



**Mindarie Mineral Sands Project  
Stage 1 Mercunda Project  
EPBC Act Referral**

**Attachment G  
Mercunda Ecological Baseline Survey and Native Vegetation  
Management Plan**

# Mercunda Ecological Baseline Survey and Native Vegetation Management Plan

Prepared for: Murray Zircon Pty Ltd

By

*GBS Consulting*

ABN: 699 26 496 759

[gregorsmith@internode.on.net](mailto:gregorsmith@internode.on.net)

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## Executive Summary

GBS Consulting was engaged by Murray Zircon to undertake a baseline flora and fauna survey of the Mercunda Strandline Project which consists of the Mercunda North Mineral Lease (ML6137), Mercunda East Mineral Lease (ML6225) and four associated Miscellaneous Purposes Licences, MPLs 76, 77, 78 and 79. While the project may be delivered in stages the survey and this report covers the tenements listed above. Murray Zircon has commenced planning to restart operations using previously identified mineral sands strandlines which have been granted Mineral Tenements by the Department of Energy and Mining. To gain approval for the Mercunda Project activities Murray Zircon is required to submit an updated PEPR to the Department of Energy and Mining (DEM) in accordance with the:

- South Australian *Mining Act 1971*,
- Mining Regulations (2020),
- Terms of Reference for Metallic and Industrial Mineral transitional PEPRs (TOR 022),
- Native Vegetation Regulations (DEW 2017),
- Guide for a Significant Environmental Benefit for the clearance of native vegetation associated with the Minerals and Petroleum Industry (DEW 2017) and
- Guide for calculating a Significant Environmental Benefit (DEW 2020).

This report meets the requirements of the acts, regulations and guidelines identified above.

This study includes the determination of Significant Environmental Benefit (SEB) offset for the clearance of native vegetation associated with the project, as required under the Native Vegetation Act 1991.

To achieve the objectives of the study a desktop review of existing databases and previous studies was undertaken prior to a five-day two-person field survey. The field study was undertaken using the methodology detailed in the 'Native Vegetation Council Bushland Assessment Manual' which is required to calculate an SEB in the Agricultural zone of South Australia. Other standard survey flora and fauna survey methods were also used. The majority of the survey area consists of cropping lands, remnant vegetation patches and scattered trees. All potentially impacted vegetation blocks were systematically surveyed for flora and fauna and a total of 22 Bushland Assessment Surveys were completed.

The flora survey recorded six native vegetation communities which are identified using categories from the Bushland Assessment methodology as follows:

- MDBSA 2.1 Open Mallee / Low Open Woodland with Chenopod Shrub Understorey (3 sites);
- MDBSA 2.2 Chenopod Open Shrublands (1 site);

- MDBSA 3.1 Mallee with Very Open Sclerophyll / Chenopod Shrub Understorey (8 sites);
- MDBSA 3.2 Mallee with Open Sclerophyll / Chenopod Shrub Understorey (3 sites);
- MDBSA 3.3 Mallee with Open Sclerophyll / Chenopod shrub Understorey / *Triodia* Sandy Loam Flats / Swales (6 sites);
- MDBSA 6.2 Tall Shrublands on Limestone Soils (1 site).

A total diversity of 152 flora species were recorded from both the desktop review (with a 5 km radius from the centre of the survey area) and the field surveys conducted from 15 to 19 November 2021 and on 27 July 2022. This total consists of 116 native species, and 36 introduced species. The flora is dominated by Compositae (daisies), Chenopodiaceae (saltbush and bluebush), Gramineae (grasses), Leguminosae (peas and acacias), and Myrtaceae (eucalypts and tea-trees). Four recorded weed species are listed as Declared weeds under the Landscapes South Australia Act 2019, and one is a Weed of National Significance.

A total fauna diversity of 87 species was recorded for the combined desktop review (with a 5 km radius from the centre of the survey area) and the field survey conducted from 15 to 19 November 2021 and on 27 July 2022. This consists of 76 species of birds, seven species of mammals and four reptile species. The fauna desktop review of NatureMaps records for a 5 km radius of the project area returned 52 species of birds, 4 species of mammals and 3 species of reptiles. No amphibians or fish were included in the results. A total of 72 species of vertebrate animals were recorded during the field survey; 61 birds, two native terrestrial mammals, five introduced terrestrial mammals, and four reptiles.

The desktop review returned five flora species listed under the NPW Act 1972 but no flora species listed under the EPBC Act 1999 as potentially present within the 5 km radius search area. The likelihood assessment undertaken in this report concluded that none of the five listed flora species are likely to occur in the survey area based on habitats present.

Desktop results identified three Threatened Ecological Communities (TEC) as potentially occurring within the Mercunda survey area. One of these communities, the *Mallee Bird Community of the Murray Darling Depression Bioregion* TEC was confirmed as occurring in five of the vegetation blocks within the Mercunda strandline. The other two TECs are not considered to be present.

The desktop review returned 12 fauna species listed under the EPBC Act 1999 as potentially present within the 5 km radius search area. Of the 11 fauna species, only one (Malleefowl *Leipoa ocellata*) has been recorded within 5 km of the survey area and two other species (Grey Falcon *Falco hypoleucos*, Regent Parrot *Polytelis anthopeplus monarchoides*) are considered by this assessment as potentially occurring within the Mercunda Strandline Project area. The remaining nine species (Growling Grass Frog *Litoria raniformis*, Flathead Galaxis *Galaxia rostratus*, Curlew Sandpiper *Calidris ferruginea*, Far Eastern Curlew *Numenius madagascariensis*, Australian Painted Snipe *Rostratula australis*, Plains Wanderer *Pedionomus torquatus*,

Night Parrot *Pezoporus occidentalis*, Black-eared Miner *Manorina melanotis*, and Corben's Long-eared Bat *Nyctophilus corbeni*) are considered as unlikely to occur in the survey area by the assessment undertaken in this report.

