assess potential impacts to riparian vegetation from dewatering activities. Three contiguous 3 x 3m vegetation plots were established at each monitoring site, extending from the lake edge towards the first dune. Each resulting transect (3 x 9m) was photographed from the edge of the transect nearest the lake bed.

Monitoring locations are as follows:

- ▶ Site A – approximately 50m to the south of the proposed discharge point (340783E, 6603665N);
- ▶ Site B – approximately 510m to the north of the proposed discharge point (340797E, 6604225N); and
- ▶ Site C – approximately 680m to the south east of the proposed discharge point (341283E, 6603245N).

Species diversity and plant cover of live plants within each quadrat was recorded at



each of the three monitoring sites.

### **3.1.3 Fauna**

GHD's qualified ecologist (Peter Moonie) conducted the fauna investigation concurrently with the flora investigation on 27 September 2010. The fauna investigation was an opportunistic survey and involved recording sightings of fauna species utilising the study area as well as any fauna signs observed, such as tracks, scats, bones, diggings and feeding signs. Fauna trapping was not undertaken. The weather was fine and mild at the time of the survey, reaching a maximum temperature of 26 °C.

### **3.1.4 Nomenclature**

Nomenclature used in this report follows that used by the DEC/WAM *NatureMap* database as it is deemed to contain the most up-to-date species information for Western Australia.

### **3.1.5 Limitations**

Complete flora and fauna surveys can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present. Some flora species are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors.

The flora survey was also predominantly restricted to flowering plants, with consideration of some other vascular plants such as cycads. Non-vascular plants were not systematically searched for, as the information available on these plants is generally limited.

The fauna survey undertaken was a reconnaissance survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats and diggings. Many cryptic and nocturnal species would not have been identified during a reconnaissance survey. Extensive detailed fauna surveys, involving trapping surveys, are required to obtain a more comprehensive list of fauna species that may utilise the site. This survey was also aimed at identifying the terrestrial vertebrate fauna of the study area. No sampling of invertebrates or aquatic species occurred.

Monitoring potential impacts from pit dewater on the receiving salt lake was restricted to limited baseline riparian vegetation monitoring. An assessment of water chemistry, sediment chemistry, benthic microbial communities, invertebrates or macroalgae was not undertaken as part of this study. Monitoring locations were chosen with limited



information (contour data, lake capacity data, anticipated dewatering volumes, etc). Monitoring locations may need to be reviewed once more detailed information is available.




## 3.2 Vegetation and Flora Results




### 3.2.1 Vegetation Description

The vegetation of the study area was classified into five vegetation types. These vegetation units have been mapped at a scale of 1:25,000 (Figure 2) and are summarised in Table 7.

**Table 7** Vegetation Type Description

Code	Vegetation Type Description	Vegetation Type Photograph
LW1	Low woodland of <i>Eucalyptus oleosa</i> with scattered <i>Casuarina pauper</i> over <i>Eremophila interstans</i> subsp. <i>interstans</i> , <i>Santalum acuminatum</i> , <i>Eremophila scoparia</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Cratystylis conocephala</i> , <i>Halgania andromedifolia</i> , <i>Eremophila glabra</i> and <i>Scaevola spinescens</i> over <i>Maireana sedifolia</i> and <i>Eremophila parvifolia</i> subsp. <i>auricampa</i> .	
LW2	Low woodland of <i>Eucalyptus salubris</i> over <i>Eremophila scoparia</i> , <i>Pimelea microcephala</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Eremophila ionantha</i> , <i>Eremophila maculata</i> subsp. <i>brevifolia</i> and <i>Lycium australe</i> over <i>Maireana sedifolia</i> .	

Code	Vegetation Type Description	Vegetation Type Photograph
OW1	Open mixed woodland of <i>Eucalyptus salmonophloia</i> , <i>E. salubris</i> and <i>E. oleosa</i> with occasional <i>E. celastroides</i> and <i>Casuarina pauper</i> over <i>Eremophila scoparia</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Eremophila glabra</i> and <i>Scaevola spinescens</i> over <i>Maireana sedifolia</i> .	
OW2	Open mixed woodland of <i>Eucalyptus lesouefii</i> , <i>E. salubris</i> , <i>E. oleosa</i> and occasional <i>Casuarina pauper</i> over <i>Eremophila glabra</i> and <i>Lycium australe</i> over <i>Maireana sedifolia</i> .	
S1	Mixed shrubland of <i>Eremophila scoparia</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Eremophila glabra</i> , <i>Acacia inceana</i> subsp. <i>inceana</i> and <i>Scaevola spinescens</i> over <i>Maireana sedifolia</i> and <i>Cratystylis conocephala</i> over <i>Eremophila parvifolia</i> subsp. <i>auricampa</i> with occasional <i>Casuarina pauper</i> .	

Code	Vegetation Type Description	Vegetation Type Photograph
LS1	<p>Low shrubland of <i>Cratystylis subspinscens</i>, <i>Atriplex vesicaria</i>, <i>Maireana amoena</i>, <i>Frankenia</i> spp, <i>Tecticornia disarticulata</i>, <i>Maireana georgei</i>, <i>Maieana glomerata</i> over <i>Disphyma crassifolium</i> with occasional <i>Callitris preissii</i>, <i>Eremophila miniata</i>, <i>Dodonaea viscosa</i> subsp. <i>angustissima</i>, and <i>Eremophila scoparia</i>.</p>	
LS2	<p>Low shrubland of <i>Tecticornia indica</i>, <i>Atriplex vesicaria</i>, <i>Maireana amoena</i>, <i>M.glomerata</i>, <i>M.tomentosa</i> subsp. <i>tomentosa</i> and <i>Frankenia</i> spp over <i>Sclerolaena eurotioides</i> and <i>Disphyma crassifolium</i>.</p>	
LS3	<p>Low shrubland of <i>Tecticornia peltata</i>, <i>Swainsona purpurea</i>, <i>Scaevola collaris</i>, <i>Gunniopsis quadrifida</i>, <i>Maireana glomerifolia</i>, <i>Frankenia pauciflora</i>, <i>Atriplex nana</i> and <i>Disphyma crassifolium</i>.</p>	





None of the vegetation types described above are considered to be unique to the study area.

### 3.2.2 Vegetation Condition

The vegetation condition of the site was rated using the vegetation condition rating scale developed by Keighery (1994), which recognises the intactness of vegetation and is defined by the following:

- ▶ Completeness of structural levels;
- ▶ Extent of weed invasion;
- ▶ Historical disturbance from tracks and other clearing or dumping; and
- ▶ The potential for natural or assisted regeneration.

The scale consists of six rating levels from *Pristine or Nearly So* to *Completely Degraded*. The Vegetation Condition Rating Scale is outlined in below in Table 8.

**Table 8 Vegetation Condition Rating Scale (after Keighery, 1994)**

Vegetation Condition Rating	Vegetation Condition	Description
1	<i>Pristine or Nearly So</i>	No obvious signs of disturbance.
2	<i>Excellent</i>	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	<i>Very Good</i>	Vegetation structure altered, obvious signs of disturbance.
4	<i>Good</i>	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	<i>Degraded</i>	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	<i>Completely Degraded</i>	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

Disturbances from exploration, historical timber extraction and pastoral activities were evident across much of the study area; however, the majority of vegetation present was



considered to be in *Excellent* (2) to *Very Good* (3) condition.

The most noticeable signs of disturbance were the major tracks (firebreaks) intersecting the operational area and the existing track extending along much of the proposed dewatering pipeline corridor. Disturbance from recent exploration drilling within the proposed pit footprint was also evident.

A few minor tracks also traverse the operational area. These minor tracks have not been mapped but are considered to be *Degraded* (5) to *Completely Degraded* (6).

General vegetation condition has been mapped in Figure 2.

### 3.2.3 Threatened Ecological Communities

No TECs or PECs were recorded during the field survey. Vegetation in the study area is considered to be similar to that occurring in adjacent areas.

### 3.2.4 Flora Species

Vegetation within the Study Area is considered to be moderately diverse. A total of 110 taxa from 30 families were recorded from the study area. Of these, 104 taxa were native plant species. Two collections could not be identified beyond genus level due to lack of flowering parts or fruiting bodies, or because they were only found in a juvenile form.