The desktop search returned records of an additional five species of birds listed as Rare under the NPW Act 1972. Two of the state listed bird species were recorded during the surveys, White-winged Chough *Corcorax melanorhamphos* and Jacky Winter *Microeca fascinans fascinans*. The remaining three state listed bird species (Chestnut Quailthrush *Cinclosoma castanotum*, Hooded Robin *Melanodryas cucullata cucullata*, and Purple-gaped Honeyeater *Lichenostomus cratitius occidentalis*) are typical of mallee habitats and are considered as potentially occurring in the survey area. No Malleefowl mounds, tracks or signs of were observed during the survey. No terrestrial reptiles or mammals listed as threatened have been recorded within 5 km of the project footprint.

Native vegetation clearance of 34.5 hectares and five scattered trees is required for development of the Mercunda Strandline and MPL 77. A total (SEB) payment has been calculated at \$472,461.70 for the identified clearance located within the project footprint which takes into account a 50% reduction for initiating rehabilitation within three years. This total consists of an SEB Payment of \$447,831.00 plus an administration fee of \$24,630.70. This payment is equivalent to an on-ground SEB offset of 1627.03 SEB points. The clearance summary tables for the Mercunda project identifies that the proposed clearance is a Risk Level 4.

The SEB offset will be delivered through a payment to the Native Vegetation Fund.

The Native Vegetation Regulations (DEW 2017) require the use of the Mitigation Hierarchy for applications to clear native vegetation. This has been applied to the project with avoidance and minimisation of native vegetation clearance applied throughout the design phase of the project through locating infrastructure, tracks, and stockpiles in cleared areas. Rehabilitation is required and will be implemented in accordance with the *Mining Act 1971* both progressively during operations, and finally at closure of operations.

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# 1. Introduction

GBS consulting was contracted by Murray Zircon to undertake a baseline flora and fauna survey of the Mercunda North (ML6137) and Mercunda East (ML6225) Strandline and four associated Miscellaneous Purposes Licences (MPL 76, MPL 77, MPL 78 and MPL 79), for the Mindarie Mineral Sands Project. Murray Zircon is proposing to mine mineral sands at Mercunda as part of the restarting of operations at the Mindarie Mineral Sands Project.

The Mindarie Mineral Sands Project is located approximately 150 km east of Adelaide in the Murray Mallee Region of South Australia (Figure 1). The project was originally developed by Australian Zircon Limited in 2006-7, with production commencing in April 2007 and continuing until September 2009 when the company went into administration (Murray Zircon 2017). In 2011 Murray Zircon Pty Ltd was formed as a joint venture between Guangdong Orient Zircon Ind Sci and Tech Co., Ltd. (OZC) and Australian Zircon NL and acquired the project (Murray Zircon 2017). Murray Zircon submitted a Program for Environment Protection and Rehabilitation (PEPR) which was approved in April 2012 and subsequently mining operations recommenced at the Mindarie C East Strandline. Mining continued until March 2015 when the project was placed into care and maintenance due to falling commodity prices. Murray Zircon has commenced planning to restart operations using previously identified mineral sands strandlines which have been granted Mineral Tenements by the Department of Energy and Mining (DEM). To gain approval for the Mercunda Project activities Murray Zircon is required to submit an updated PEPR to DEM in accordance with the:

- South Australian *Mining Act 1971*,
- Mining Regulations (2020),
- Terms of Reference for Metallic and Industrial Mineral transitional PEPRs (TOR 022),
- Native Vegetation Regulations (DEW 2017),
- Guide for a Significant Environmental Benefit for the clearance of native vegetation associated with the Minerals and Petroleum Industry (DEW 2017) and
- Guide for calculating a Significant Environmental Benefit (DEW 2020).

## 1.1. Objectives of this study

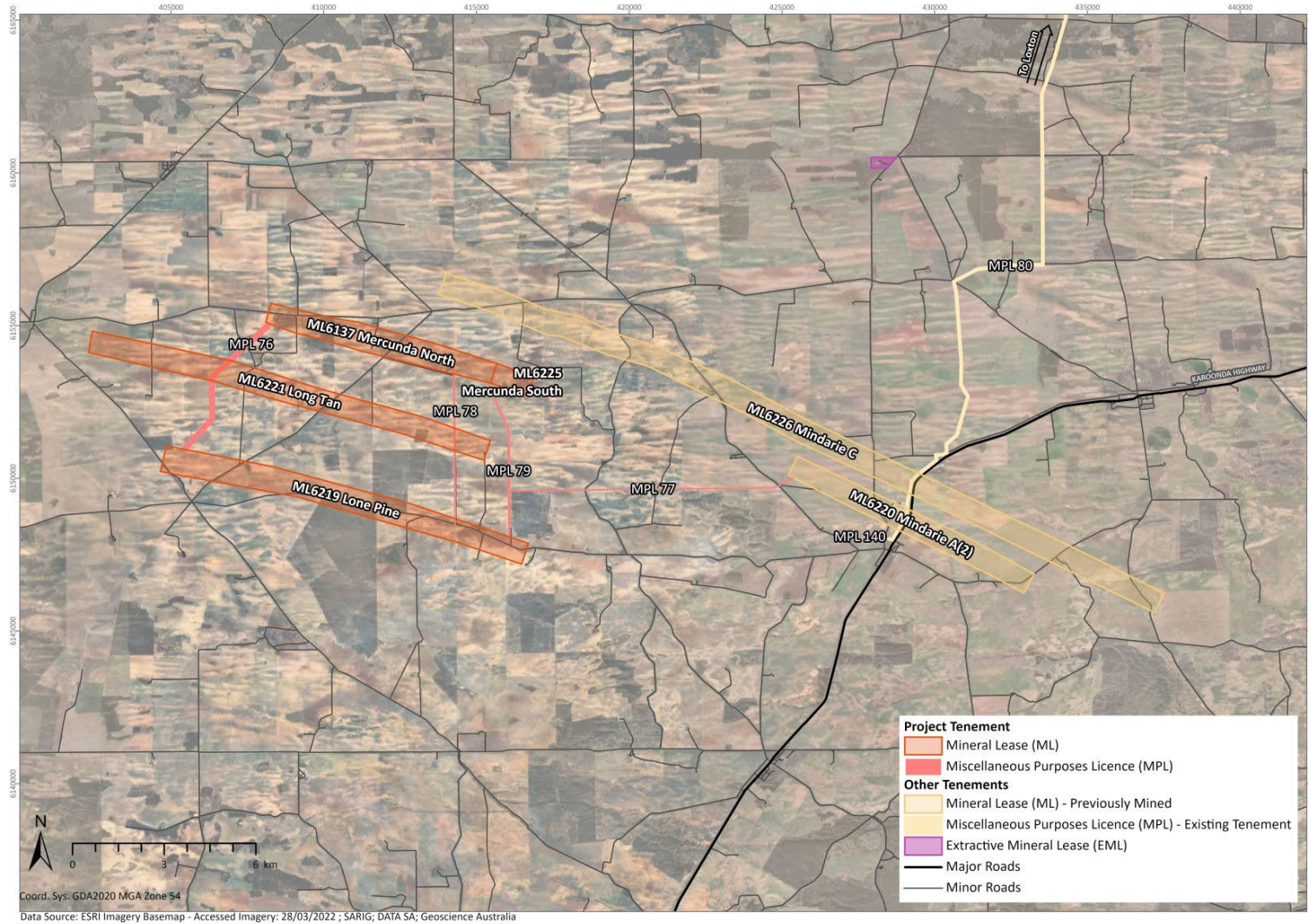
The objectives of this study were to:

- Produce baseline environmental information to support a mining Program for Environment Protection and Rehabilitation (PEPR);
- Identify any Threatened Ecological Communities present in the survey area and

provide baseline data on threatened flora and fauna that can be applied to an assessment of impacts;

- Determine the required Significant Environmental Benefit (SEB) required for vegetation clearance; and
- Provide a Native Vegetation Management Plan in accordance with ToR 022.
- In order to achieve these objectives, the study consist of the following:
- Review of previous studies and databases;
- Undertaking a baseline flora and fauna survey using standard survey methods to provide:
  - a baseline description of flora, fauna and vegetation communities present within the survey area;
  - a baseline description of weeds and pests within the survey area;
  - a vegetation survey using the Native Vegetation Councils Bushland Assessment Method (NVC 2020) to determine a Significant Environmental Benefit (SEB) in the agricultural region of South Australia; and
  - fauna information which meets requirements to determine Significant Environmental Benefit (SEB) in the agricultural region and includes documentation of rare and threatened flora and fauna species.
- Undertaking a likelihood assessment of threatened and migratory species using the proposed footprint.
- Calculation of the Significant Environmental Benefit (SEB) required to clear native vegetation included in the project footprint in accordance with Native Vegetation Council requirements.

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**Figure 1– Mindarie Mineral Sands Project Layout**

## 1.2. Project Description

The subject of this study is the Mercunda Strandline (ML 6137 and ML 6225) and four associated Miscellaneous Purposes Licences (MPLs) 76, 77, 78 and 79. The purpose of the MPLs is for supporting infrastructure such as haul roads, power lines and water pipelines (Figure 2). These tenements are part of a larger Mindarie Mineral Sands Project which consists of the existing processing site approximately 1.5 km north of Mindarie, the previously mined Mindarie C East Strandline and seven other strandlines.

The two mineral leases are adjacent (Figure 2) and are approximately nine kilometres in length and 800 m wide at the widest point. The proposed Mercunda Strandline commences approximately 13 km north-east of Mindarie and 20 km east of Wanbi (Figure 1) and is orientated in a north-west direction. It has an estimated heavy mineral sands ore reserve of 8.7 million tonnes.