Dominant families recorded included:

▶ Chenopodiaceae (chenopods):	32 taxa
▶ Scrophulariaceae (poverty bushes):	12 taxa
▶ Asteraceae (daisies):	9 taxa
▶ Fabaceae (wattles, peas, cassias):	7 taxa
▶ Poaceae (grasses):	7 taxa
▶ Myrtaceae (eucalypts, melaleucas):	5 taxa

Dominant genera recorded from the Study Area included:

▶ <i>Eremophila</i> :	12 taxa
▶ <i>Maireana</i> :	12 taxa
▶ <i>Atriplex</i> :	7 taxa

A full list of flora species present in the Study Area is provided in Table 15 (Appendix B).

### 3.2.5 Declared Rare Flora

No DRF species were recorded from the Study Area during this survey.

### 3.2.6 Priority Listed Flora

A specimen collected during the field survey may potentially be the Priority Listed Flora species *Eremophila praecox*. Only one individual of this taxon was recorded during this survey. It was observed growing within the footprint of the proposed waste dump (51J 344572E, 6603956N).

*Eremophila praecox* (P1) is a small broom-like shrub, ranging in height from 0.3-1.5m. Its general flowering period is from October to December and has purple flowers (Department of Environment and Conservation, 2009). It is known from seven records and its distribution ranges from just north of Kalgoorlie to near Coolgardie.

Andrew Brown (DEC Coordinator – Threatened Species Branch) was consulted regarding the identification of the specimen collected. He advised that although the specimen is likely to be the Priority Flora species *Eremophila praecox*, identification cannot be confirmed without flowering material. Given that the plant observed was not flowering at the time of the survey, the identification of this plant specimen remains unresolved.

As a precaution, this plant should be taken into consideration when siting mine infrastructure and the area should be avoided if possible. Flowering material should also be collected if observed and sent to the Western Australian Herbarium for identification.



**Plate 1:** *Eremophila ?praecox*, individual growing within the proposed waste dump footprint (Collection Number: PM 709)

### 3.2.7 Weeds

High densities of the weed *Salvia verbenaca*\* were recorded adjacent to existing tracks; however, weed levels across the remainder of the site were relatively low. A total of six weed species were recorded, comprising approximately 5% of the total number of plant species recorded in the study area. Weed species recorded are listed in Table 9.

**Table 9 Weed Species Recorded within the Study Area**

Genus	Species	Common Name
<i>Carrichtera</i>	<i>annua</i> *	Ward's Weed
<i>Cucumis</i>	<i>myriocarpus</i> *	Prickly Paddy Melon
<i>Malva</i>	<i>parviflora</i> *	Marshmallow
<i>Medicago</i>	<i>minima</i> *	Small Burr Medic
<i>Oligocarpus</i>	<i>calendulaceus</i> *	
<i>Salvia</i>	<i>verbenaca</i> *	Wild Sage

#### Significant Weed Species

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WONS) is based on four major criteria: invasiveness, impacts, potential for spread, and socio-economic and environmental values.

- ▶ No WONS species were recorded from the Study Area.

Weeds that are, or may become, a problem to agriculture or the environment can be formally classified as Declared Plants under the *Agriculture and Related Resources Protection Act, 1976* (ARRP Act). The Department of Agriculture and Food and the Agriculture Protection Board maintains a list of Declared Plants for Western Australia. If a plant is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the specific category of control. Declarations specify a category, or categories, for each plant according to the control strategies or objectives which the Agriculture Protection Board believes are appropriate in a particular place.

Among the factors considered in categorising declared plants are:

- ▶ The impact of the plant on individuals, agricultural production and the community in general;
- ▶ Whether it is already established in the area; and
- ▶ The feasibility and cost of possible control measures.

These Declared Plants are divided into five control code categories, which are detailed in



Table 10.

**Table 10 Department of Agriculture and Food Declared Plant Control Code Category**

<b>Control Code Category</b>	<b>Description of Landholder Obligations</b>
P1	Prohibits movement of plants or their seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
P2	Eradicate infestation to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
P3	Control infestation in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants.
P4	Prevent the spread of infestation from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set on all plants.
P5	Infestations on public lands must be controlled.

No Declared Plant taxa were recorded from the Study Area.

### **3.3 Vertebrate Fauna Results**

#### **3.3.1 Fauna Habitats**

No habitats were recorded that are considered to be exclusive to the study area. The broad habitat types identified within the study area included:

- ▶ Mixed woodland over mixed shrubs;
- ▶ Mixed shrublands;
- ▶ Samphire/chenopod shrublands; and
- ▶ Cleared areas.

#### **Habitat Value**

The mixed woodland over mixed shrubs habitat is considered to provide a medium level of habitat value to fauna. The vegetation has good structural diversity with medium sized eucalypts, mallees and a reasonable understorey of small and larger shrubs present. Such heterogeneity within the habitat provides a range of ecological niches for vertebrate and invertebrate fauna.

As commonly observed in woodland habitats within the vicinity of Kalgoorlie, large hollow bearing trees as well as standing dead trees and logs are far less abundant than in areas not subjected to historical timber extraction. Such habitat features provide refuge for a range of fauna species. Chapman and Kealley (2001) suggest that the loss of at least two



bird species (Southern Boobook and the Goldfields Rufous Tree-creeper) from the region is due to vegetation changes associated with timber harvesting.

Although the mixed shrublands are likely to support lower diversity than the mixed woodland habitat, the vegetation present was generally in very good to excellent condition and is also considered to provide a medium level of habitat for fauna. The dominant fauna are likely to be the highly mobile bird community, particularly the thornbills. Ground dwelling reptile species are likely to be less prevalent, given the typically sparse understorey and litter layer within this habitat.

The samphire/chenopod shrubland habitat present is generally less diverse (both structurally and floristically) than the woodland habitat, however, the vegetation present for was generally in excellent to very good condition and is considered to provide a medium level of habitat value to fauna. The shrubland vegetation associated with the lake margins is particularly important for habitat specialised species such as the Claypan Dragon and may also provide suitable habitat for the Slender-billed Thornbill and Hooded Plover, both of which are species of conservation significance. It should be noted; however, that the fringing vegetation of the unnamed lake was relatively degraded with sparse vegetation cover and poor vegetation health observed, including a high proportion of dead standing trees.

The cleared areas (i.e. tracks/firebreaks/drill pads) within the study area were highly disturbed, devoid of most vegetation and offer little habitat value for fauna. The species diversity for all taxonomic groups is likely to be very limited in this habitat type.

### **Habitat Linkages**

Habitat linkages are important to allow animals to move between areas of resource availability. Habitat linkage is important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters or habitat changes over time. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat. Where the distance between habitat fragments is small, species may still be able to move between these habitats, but may be more exposed to predation pressures in the cleared areas.

The Study Area is surrounded by relatively intact vegetation and is not considered to constitute a significant corridor or habitat linkage for fauna.

### **Habitats of Significance**

No fauna habitats recorded within the Study Area are considered to be significant. All habitats observed are widespread within the region. Species of birds, reptiles, amphibians and mammals present or likely to visit the site would also be present or visit other similarly vegetated areas in the region.

### 3.3.2 Fauna Species

A total of 19 bird species, four mammal species and three reptile species were recorded within the study area during the reconnaissance survey. No amphibian species were recorded during the survey. Species observed are listed in Table 16 (Appendix C).

A Claypan Dragon (*Ctenophorus salinarum*) was observed basking on the margins of the unnamed lake at the western extent of the Study Area. Although this species is not threatened in Western Australia, it is restricted to chenopod shrublands and sandy heaths on the periphery of salt pans and claypans, largely within the Goldfields region. Development activities are unlikely to impact on this species as it is likely to move to adjacent areas of similar habitat if disturbed.



**Plate 2: A Claypan Dragon (*Ctenophorus salinarum*) observed basking on Samphire Shrubland within the Study Area**

### 3.3.3 Significant fauna Species Recorded

The bird species, *Coracina novaehollandiae* (Black-faced Cuckoo-shrike), listed as Marine under the *EPBC Act* was recorded during the field survey. This species may reside within the study area, however development activities are unlikely to impact on this species as it will move its foraging and breeding activities to adjacent areas of undisturbed habitat.

It should be noted that the Crested Bellbird was also recorded within the study area. The area is known to support both the Crested Bellbird (*Oreoica gutturalis*) and the Priority 4 listed subspecies (*Oreoica gutturalis gutturalis*). Although less likely, it is possible that the Crested Bellbird recorded within the study area is the Priority 4 *Oreoica gutturalis*



*gutturalis* subspecies. Despite taxonomic uncertainty, development activities are unlikely to impact on either as both are vagrants and are likely to move to adjacent areas of intact vegetation if disturbed.

### 3.3.4 Significant Fauna Assessment

Desktop searches indicate that a number of protected fauna species not recorded during the field survey may also occur within the Study Area. The habitat requirements of these species and the likelihood of their occurrence in the Study Area are considered below.

#### **Slender-billed Thornbill – western (*Acanthiza iredalei iredalei*)**

The Slender-billed Thornbill is listed as Vulnerable under the *EPBC Act*. This species preferred habitat is chenopod shrublands and sandplain heath, expected along shores of salt lakes and other saline-clay pans (DEWHA, 2004). It is therefore likely to be limited to those sections of the Study Area. The Slender-billed Thornbill is likely to move to adjacent areas if disturbed; however impacts on suitable habitat should be minimised where possible.

#### **Malleefowl (*Leipoa ocellata*)**

Malleefowl build large mounds from soil, leaves, sticks and small stones from the surrounding shrublands and woodlands (Department of Environment and Conservation, 2007). The Malleefowl's habitat can be broadly described as semi-arid areas and remnant vegetation within agricultural zones. The species main danger lies through land clearing, predation and altered fire regimes (Department of Environment and Conservation, 2007). The Study Area is considered to be at the north-eastern periphery of its range. Although it may potentially occur in woodlands of the Study Area, it is considered unlikely given the level of previous disturbance. No evidence of its presence was recorded during the survey.

#### **Shy Heathwren (*Hylacola Cauta whitlocki*)**

This species is reliant on dense shrub and heath undergrowth of mallee communities. Habitat degradation of remnant bushland and land clearing are the major threats to this species. Proposed mining activities are unlikely to impact on the conservation significance of this species.

#### **White-browed Babbler - western wheatbelt (*Pomatostomus superciliosus ashbyi*)**

The White-browed Babbler inhabits dry sclerophyll woodlands with scrubby understorey and scrub along watercourses. This species is widespread and relatively common. Outside of the Wheatbelt, threats to this species (i.e. habitat loss) are generally not significant. Proposed mining activities are unlikely to impact this species and if disturbed, will readily move to adjacent areas.





### **Hooded Plover (*Charadrius rubricollis*)**

The Hooded Plover is a wader that is endemic to Australia with most of the remaining birds occurring in southern Western Australia. Hooded Plovers live on ocean beaches and on coastal and inland salt lakes. They are mainly found on the coast during the dry season, but some birds move inland during the wet season and are known to breed around inland salt lakes (reported in Muir, 1999). They feed on invertebrates such as worms, shellfish, crustaceans, insects and seeds. Hooded Plovers are particularly vulnerable in the first stages of their lives. They take approximately four weeks to hatch and are flightless for five to six weeks after that. The eggs and flightless chicks can easily be hunted and eaten by foxes, dogs and cats. Being highly camouflaged they are also accidentally crushed by pedestrians, 4WD vehicles and trail bikes (Birds WA, 2007).

The Hooded Plover may utilise the salt lake system within the periphery of the Study Area; however, it is likely to move to adjacent areas if disturbed.

### **Australian Bustard (*Ardeotis australis*)**

The Australian Bustard is listed as a Priority 4 species under the *WA Wildlife Conservation Act (1950)*. It is possible this species could occur in the Study Area as their habitat includes woodlands and grasslands. Given their mobility and general habit of moving over large areas, any impact on this species from proposed development activities would be minimal.

### **Carpet Python (*Morelia spilota imbricata*)**

Although generally uncommon, this subspecies has a wide distribution within the south west, having been recorded from semi-arid coastal and inland habitats, Banksia woodland, Eucalypt woodlands, and grasslands. It commonly utilises hollow logs for shelter (Wilson and Swan, 2003). Local populations in the south west have suffered due to extensive clearing, changed fire regimes and the removal of habitat for this species (Department of Environment and Conservation, 2008). This species is likely to move to adjacent areas if disturbed. Care should be taken when clearing vegetation and any animals observed within the clearing footprint should be relocated to adjacent bushland areas.

### **Numbat (*Myrmecobius fasciatus*)**

The Numbat is listed as Schedule 1 by DEC and as Vulnerable by EPBC and IUCN. Populations of the Numbat currently occur in habitat types including upland Jarrah forests, open Eucalypt woodlands, Banksia woodlands and tall closed shrublands. This species is found in areas with an abundance of termites, hollow logs and branches for shelter. The severe decline in the population numbers of Numbats is due to predation by foxes, loss of habitat due to clearing for agriculture and changes in fire regimes. This species is presumed extinct in the region.



### **Bilby (*Macrotis lagotis*)**

The Bilby usually spends the daytime in burrows. After dark they leave their burrows to feed and populations are known to move long distances when current habitat ranges become unsuitable. Bilbies are largely solitary, widely dispersed and found in low numbers. This species is presumed extinct in the region.

### **Rainbow Bee-eater (*Merops ornatus*)**

The Rainbow Bee-eater (Migratory, *EPBC Act*) is a migratory species listed under the *EPBC Act*, migrating to south-western Australia to breed during spring and summer. The Rainbow Bee-eater nests in burrows excavated in sandy ground or banks (Australian Museum, 2008). The Rainbow Bee-eater is a common and widespread species. Proposed development activities are unlikely to impact on the conservation significance of the species as it will move its foraging (and breeding) to adjacent areas of undisturbed habitat.

### **Fork-tailed Swift (*Apus pacificus*)**

Likely to utilise the Study Area but is an aerial species, and as such is unlikely to be affected by proposed development activities.

### **Great Egret (*Ardea alba*) and Cattle Egret (*Ardea ibis*)**

Both species are migratory and are unlikely to be affected by proposed development activities.

### **3.3.5 Introduced Species**

Three introduced mammal species were recorded from the Study Area (refer Table 16).



## 4. Assessment of Flora and fauna Impacts

### 4.1 Potential Flora and Fauna Impacts

The main impacts on flora and fauna are:

- ▶ *Vegetation Clearing*: This project will require the clearing of native vegetation in very good to excellent condition; however, the extent of clearing required (approximately 60 ha) is relatively minor compared to the large areas of similar vegetation adjacent to the Study Area.
- ▶ *Soil degradation and erosion*: Native vegetation serves an important role in the stabilisation of soil within the landscape. Removal of vegetation can cause land degradation, including erosion. Retaining vegetation within existing drainage lines and their surrounds will assist in maintaining soil stability.
- ▶ *Weed introduction and invasion*: The majority of the Study Area is largely weed free. Disturbance from development activities has the potential to introduce weeds to the areas directly impacted by clearing.
- ▶ *Hydrological Changes*: Changes to natural drainage from clearing or other activities may impact on both vegetation structure and fauna habitat in adjoining areas. Appropriate surface water management measures should be implemented.
- ▶ *Habitat loss and damage*: The amount of area required for proposed development activities is small relative to the amount of good quality habitat surrounding the Study Area and the impacts on fauna species are expected to be minimal.
- ▶ *Death or harm to fauna species*: Any construction works have the potential to cause death or harm to fauna species. Vegetation clearing and vehicle movements are likely to result in an increased incidence of animal death or injury. Slower moving land animals (including mammals, reptiles and amphibians) are most at risk, as they are often unable to vacate disturbed areas of vegetation quickly enough to avoid harm. Animals may become disorientated following destruction of their current habitat ranges.

### 4.2 Management of Issues

Impacts on flora and fauna can be minimised and managed by a number of measures which are outlined below:

- ▶ All clearing operations should be kept to a minimum and designated clearing areas should be clearly defined and contractors should be adequately briefed to ensure accidental clearing does not occur. Clearing should occur from the most disturbed areas towards undisturbed areas, thereby directing fleeing species away from the disturbance zone. Where possible, a fauna clearance team should be available to remove fauna during the clearing process.
- ▶ The potential Priority One Flora species: *Eremophila ? praecox* should be retained



where possible. Specimens to be retained should be clearly marked on site and an appropriate buffer from clearing provided.