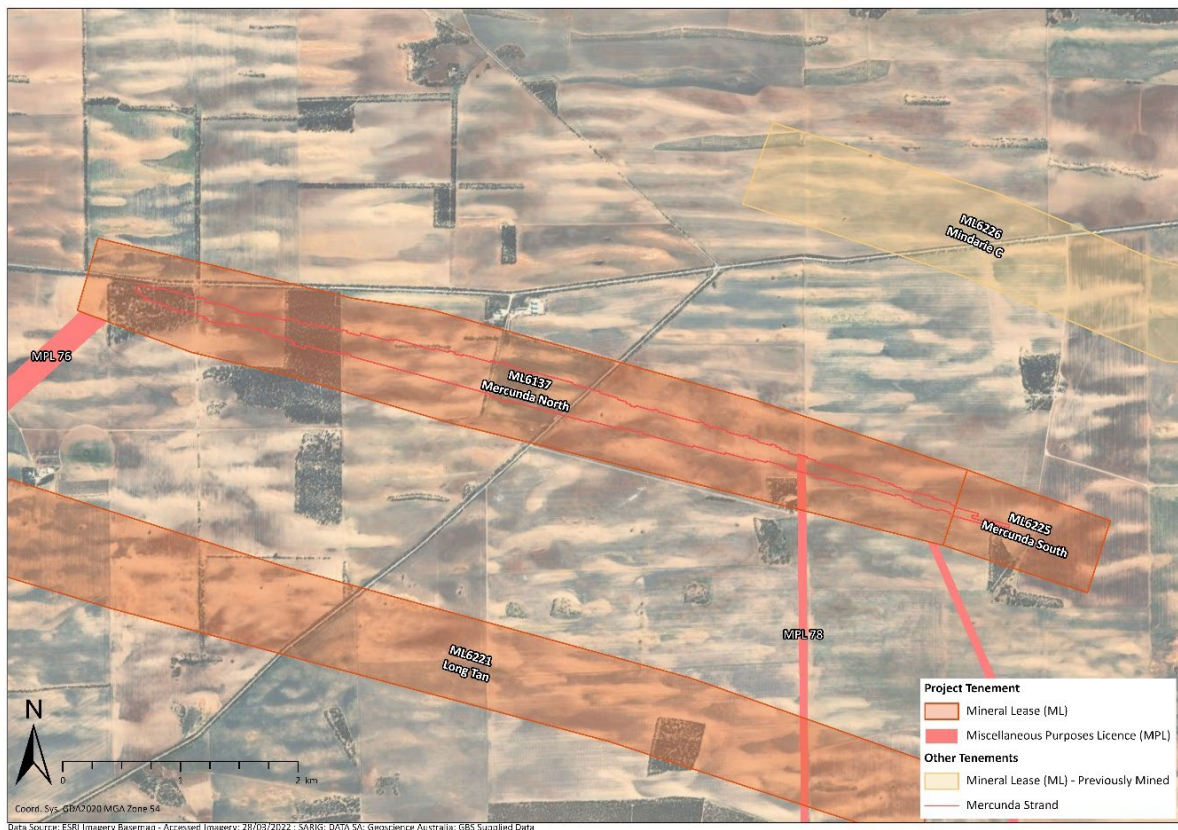


Figure 2 – Mercunda strandline (ML6137 and ML6225)

## 1.3. Site description

The project is located within the District Council of Karoonda East Murray in the central portion of the Murray Mallee Planning Region. The area's primary industries are broad-acre production of wheat and barley, breeding of sheep (predominantly Merino/Poll Merino) for their meat and wool production (Murray Zircon 2017).

The Mindarie project is located in the Murray Darling Depression (MDD) bioregion and Murray Mallee subregion. The topography of the project area is described as an undulating calcrete plain with extensive sand sheets, low dunes and shallow depressions (Murray Zircon 2017). The project area mainly consists of loamy soils on the plains, swales and gentle slopes with mainly neutral to alkaline, unbleached siliceous sand with calcareous subsoil on dunes (Murray Zircon 2017).

The Mercunda Strandline and MPLs are within the Kunlara Environmental Association MPL77 also extends into the Holder Environmental Association (Enviro Data SA 2021). The Kunlara Environmental Association contains approximately 9% of remnant vegetation and the Holder Environmental Association contains approximately 18% of remnant vegetation (DEW 2017). The survey area occurs in an area where native vegetation has been extensively cleared for agricultural purposes and between 3% and 11% remnant native vegetation is left within a 5 km radius (Enviro Data SA 2021). Native vegetation is mostly present along roadsides and as small, degraded patches, isolated trees and with occasional larger patches of greater than 100 hectares. One conservation reserve, Bandon Conservation Park, is approximately 5 km south of the Mercunda Strandline and Billiat Conservation Park and Wilderness Area are approximately 26 km south-east of the Mercunda Strandline.

### 1.4. Climate and Rainfall

The Murray Mallee region of South Australia is semi-arid with warm to hot summers and cool to cold winters. Average temperatures range from 14.4°C (June) to 33.2°C in February and average annual pan evaporation for the area is estimated to be between 1,600 and 1,700 mm/annum.

The mean annual rainfall for Mindarie is 303 mm, however rainfall records for Mindarie were discontinued in 2017. Average annual rainfall for the survey area is recorded as 294 mm (Enviro Data SA 2021). The majority of rain falls in the winter months with low rainfall over the summer months. According to Bureau of Meteorology records, the region received substantially less rainfall than average in 2018 and 2019 and Karoonda (approximately 50 km south-west of Mindarie) had a rainfall in 2018 of 186 mm compared to an average rainfall of 340 mm. Regional rainfall returned to approximately average in 2020 and 2021. A similar rainfall pattern is likely for the survey area.

Temperatures recorded at Loxton during the surveys are given in Table 1 as Karoonda had incomplete records for that week. No rain was recorded during the survey.