- ▶ Management measures should be implemented to ensure clearing does not cause appreciable land degradation, including minimising runoff from the cleared areas.
- ▶ Management measures should be implemented to minimise the introduction and spread of weeds, such as avoiding movement of soils containing weedy species.
- ▶ Management measures should be implemented to maintain natural surface water flow paths where practicable.
- ▶ Management measures should be implemented to ensure fauna species are not adversely impacted during construction. This may include keeping pits and trenches open for minimal periods, providing exit ramps, regularly inspecting excavations and liaising with the DEC as necessary regarding the relocation of fauna species. Staff and contractors should also be educated during inductions on significant fauna species which may potentially be present in the area.
- ▶ Destruction of fauna habitat should be minimised during clearing. Dead, standing or fallen timber should be retained as habitat, wherever possible. Where micro-habitats, such as rocks, logs and other debris, must be disturbed for construction, these should be retained and used in rehabilitation;
- ▶ Avoid driving vehicles at dusk and dawn where possible, to minimise the potential for collisions with nocturnal animals.
- ▶ Areas containing suitable habitat for Malleefowl (i.e. dense vegetation and a reasonable litter layer) should be searched before clearing commences.
- ▶ Dewater points/water holding areas should be fenced from Kangaroo species to prevent deaths from drowning.
- ▶ Management measures should be implemented to prevent impacts on adjacent flora and fauna from pollution, such as litter and oil spills.
- ▶ Implement measures to reduce the risk of fire starting from activities at site.

Disturbed areas not required for the operation or ongoing maintenance of the facility should be rehabilitated where possible. Topsoil and vegetation should be stockpiled for later use in rehabilitation works.



### **4.3 Assessment against Clearing Principles**

Any clearing of native vegetation will require a permit under Part V Division 2 of the EP Act, except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, and it is not in an ESA.

Table 11 provides an assessment of the proposed project against the '10 Clearing Principles' as outlined in Schedule 5 of the Environmental Protection Amendment Act 2003 to determine whether it is at variance to the Principles. These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

This project may potentially be at variance against Principles (a) and (f). The presence of the potential Priority One Flora species within the Study Area is assessed in Principle (a).



**Table 11 Assessment against the 10 Clearing Principles**

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	<p>The Study Area is not considered to be of higher biodiversity than the broader surrounding area and the proposed clearing is unlikely to have any significant impact on the biodiversity of the region.</p> <p>A specimen collected from within the proposed waste dump footprint during the field survey may potentially be the Priority One Listed Flora species <i>Eremophila praecox</i>. Identification of this species cannot be confirmed without flowering material which was unavailable at the time of the survey.</p> <p><i>Eremophila praecox</i> is known from seven records and its distribution ranges from just north of Kalgoorlie to near Coolgardie. The habitat in which the specimen was collected is not unique to the study area and similar habitat exists with the broader region.</p> <p>Assuming that the specimen collected is the Priority Flora species <i>Eremophila praecox</i>, clearing of the individual plant observed is not considered to significantly impact on the continued existence of this species given the presence of additional recorded populations within the Goldfields.</p> <p>No TECs or PEC were recorded within the study area.</p>	The proposal may potentially be at variance with the Principle.



Principle Number	Principle	Assessment	Outcome
(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.	<p>No specific habitat was noted within the Study Area that was not present in the local area. The vegetation and associated fauna habitat within the Study Area is considered to be minimal in a regional perspective. Fauna species present in the Study Area are likely to find similar habitat adjacent to the Study Area.</p> <p>The area required to be cleared for the small scale mining operation is not likely to impact on significant fauna or required habitat.</p>	The proposal is not considered to be at variance with the Principle.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No DRF species have been recorded within the Study Area.	The proposal is not considered to be at variance with the Principle.
(d)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a TEC.	No TECs or PECs or associated native vegetation will be impacted by the proposed works.	The proposal is not considered to be at variance with the 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.	Clearing of approximately 60 ha of native vegetation within the Study Area will not significantly reduce the known extent from pre-European extents.	The proposal is not considered to be at variance with the Principle.



Principle Number	Principle	Assessment	Outcome
(f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	<p>There are no permanent drainage lines within the Study Area. An unnamed lake exists at the western end of the proposed dewater discharge pipeline.</p> <p>Appropriate mitigation measures will be implemented to minimise runoff and sedimentation to this wetland during construction and operation of the pipeline.</p> <p>Intermin Resources will also monitor impacts to riparian vegetation from proposed dewatering activities.</p>	The proposal may be at variance with the Principle.
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	Short-term soil erosion may occur within the Study Area following any potential clearing. Soil erosion can be mitigated by use of appropriate water management and rehabilitation regimes.	The proposal is not considered to be at variance with the 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.	There are no conservation areas within or in close proximity to the Study Area.	The proposal is not considered to be at variance with the 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.	<p>The clearing of native vegetation is not considered likely to alter the quality of surface or ground waters within the Study Area.</p> <p>Erosion may occur following any potential clearing. Erosion can be mitigated by the use of appropriate surface water management and rehabilitation techniques.</p>	The proposal is not considered to be at variance with the Principle.
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	<p>The clearing of native vegetation is not considered likely to cause or exacerbate the incidence or intensity of flooding.</p> <p>Clearing on, or around watercourses should be avoided where possible.</p>	The proposal is not considered to be at variance with the Principle.





## 5. Vegetation Monitoring

A summary of baseline vegetation information gathered at the receiving salt lake from the three established monitoring sites is presented below.

### 5.1 Site A

Site A is located approximately 50m to the south of the proposed discharge point (refer Figure 2). Site A consisted of a single transect comprised of three contiguous 3 x 3m vegetation quadrats. Each quadrat was assigned an alpha numeric reference code for identification purposes. The Site A transect consisted of Quadrats A1, A2 and A3 with Quadrat A1 located closest to the lake bed and A3 closest to the first dune (Plate 3).

The elevation of the lake bed (as recorded by handheld GPS) is 341m. The general vegetation type recorded for the area is described as follows: Low shrubland of *Tecticornia peltata*, *Swainsona purpurea*, *Scaevola collaris*, *Gunningsia quadrifida*, *Maireana glomerifolia*, *Frankenia pauciflora*, *Atriplex nana* and *Disphyma crassifolium*.

Fringing vegetation along the beach zone within the immediate area and surrounds showed signs of disturbance, including including sparse cover, a high proportion of stressed plants and noticeable plant death.

Site A quadrat data gathered during the initial monitoring period (2010) is provided in Table 12.

**Table 12 Site A Quadrat Data**

Species	Quadrat 1 - % Cover	Quadrat 2 - % Cover	Quadrat 3 - % Cover	Mean %
<i>Tecticornia peltata</i>	19	32	24	25
<i>Scaevola collaris</i>	1	0	1	0.66
Total	20	32	25	25.66



**Plate 3 Site A Transect Photo (2010)**

## 5.2 Site B

Site B is located approximately 510 m to the south of the proposed discharge point (refer Figure 2). Site A consisted of a single transect comprised of three contiguous 3 x 3m vegetation quadrats. Each quadrat was assigned an alpha numeric reference code for identification purposes. The Site B transect consisted of Quadrats B1, B2 and B3 with Quadrat B1 located closest to the lake bed and B3 closest to the first dune (Plate 4).

The elevation of the lake bed (as recorded by handheld GPS) was 345m. The general vegetation type recorded for the area is described as follows: Low shrubland of *?Tecticornia peltata*, *Swainsona purpurea*, *Scaevola collaris*, *Gunniopsis quadrifida*, *Maireana glomerifolia*, *Frankenia pauciflora*, *Atriplex nana* and *Disphyma crassifolium*.

Fringing vegetation along the beach zone within the immediate area and surrounds showed signs of disturbance, including sparse vegetation cover, a high proportion of stressed plants and noticeable plant death.

Site B quadrat data gathered during the initial monitoring period (2010) is provided in Table 13.

**Table 13 Site B Quadrat Data**

Species	Quadrat 1 - % Cover	Quadrat 2 - % Cover	Quadrat 3 - % Cover	Mean %
<i>?Tecticornia peltata</i>	16	20	4	13.3



**Plate 4 Site B Transect Photo (2010)**

### **5.3 Site C**

Site C is located approximately 680 m to the south east of the proposed discharge point (refer Figure 2). Site C consisted of a single transect comprised of three contiguous 3 x 3m vegetation quadrants. Each quadrat was assigned an alpha numeric reference code for identification purposes. The Site C transect consisted of Quadrats C1, C2 and C3 with Quadrat C1 located closest to the lake bed and C3 closest to the first dune (Plate 4).

The elevation of the lake bed (as recorded by handheld GPS) was 345m. The general vegetation type recorded for the area is described as follows: Low shrubland of *Tecticornia peltata*, *Swainsona purpurea*, *Scaevola collaris*, *Gunniopsis quadrifida*, *Maireana glomerifolia*, *Frankenia pauciflora*, *Atriplex nana* and *Disphyma crassifolium*.

Fringing vegetation along the beach zone within the immediate area and surrounds showed signs of disturbance, including sparse cover, a high proportion of stressed plants and noticeable plant death.

Site C quadrat data gathered during the initial monitoring period (2010) is provided in

**Table 14 Site C Quadrat Data**

Species	Quadrant 1 - % Cover	Quadrant 2 - % Cover	Quadrant 3 - % Cover	Mean %
<i>Tecticornia peltata</i>	16	12	0	9.33
<i>Atriplex nana</i>	0	1	1	0.67
Grass sp. (insufficient material – grazed)	0	0.5	0.5	0.34
<i>Swainsona purpurea</i>	0	0	0.5	0.17
<i>Eragrostis dielsii</i>	0	0	0.5	0.17
<i>Maireana glomerifolia</i>	0	0	0.5	0.17
<b>Total</b>	16	13.5	3	10.85



**Plate 5 Site C Transect Photo**



## 6. Report Limitations

This report presents the results of a Flora and Fauna Assessment prepared for the purpose of this commission. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent scientist/botanist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where reports, searches, any third party information and similar work has been performed and recorded by others, GHD has used this data in the form that it was provided. The responsibility for the accuracy of such data therefore remains with the issuing authority, not with GHD.

An understanding of site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experience based. Hence, this report should not be altered, amended or abbreviated, issued in part or incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of the report that has been modified in any way as outlined above.



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## Appendix A

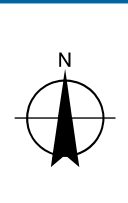
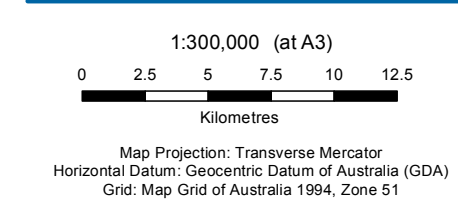
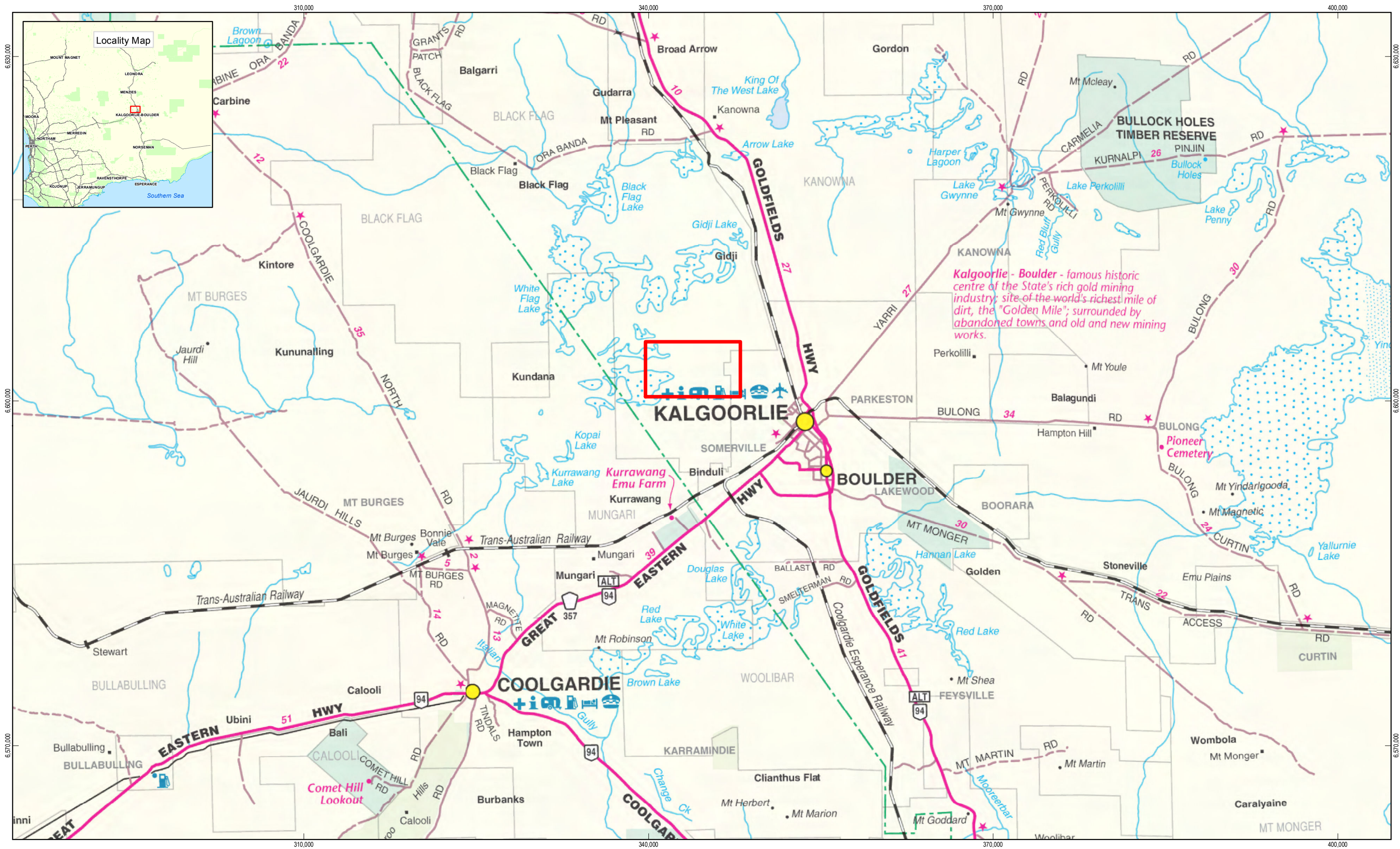
# Figures


Figure 1 Location Map

Figure 2 Vegetation Type

Figure 3 Vegetation Condition





LEGEND  
 Study Area



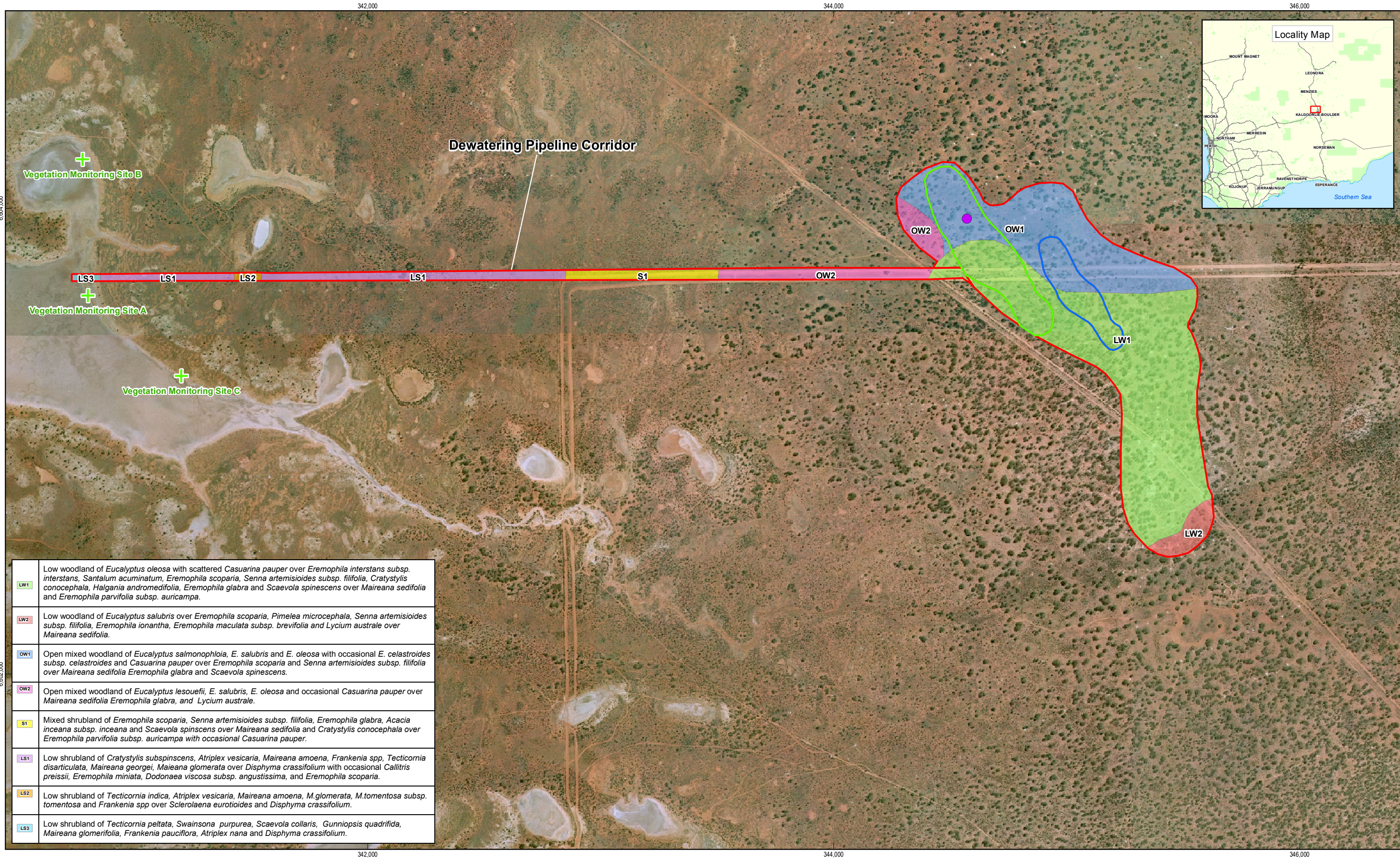
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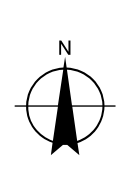
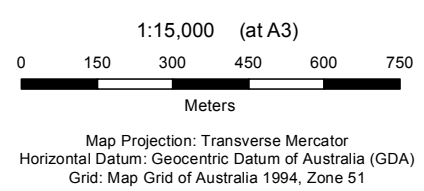
Locality Plan