*Table 1 – Minimum and Maximum temperatures for days surveyed at Loxton*

<b>Date</b>	<b>Max.°C</b>	<b>Min.°C</b>
15/11/2021	19.0	8.1
16/11/2021	19.7	4.7
17/11/2021	25.4	4.1
18/11/2021	35.5	14.1
19/11/2021	21.5	12.1

## 2. Methodology

### 2.1. Desktop surveys

A desktop survey was undertaken in accordance with requirements of the Native Vegetation Council (NVC) guidelines including the:

- Native Vegetation Council Bushland Assessment Manual (DEW 2020);
- Native Vegetation Council Scattered Tree Assessment Methodology (DEW 2020); and
- Guide for a Significant Environmental benefit for the clearance of native vegetation associated with the Minerals and Petroleum industry (DEW 2017).

A desktop review of flora and fauna occurrence for the project area was undertaken. In accordance with NVC requirements for calculating an SEB offset within the agricultural zone of South Australia (DEW 2017), desktop searches used a buffer of a 5 km radius from the centre of the survey area to assess flora and fauna records. A desktop search for records of bird species listed under the Mallee Bird Community Threatened Ecological Community within 20 km of the survey area was also required to be undertaken. The desktop review used the following sources:

- Department of Agriculture, Water and the Environment (DAWE); Protected Matters Search Tool (PMST) for potentially occurring EPBC listed species and communities;
- NatureMaps, incorporating records from Biological Database of South Australia (BDBSA), South Australian Department of Environment and Water (DEW 2021); and
- the Atlas of Living Australia (ALA).

The following reports were also reviewed in the preparation of this report:

- A Biological Survey of the Murray Mallee, South Australia (Department for Environment and Heritage, South Australia, 2000);
- Mindarie Mineral Sands Project, Mindarie C and A (2), Program for Environment Protection and Rehabilitation (PEPR) (Murray Zircon, 2017).

### 2.2. Field Survey

The Spring Flora and Fauna survey of all areas except for MPL 77 was undertaken in late spring over a single five-day, two-person site visit from 15 to 19 November 2021. A further one day site visit was undertaken on 27 July 2022 by Ecosphere Ecological Solutions to survey vegetated areas of MPL 77 (Ecosphere 2022). The aims of surveys were to:

- identify the flora associations present in the survey area,



- document the fauna of the survey area,
- record any listed flora and fauna species, and
- collect data required by the Bushland Assessment Method (NVC 2020) for calculating the Significant Environmental Benefit (SEB), to offset native vegetation clearance within the project footprint.

Fauna survey methods used during the survey are described in detail in Section 2.2.2 and consist of the following:

- 30-minute fauna surveys of each vegetation block;
- Automated Songmeters to record bird calls;
- Opportunistic recording of reptiles, birds and mammals including any tracks, scats or other signs.

### 2.2.1. Flora Survey

The field assessment was undertaken using the methodology detailed in the 'Native Vegetation Council Bushland Assessment Manual' (DEW 2020) which describes the methodology required to calculate an SEB in the Agricultural zone of South Australia.

The methodology the within the application (survey) area vegetation 'Blocks' which are contiguous areas of vegetation are identified and labelled A, B C etc. Each block is divided into its constituent vegetation associations based initially on its overstorey (canopy) structural formation and then by understorey structure. Each different vegetation associations within each block is then labelled as a site (1, 2, 3 etc). A representative 1-hectare quadrat is surveyed for each site.

The Mercunda Strandline survey area has a number of remnant vegetation patches of various sizes, and these were all surveyed individually and labelled from Block A to Block L from west to east (Figure 3). Vegetation blocks within the Miscellaneous Purpose Licences (MPLs 76 to 79) associated the Mercunda strandline were also surveyed and labelled as Block M to Block R (Figure 3). Where differentiated vegetation associations were present within a block, each was surveyed, and these were labelled as Site 1, Site 2, or Site 3 as no more than three sites were surveyed for a block (Figure 3).

A list of native and introduced species was compiled for each site with a focus on searching for listed species. At each site cover ratings for native plant life forms present were scored from 0 to 6 according to categories provided in the Bushland Assessment Manual (Table 2). A vegetation condition parameter 'mature tree density rating' was scored from 0 to 8 and takes into account canopy density and also extent of foliage dieback (Table 3). Habitat attributes were scored from 0 to 5 for native species: weed ratio of the understorey; fallen timber; and presence of hollows (Table 4 to Table 6). Fauna species observed were recorded including signs such as burrows, tracks and scats.

The survey also considered individual trees, termed scattered trees, which are

isolated from vegetation blocks and which may potentially be cleared. Scattered Trees were surveyed according to a separate methodology described in the Scattered Tree Assessment Manual (DEW 2020 - 2). The following data was collected for each tree:

- Species,
- Height,
- Trunk diameter at 1 metre above the ground,
- Tree health as determined by percent of foliage dieback,
- The number of small, medium and large hollows,
- Photograph.

A total of 25 Bushland Assessment Method (BAM) surveys were completed within 18 vegetation 'blocks' and 17 Scattered Tree Assessments were completed at 11 locations (Figure 3). Some blocks (C, D, J and K) and scattered trees (Trees 6 to 14) are not within the final project footprint and therefore do not contribute to the SEB calculation. Vegetation clearance proposed within this application is only planned to occur within the Mercunda Strandline (ML6137 and ML 6225) and one Miscellaneous Purpose Licence area, MPL 77. The SEB calculation does not therefore include any vegetation within MPL 76, MPL 78 and MPL 79.