Figure 1

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LW1	Low woodland of <i>Eucalyptus oleosa</i> with scattered <i>Casuarina pauper</i> over <i>Eremophila interstans</i> subsp. <i>interstans</i> , <i>Santalum acuminatum</i> , <i>Eremophila scoparia</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Cratystylis conocephala</i> , <i>Halgania andromedifolia</i> , <i>Eremophila glabra</i> and <i>Scaevola spinescens</i> over <i>Maireana sedifolia</i> and <i>Eremophila parvifolia</i> subsp. <i>auricampa</i> .
LW2	Low woodland of <i>Eucalyptus salubris</i> over <i>Eremophila scoparia</i> , <i>Pimelea microcephala</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Eremophila ionantha</i> , <i>Eremophila maculata</i> subsp. <i>brevifolia</i> and <i>Lycium australe</i> over <i>Maireana sedifolia</i> .
OW1	Open mixed woodland of <i>Eucalyptus salmonophloia</i> , <i>E. salubris</i> and <i>E. oleosa</i> with occasional <i>E. celastroides</i> subsp. <i>celastroides</i> and <i>Casuarina pauper</i> over <i>Eremophila scoparia</i> and <i>Senna artemisioides</i> subsp. <i>filifolia</i> over <i>Maireana sedifolia</i> <i>Eremophila glabra</i> and <i>Scaevola spinescens</i> .
OW2	Open mixed woodland of <i>Eucalyptus lesouefii</i> , <i>E. salubris</i> , <i>E. oleosa</i> and occasional <i>Casuarina pauper</i> over <i>Maireana sedifolia</i> <i>Eremophila glabra</i> , and <i>Lycium australe</i> .
S1	Mixed shrubland of <i>Eremophila scoparia</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Eremophila glabra</i> , <i>Acacia inceana</i> subsp. <i>inceana</i> and <i>Scaevola spinescens</i> over <i>Maireana sedifolia</i> and <i>Cratystylis conocephala</i> over <i>Eremophila parvifolia</i> subsp. <i>auricampa</i> with occasional <i>Casuarina pauper</i> .
LS1	Low shrubland of <i>Cratystylis subsp. subsp.</i> , <i>Atriplex vesicaria</i> , <i>Maireana amoena</i> , <i>Frankenia</i> spp, <i>Tecticornia disarticulata</i> , <i>Maireana georgei</i> , <i>Maieana glomerata</i> over <i>Disphyma crassifolium</i> with occasional <i>Callitris preissii</i> , <i>Eremophila miniata</i> , <i>Dodonaea viscosa</i> subsp. <i>angustissima</i> , and <i>Eremophila scoparia</i> .
LS2	Low shrubland of <i>Tecticornia indica</i> , <i>Atriplex vesicaria</i> , <i>Maireana amoena</i> , <i>M. glomerata</i> , <i>M. tomentosa</i> subsp. <i>tomentosa</i> and <i>Frankenia</i> spp over <i>Sclerolaena eurotioides</i> and <i>Disphyma crassifolium</i> .
LS3	Low shrubland of <i>Tecticornia peltata</i> , <i>Swainsona purpurea</i> , <i>Scaevola collaris</i> , <i>Gunnopsia quadrifida</i> , <i>Maireana glomerifolia</i> , <i>Frankenia pauciflora</i> , <i>Atriplex nana</i> and <i>Disphyma crassifolium</i> .



LEGEND	
	<i>Eremophila ? praecox</i>
	Vegetation Monitoring Sites
	Proposed Waste Pump Location
	Proposed Pit Location
	Proposed Clearing Footprint



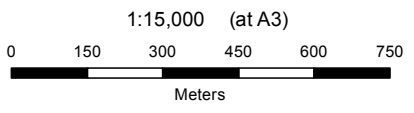
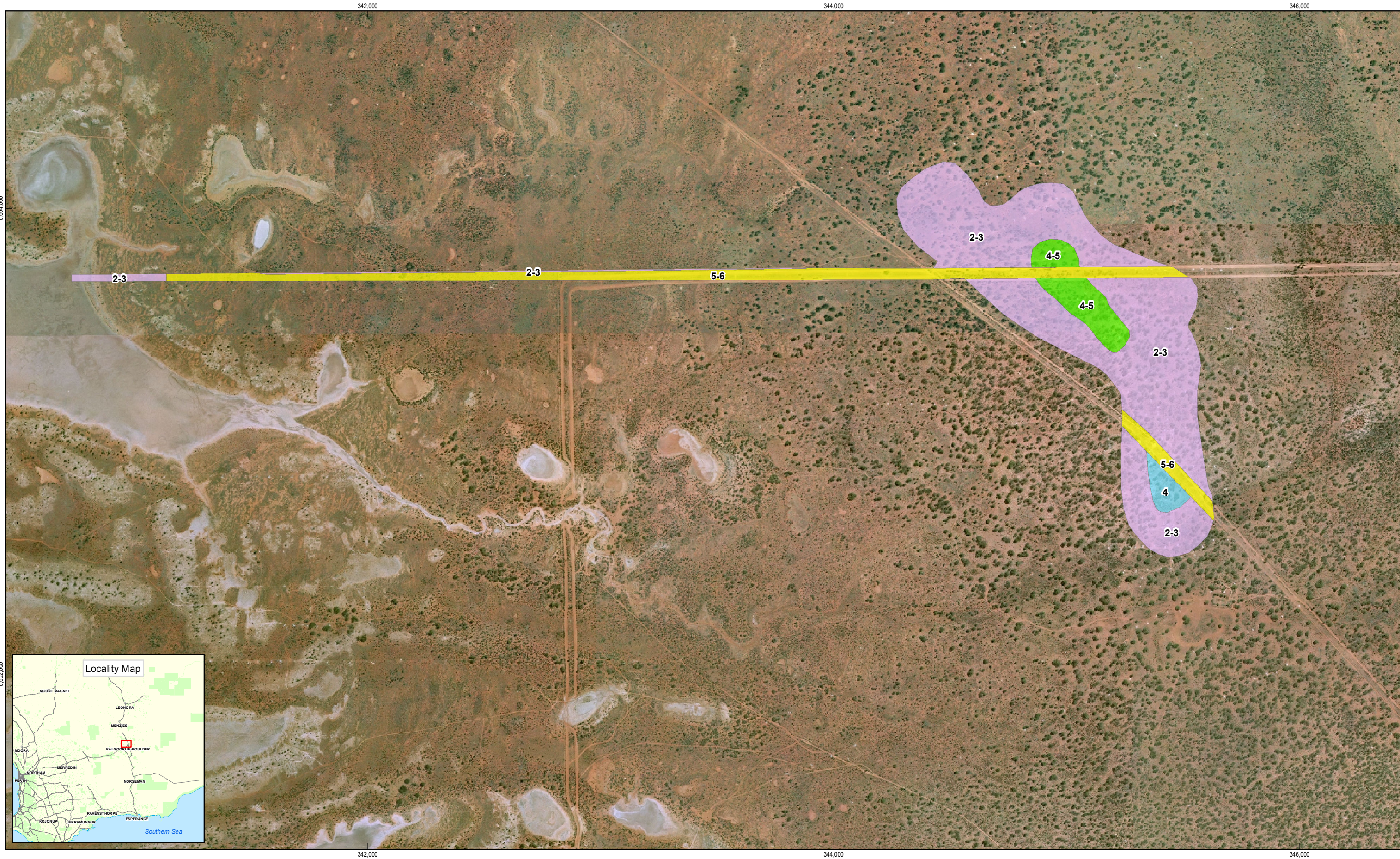
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### Vegetation Type, Priority Flora Locations and Vegetation Monitoring Sites