**Table 2. Vegetation life forms scored, and the categories used to score cover/abundance (from DEW 2020)**

<b>Category</b>	<b>Score</b>
Not many, cover < 1%	1
Covering 1 - 5%	2
Covering 6 - 25%	3
Covering 26 - 50%	4
Covering 51 - 75%	5
Covering > 76%	6
<b>Floristic Life Form</b>	<b>Height class</b>
Trees	>15 m
	5 - 15 m
	< 5 m
Mallee	> 5 m
	≤ 5 m
Shrubs	> 2 m
	0.5-2 m
	< 0.5 m
Mat plants	-
Forbs	-
'Grasses'	> 0.2m
	≤ 0.2m
'Sedges'	> 1m
	≤ 1m
Hummock grass	-
Vines, scramblers	-
Mistletoe	-
Ferns	-

**Table 3. Categories used to score mature tree density including canopy die-back (from DEW 2020)**

<b>Mature Trees density (trees per ha)</b>	<b>% Tree Canopy dieback</b>		
	<b>&lt;30 %</b>	<b>30 - 70 %</b>	<b>&gt;70%</b>
None present	0	0	0
0 - 25%	2	1	0
>25 - 50%	4	3	2
>50 - 75%	6	5	4
>75 - 100%	8	7	6

**Table 4. Categories used to score understorey native plant:weed biomass ratio (from DEW 2020)**

<b>Category</b>	<b>Score</b>
> 80%	1
> 40 - 80%	2
> 20 - 40%	3
> 10 - 20%	4
5 - 10%	5
< 5%	6

**Table 5. Categories used to score fallen timber and leaf litter (from DEW 2020)**

<b>Fallen Timber/debris (log size = that of canopy species (+ emergent species if present))</b>			
<b>Log diameter</b>	<b>None</b>	<b>&lt;1 per 10 canopy trees</b>	<b>&gt;1 per 10 canopy trees</b>
Trunk sized	0	2	3
Branch-sized	0	0.5	1
<b>Leaf Litter</b>	<b>Little or None</b>	<b>Sparse, Patchy</b>	<b>Dense, continuous</b>
Leaf Litter	0	0.5	1

**Table 6. Categories used to score presence of hollows (from DEW 2020)**

<b>Hollow score</b>	<b>Score</b>
None	0
Small hollows only	1
Large +/- sm hollows in </=5 trees/ha	2
Large +/- sm hollows in 6-10 trees/ha	3
Large +/- sm hollows in 11-20 trees/ha	4
Large +/- sm hollows in >20 trees/ha	5

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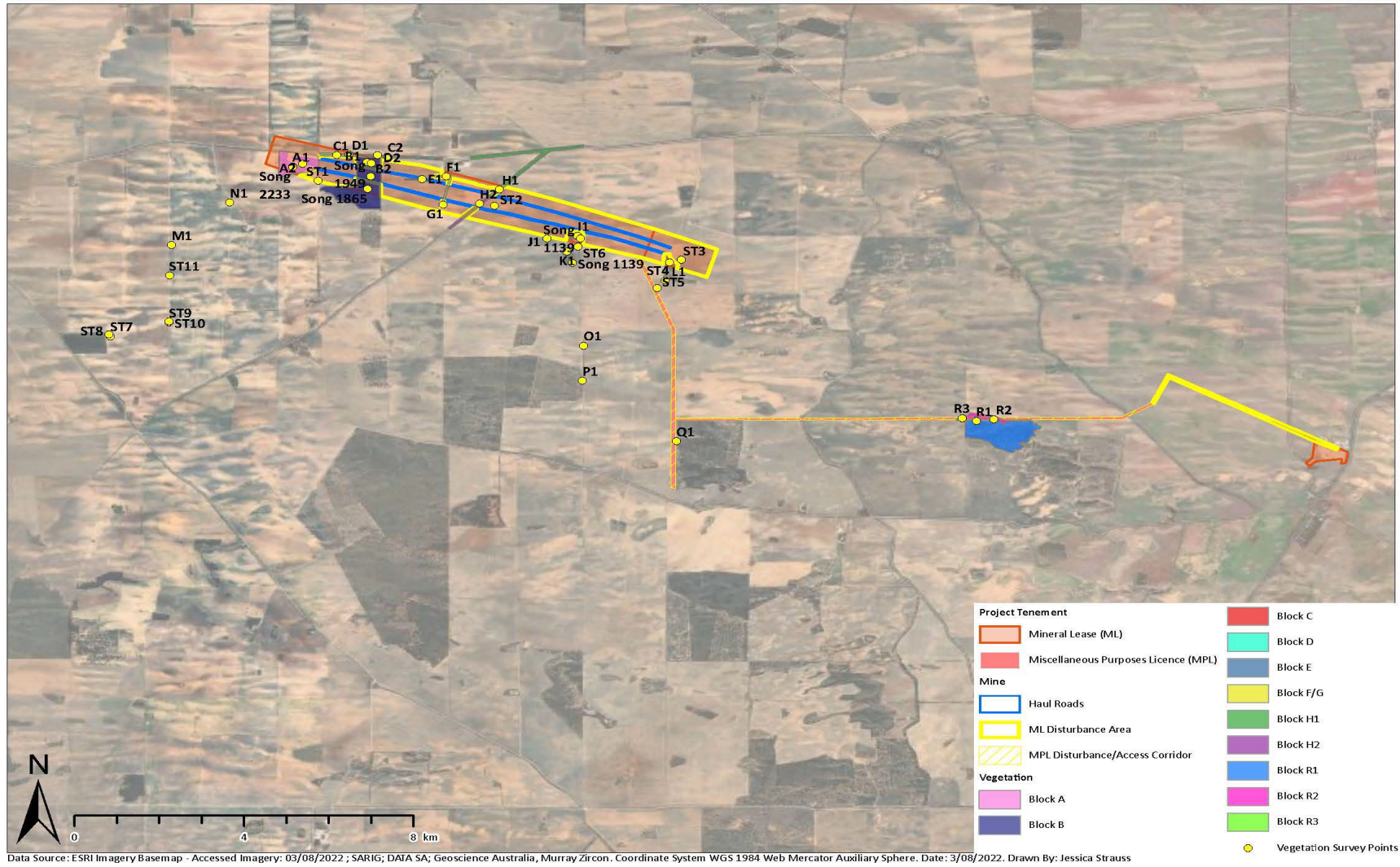


Figure 3 Survey sites within the Mercunda Strandline (ML6137 and ML6225) and associated MPLs (MPL76, MPL77, MPL78 and MPL79).

### 2.2.2. Fauna survey

All vegetation blocks were systematically surveyed for fauna for a minimum of 30 minute at the time of the vegetation survey. Larger blocks (A, B and L) were surveyed for approximately two hours, one hour each on two different days. Surveys included searches for threatened bird species and EPBC listed bird species in particular. This included searching for Malleefowl tracks and mounds including long inactive and dis-used mounds that may not have the typical mound shape. No fauna trapping was undertaken as the focal species identified in the desktop review only consisted of bird species and did not include conservation significant mammals or reptiles.

Stock watering points and farm dams were monitored for various periods of time to observe wildlife coming to drink, especially in the morning and late afternoon. Block L had a stock water trough which was visited on three days at various times. Block I had a dam with water in it which was also visited on three days at various times.

All wildlife observed or heard was recorded and tracks and diggings were also documented as evidence. When listed species were observed GPS waypoints were taken and locations recorded. Opportunistic observations were also recorded along with the location, date, time, number of animals and any pertinent comments.

Four SM4 Songmeter audio recording machines (Figure 4) were used to record bird calls at five sites as identified in Table 7. Different bird species have different peak call times throughout the day hence songmeters were set to record on a schedule covering the different periods of the day as follows:

- 20 minutes recording and 20 minutes not recording starting at 05:00 and finishing at 08:00
- 30 minutes recording and 30 minutes not recording starting at 08:00 and finishing at 04:00 the next morning.

This resulted in a total of approximately 12 hours per day spread over the whole 24-hour period of each survey day covering the dawn chorus, early to late morning, late afternoon and evenings. Audio files were filtered to remove periods of high wind and audio disturbance, and to focus on periods of bird activity. Good recordings were made during each survey period allowing analysis of a suite of sound files, covering all periods of the day, for each survey site. Recordings were analysed with a focus on early morning when calling is at its peak for diurnal species and evenings to capture nocturnal birds. Sound files were also analysed to complete a set of recordings over the 24-hour schedule for each site and to obtain replication where possible. The mornings and evenings of 16<sup>th</sup>, 17<sup>th</sup> and 19<sup>th</sup> November were still and produced the best quality recordings and these were primarily used for analysis. Calls were compared to reference audio files of bird calls where required. Species identified were recorded as a presence to produce a list of species recorded at each site.



Figure 4 – Songmeter located at block A

Table 7 – Fauna survey site locations, descriptions, and survey effort per site

Location	Habitat	Datum	Zone	Easting	Northing	Survey Dates
Block A	Open Mallee on dune	GDA94	54	0408632	6155046	15/11/21 - 15:30 to 19/11/21 - 11:30
Block B North (Site 1)	Mallee Woodland on low dune	GDA94	54	0410081	6154584	15/11/21 - 16:30 to 19/11/21 - 13:30
Block B South (Site 2)	Mallee Woodland on flat plain	GDA94	54	0410157	6155149	15/11/21 - 16:30 to 19/11/21 - 13:30
Block I	Farm dam adjacent to Mallee Woodland	GDA94	54	0414230	6153536	15/11/21 - 15:30 to 17/11/21 - 15:00
Block L	Stock trough adjacent to open Mallee	GDA94	54	0414069	6152998	17/11/21 - 16:00 to 19/11/21 - 12:00

### 2.2.3. Threatened Species Likelihood assessment

Threatened species observed during the field survey and those identified as potentially occurring in the survey area from the desktop survey were compiled in tables. The likelihood of these species using the survey area was assessed based on the observed habitats, field observations, desktop records likelihood ratings from the protected matters search, and expert knowledge.

The likelihood assessment resulted in identification of species that are known or likely to use habitats within the project area. These species were included in the SEB scoresheets and determined the threatened flora score and the threatened fauna score which contributes to the overall Universal Biodiversity Score (UBS).

## 2.3. SEB Calculation

Following completion of the bushland assessment field survey site data and listed species likely to occur in the survey area were entered for each survey location into the Bushland Assessment Scoresheet provided by the NVC.

The scoresheet determines the vegetation community for each site according to a set of Benchmark Vegetation Communities contained within the spreadsheet which have been adopted from the Nature Conservation Society of South Australia (NCSSA) Bushland Condition Monitoring Manuals (NCSSA 2005).