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Figure 2

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Data Source: GHD: Vegetation Types - 20101005; GHD: Plant of conservation significance, Proposed Pit & Pump Location and Clearing Footprint - 20101102; Landgate: Kalgoorlie Mosaic - 2003; GHD: Monitoring Location - 2010. Created by: jhchen



**LEGEND**

Vegetation Condition

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**Vegetation Condition**

**Figure 3**

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## Appendix B

# Flora

Flora Species Recorded during Field Survey of the  
Study Area – September 2010



**Table 15 Flora Species Recorded during Field Survey of the Study Area – September 2010**

<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Common Name</b>
Aizoaceae	<i>Disphyma</i>	<i>crassifolia</i>	Round-leaved Pigface
Aizoaceae	<i>Gunniopsis</i>	<i>quadrifida</i>	Sturts Pigface
Aizoaceae	<i>Gunniopsis</i>	<i>septifraga</i>	
Amaranthaceae	<i>Ptilotus</i>	<i>exaltatus</i>	Tall Mulla Mulla
Amaranthaceae	<i>Ptilotus</i>	<i>obovatus</i>	Cotton Bush
Asclepiadaceae	<i>Marsdenia</i>	<i>australis</i>	Cogla
Asteraceae	<i>Brachycome</i>	<i>ciliaris</i>	
Asteraceae	<i>Cratystylis</i>	<i>conocephala</i>	Greybush
Asteraceae	<i>Cratystylis</i>	<i>microphylla</i>	Small-leaved Grey Bush
Asteraceae	<i>Cratystylis</i>	<i>subspinescens</i>	
Asteraceae	<i>Olearia</i>	<i>muelleri</i>	Goldfields Daisy
Asteraceae	<i>Olearia</i>	<i>pimeleoides</i>	
Asteraceae	<i>Oligocarpus</i>	<i>calendulaceus*</i>	
Asteraceae	<i>Senecio</i>	<i>pinnatifolius</i>	
Asteraceae	<i>Trichanthodium</i>	<i>skirrophorum</i>	
Boraginaceae	<i>Halgania</i>	<i>andromedifolia</i>	
Brassicaceae	<i>Carrichtera</i>	<i>annua*</i>	Ward's Weed
Casuarinaceae	<i>Casuarina</i>	<i>pauper</i>	Black Oak



<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Common Name</b>
Chenopodiaceae	<i>Atriplex</i>	<i>bunburyana</i>	Silver Saltbush
Chenopodiaceae	<i>Atriplex</i>	<i>codonocarpa</i>	Flat-topped Saltbush
Chenopodiaceae	<i>Atriplex</i>	<i>holocarpa</i>	Pop Saltbush
Chenopodiaceae	<i>Atriplex</i>	<i>nana</i>	
Chenopodiaceae	<i>Atriplex</i>	<i>nummularia subsp. spathulata</i>	Old Man Saltbush
Chenopodiaceae	<i>Atriplex</i>	<i>stipitata</i>	
Chenopodiaceae	<i>Atriplex</i>	<i>vesicaria</i>	Bladder Saltbush
Chenopodiaceae	<i>Dysphania</i>	<i>kalpari</i>	Rat's Tail
Chenopodiaceae	<i>Enchylaena</i>	<i>tomentosa</i>	Barrier Saltbush
Chenopodiaceae	<i>Maireana</i>	<i>amoena</i>	
Chenopodiaceae	<i>Maireana</i>	<i>carnosa</i>	Cottony Bluebush
Chenopodiaceae	<i>Maireana</i>	<i>eriodlada</i>	
Chenopodiaceae	<i>Maireana</i>	<i>georgei</i>	Satiny Bluebush
Chenopodiaceae	<i>Maireana</i>	<i>glomerifolia</i>	Ball Leaf Bluebush
Chenopodiaceae	<i>Maireana</i>	<i>pentatropis</i>	
Chenopodiaceae	<i>Maireana</i>	<i>platycarpa</i>	
Chenopodiaceae	<i>Maireana</i>	<i>pyramidata</i>	Sago Bush
Chenopodiaceae	<i>Maireana</i>	<i>sedifolia</i>	Pearl Bluebush
Chenopodiaceae	<i>Maireana</i>	<i>tomentosa subsp. tomentosa</i>	Felty Bluebush



<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Common Name</b>
Chenopodiaceae	<i>Maireana</i>	<i>trichoptera</i>	Downy Bluebush
Chenopodiaceae	<i>Maireana</i>	<i>triptera</i>	Three-winged Bluebush
Chenopodiaceae	<i>Rhagodia</i>	<i>crassifolia</i>	Fleshy Saltbush
Chenopodiaceae	<i>Salsola</i>	<i>tragus</i>	Roly Poly
Chenopodiaceae	<i>Sclerolaena</i>	<i>cuneata</i>	Yellow Bindii
Chenopodiaceae	<i>Sclerolaena</i>	<i>diacantha</i>	Grey Copperburr
Chenopodiaceae	<i>Sclerolaena</i>	<i>eriacantha</i>	
Chenopodiaceae	<i>Sclerolaena</i>	<i>eurotioides</i>	
Chenopodiaceae	<i>Sclerolaena</i>	<i>obliqicuspis</i>	
Chenopodiaceae	<i>Tecticornia</i>	<i>halocnemoides subsp. catenulata</i>	
Chenopodiaceae	<i>Tecticornia</i>	<i>disarticulata</i>	
Chenopodiaceae	<i>Tecticornia</i>	<i>doleiformis</i>	
Chenopodiaceae	<i>Tecticornia</i>	<i>indica</i>	
Chenopodiaceae	<i>Tecticornia</i>	<i>peltata</i>	
Colchicaceae	<i>Wurmbea</i>	<i>sp. (insufficient material)</i>	
Cucurbitaceae	<i>Cucumis</i>	<i>myriocarpus*</i>	Prickly Paddy Melon
Cupressaceae	<i>Callitris</i>	<i>preissii</i>	Rottneest Island Pine
Fabaceae	<i>Acacia</i>	<i>hemiteles</i>	Tan Wattle
Fabaceae	<i>Acacia</i>	<i>inceana subsp. inceana</i>	



<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Common Name</b>
Fabaceae	<i>Acacia</i>	<i>nyssophylla</i>	
Fabaceae	<i>Acacia</i>	<i>tetragonophylla</i>	Kurara
Fabaceae	<i>Senna</i>	<i>artemisioides subsp. artemisioides</i>	
Fabaceae	<i>Senna</i>	<i>artemisioides subsp. filifolia</i>	
Fabaceae	<i>Senna</i>	<i>stowardii</i>	
Frankeniaceae	<i>Frankenia</i>	<i>interioris</i>	
Frankeniaceae	<i>Frankenia</i>	<i>pauciflora</i>	
Goodeniaceae	<i>Scaevola</i>	<i>collaris</i>	
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>	Currant Bush
Lamiaceae	<i>Salvia</i>	<i>verbenaca*</i>	Wild Sage
Lamiaceae	<i>Westringia</i>	<i>rigida</i>	Stiff Westringia
Malvaceae	<i>Malva</i>	<i>parviflora*</i>	Marshmallow
Myrtaceae	<i>Eucalyptus</i>	<i>celastroides subsp. celastroides</i>	Mirret
Myrtaceae	<i>Eucalyptus</i>	<i>lesouefii</i>	Goldfileds Blackbutt
Myrtaceae	<i>Eucalyptus</i>	<i>oleosa</i>	
Myrtaceae	<i>Eucalyptus</i>	<i>salmonophloia</i>	Salmon Gum
Myrtaceae	<i>Eucalyptus</i>	<i>salubris</i>	Gimlet
Papilionaceae	<i>Medicago</i>	<i>minima*</i>	Small Burr Medic
Papilionaceae	<i>Swainsona</i>	<i>purpurea</i>	





<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Common Name</b>
Phormiaceae	<i>Dianella</i>	<i>revoluta</i>	Blueberry Lily
Pittosporaceae	<i>Pittosporum</i>	<i>angustifolium</i>	Native Apricot
Plantaginaceae	<i>Plantago</i>	<i>drummondii</i>	Sago Weed
Poaceae	<i>Austrostipa</i>	<i>elegantissima</i>	Showy Feathergrass
Poaceae	<i>Austrostipa</i>	<i>nitida</i>	
Poaceae	<i>Enneapogon</i>	<i>avenaceus</i>	Bottle Washers
Poaceae	<i>Enteropogon</i>	<i>ramosus</i>	Windmill Grass
Poaceae	<i>Eragrostis</i>	<i>dielsii</i>	Mallee Lovegrass
Poaceae	<i>Eragrostis</i>	<i>falcata</i>	Sickle Lovegrass
Poaceae	<i>Eriachne</i>	<i>? pulchella subsp. pulchella</i>	
Proteaceae	<i>Grevillea</i>	<i>sarissa</i>	
Rhamnaceae	<i>Pomaderris</i>	<i>forrestiana</i>	
Santalaceae	<i>Exocarpos</i>	<i>aphyllus</i>	Leafless Ballart
Santalaceae	<i>Santalum</i>	<i>acuminatum</i>	Quandong
Sapindaceae	<i>Alectryon</i>	<i>oleifolius subsp. canescens</i>	
Sapindaceae	<i>Dodonaea</i>	<i>viscosa subsp. angustissima</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>caperata</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>dempsteri</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>glabra subsp. glabra</i>	



<b>Family</b>	<b>Genus</b>	<b>Species</b>	<b>Common Name</b>
Scrophulariaceae	<i>Eremophila</i>	<i>interstans</i> subsp. <i>Interstans</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>interstans</i> subsp. <i>virgata</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>ionantha</i>	Violet-flowered Eremophila
Scrophulariaceae	<i>Eremophila</i>	<i>maculata</i> subsp. <i>brevifolia</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>miniata</i>	Kopi Poverty Bush
Scrophulariaceae	<i>Eremophila</i>	<i>oppositifolia</i> subsp. <i>angustifolia</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>parvifolia</i> subsp. <i>auricampa</i>	Small-leaved Eremophila
Scrophulariaceae	<i>Eremophila</i>	? <i>praecox</i>	
Scrophulariaceae	<i>Eremophila</i>	<i>scoparia</i>	
Solanaceae	<i>Lycium</i>	<i>australe</i>	Australian Boxthorn
Solanaceae	<i>Solanum</i>	<i>hoplopetalum</i>	Thorny Solanum
Solanaceae	<i>Solanum</i>	<i>lasiophyllum</i>	Flannel Bush
Solanaceae	<i>Solanum</i>	<i>nummularium</i>	Money-leaved Solanum
Thymelaeaceae	<i>Pimelea</i>	<i>microcephala</i>	Shrubby Riceflower
Zygophyllaceae	<i>Zygophyllum</i>	<i>aurantiacum</i>	Shrubby Twinleaf
Zygophyllaceae	<i>Zygophyllum</i>	<i>eremaeum</i>	



Appendix C  
EPBC Act Fauna Conservation Categories  
Fauna Records



## **EPBC Act Fauna Conservation Categories**

### ***Listed threatened species and ecological communities***

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild,
- critically endangered,
- endangered, or
- vulnerable.

An action will also require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories:

- critically endangered, or
- endangered.

### ***Critically endangered and endangered species***

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat+, or
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

*\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

### ***Vulnerable species***

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- Lead to a long-term decrease in the size of an important population of a species, or



- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat\*, or
- introduce disease that may cause the species to decline, or
- interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.

### ***Listed migratory species***

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established\* in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
- habitat utilised by a migratory species which is at the limit of the species range, or



- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.

### ***The Commonwealth marine environment***

An action will require approval from the Environment Minister if:

- the action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment, or
- the action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment in a Commonwealth marine area.

An action has, will have or is likely to have a significant impact on the environment in a Commonwealth marine area if it does, will, or is likely to:

- result in a known or potential pest species becoming established in the Commonwealth marine area\*, or
- modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results, or
- have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (eg breeding, feeding, migration behaviour, and life expectancy) and spatial distribution, or
- result in a substantial change in air quality\*\* or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

*\*Translocating or introducing a pest species may result in that species becoming established.*

*\*\*The Commonwealth marine area includes any airspace over Commonwealth waters.*

(Department of Environment and Heritage, 2006)



**Table 16 Fauna Species Recorded within the Study Area – September 2010**

Family	Genus	Species	Common Name	Conservation listing	Introduced Fauna
Birds					
Acanthizinae	<i>Smicronis</i>	<i>brevirostris occidentalis</i>	Weebill		
Acanthizinae	<i>Acanthiza</i>	<i>chrysorrhoa</i>	Yellow-rumped thornbill		
Artamidae	<i>Artamus</i>	<i>cyanopterus</i>	Dusky Woodswallow		
Artamidae	<i>Cracticus</i>	<i>torquatus</i>	Grey Butcherbird		
Cacatuidae	<i>Eolophurus</i>	<i>roseicapilla</i>	Pink and Grey Galah		
Campephagidae	<i>Coracina</i>	<i>novaehollandiae</i>	Black-faced Cuckoo-shrike	Marine	
Columbidae	<i>Phaps</i>	<i>chalcoptera</i>	Common Bronzewing		
Corvidae	<i>Corvus</i>	<i>coronoides perplexus</i>	Australian Raven		
Dricuridae	<i>Rhipidura</i>	<i>leucophrys</i>	Willie Wagtail		
Dicruridae	<i>Grallina</i>	<i>cyanoleuca</i>	Magpie Lark		
Hirundinidae	<i>Hirundo</i>	<i>neoxena</i>	Welcome Swallow		
Meliphagidae	<i>Anthochaera</i>	<i>carunculata</i>	Red Wattlebird		
Meliphagidae	<i>Manorina</i>	<i>flavigula</i>	Yellow-throated Miner		
Meliphagidae	<i>Lichmera</i>	<i>indistincta</i>	Brown Honeyeater		
Meliphagidae	<i>Lichenostomus</i>	<i>virescens</i>	Singing Honeyeater		
Meliphagidae	<i>Lichenostomus</i>	<i>ornatus</i>	Yellow-plumed Honeyeater		
Pachycephalidae	<i>Oreoica</i>	<i>gutturalis</i>	Crested Bellbird		



Family	Genus	Species	Common Name	Conservation listing	Introduced Fauna
Podargidae	<i>Podargus</i>	<i>strigoides</i>	Tawny Frogmouth		
Psittacidae	<i>Platycercus</i>	<i>zonarius zonarius</i>	Australian Ringneck		
Reptiles					
Agamidae	<i>Ctenophorus</i>	<i>salinarum</i>	Claypan Dragon		
Scincidae	<i>Tiliqua</i>	<i>rugosa</i>	Shingleback		
Varanidae	<i>Varanus</i>	<i>gouldi</i>	Goulds Monitor		
Mammals					
Canidae	<i>Vulpes</i>	<i>vulpes</i>	Fox		X
Felidae	<i>Felis</i>	<i>catus</i>	Cat		X
Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>	European Rabbit		X
Macropodidae	<i>Macropus</i>	<i>fuliginosus</i>	Western Grey Kangaroo		





Family	Genus	Species	Common Name	Conservation listing	Introduced Fauna
Podargidae	<i>Podargus</i>	<i>strigoides</i>	Tawny Frogmouth		
Psittacidae	<i>Platycercus</i>	<i>zonarius zonarius</i>	Australian Ringneck		
Reptiles					
Agamidae	<i>Ctenophorus</i>	<i>salinarum</i>	Claypan Dragon		
Scincidae	<i>Tiliqua</i>	<i>rugosa</i>	Shingleback		
Varanidae	<i>Varanus</i>	<i>gouldi</i>	Goulds Monitor		
Mammals					
Canidae	<i>Vulpes</i>	<i>vulpes</i>	Fox		X
Felidae	<i>Felis</i>	<i>catus</i>	Cat		X
Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>	European Rabbit		X
Macropodidae	<i>Macropus</i>	<i>fuliginosus</i>	Western Grey Kangaroo		



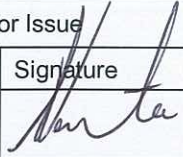
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