The primary result of this spreadsheet is the Universal Biodiversity Score (UBS). A Clearance Summary Spreadsheet summarises the scoresheet data on a single spreadsheet including the UBS values and the number of hectares to be cleared. A Total Biodiversity Score (TBS) is then determined for each vegetation block by multiplying the UBS values with the number of hectares to be cleared. This calculation results in the number of hectares that would be needed to fulfill the Significant Environmental Benefit (SEB) offset requirements. The spreadsheet also calculates a cost and an administration fee in dollars if a payment into the Native vegetation fund is the option taken to achieve the SEB. The area to be cleared was provided as a project footprint for the mine strandline and associated infrastructure footprint. The clearance areas for each of the blocks was then calculated to determine the TBS and SEB cost for each of these categories.

Data for scattered trees was entered into the scattered tree assessment scoresheet. Data entered included field data and suitability of each tree for fauna threatened species, as determined from the threatened species desktop search and ecological knowledge of these species. The spreadsheet calculates a Total Biodiversity Score (TBS) for each tree along with the number of SEB points required for an on-ground offset, and a total SEB payment for each tree where the offset is to be achieved by a payment into the Native Vegetation Fund.



## 3. Results

### 3.1. Flora

A total diversity of 152 flora species were recorded for the combined desktop survey (with a 5 km radius from the centre of the survey area) and the field survey conducted over five days from 15 to 19 November 2021. This total consists of 116 native species, and 36 introduced species. These results are discussed in more detail below.

#### 3.1.1. Desktop reviews

A flora list generated from NatureMaps for a radius of 5 km from the centre of the survey area produced a list of 79 species, of which 67 are native and 12 species are introduced (Appendix 1). Flora records are dominated by species from typical Mallee families such as Compositae (daisies), Chenopodiaceae (saltbush, bluebush etc), Gramineae (grasses), Leguminosae (peas and acacias), and Myrtaceae (eucalypts, tea-trees etc).

Vegetation mapping in NatureMaps identifies four Floristic Groups (vegetation communities) within the survey area all of which are Mallee woodland communities, and these are described below:

- Floristic Group MM14.01: *Eucalyptus leptophylla*, *Eucalyptus socialis* ssp. mid mallee woodland over +/- *Melaleuca lanceolata* shrubs over *Triodia irritans*, *Austrostipa* sp., +/- *Helichrysum leucopsideum* hummock grasses.
- Floristic Group MM17.01: *Eucalyptus calycogona* ssp. +/- *Eucalyptus dumosa* mid open mallee woodland over +/- *Melaleuca acuminata* ssp. *acuminata* shrubs over *Austrostipa* sp., *Danthonia* sp. tussock grasses.
- Floristic Group MM18.01: *Eucalyptus gracilis*, *Eucalyptus oleosa* ssp. *oleosa* mid open mallee woodland over +/- *Melaleuca lanceolata* shrubs over *Sclerolaena diacantha/uniflora*, *Austrostipa* sp., *Zygophyllum apiculatum*, *Maireana pentatropis* shrubs.
- Floristic Group MM19.01: *Eucalyptus incrassata* +/- *Eucalyptus leptophylla* mid mallee woodland over *Leptospermum coriaceum*, *Melaleuca uncinata*, *Callitris verrucosa*, *Babingtonia behrii* shrubs over *Hibbertia australis*, *Glischrocaryon behrii* shrubs.

Additional non-mallee vegetation communities were described for the Mindarie Minerals Sands Project in the previous PEPR (Murray Zircon 2017) as follows:

- *Maireana brevifolia* (Short-leaf Bluebush)/Exotic grassland Open Shrubland.
- *Atriplex nummularia* ssp. (Old-man Saltbush) Plantation.
- *Grevillea pterosperma* (Dune Grevillea)/*Acacia brachybotrya* (Grey Mulga-bush) Open Shrubland

The EPBC protected matters search (Appendix 3) identified that three threatened ecological communities (TECs) listed under the EPBC Act 1999 as potentially present within a 5 km buffer zone and potentially occurring within the survey area:

- The *Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions* (Buloke Woodlands) was listed as Endangered on 16 July 2000 and is given an occurrence likelihood of 'may occur' within the search area.
- The *Plains mallee box woodlands of the Murray Darling Depression, Riverina and Naracoorte Coastal Plain Bioregions* (Plains mallee box) was listed as Critically Endangered on 10 June 2021 and is given an occurrence likelihood of 'likely to occur' within the search area.
- The *Mallee Bird Community of the Murray Darling Depression Bioregion*, (TEC 151) was listed as Endangered on 7 December 2021 according to the Approved Conservation Advice for the Mallee Bird Community of the Murray Darling Basin Depression Bioregion. The conservation advice gives an occurrence likelihood of 'likely to occur' within the search area.

The *Buloke Woodlands of the Riverina and Murray Darling Depression Bioregions* TEC encompasses a number of closely-related woodland communities in which Buloke (*Allocasuarina luehmannii*) is usually a dominant or co-dominant tree (Cheal et al. 2011). Buloke Woodlands includes vegetation where Buloke is a minor component or may even be absent (Cheal et al. 2011). The presence of Buloke is not necessarily a reliable indicator of Buloke Woodlands, and the lack of Buloke does not necessarily preclude a vegetation stand from being part of this TEC. Other trees that may be prominent in Buloke Woodlands include:

- Slender Pine (*Callitris gracilis*) - a common codominant
- White/Murray Pine (*Callitris glaucophylla*) - a common associate
- Black Box (*Eucalyptus largiflorens*) - a frequent dominant from adjoining communities
- Yellow/Blue Gum (*Eucalyptus leucoxylon subsp. pruinosa*) - a common codominant
- Grey Box (*Eucalyptus microcarpa*) - a common codominant

The description for Buloke Woodlands TEC is not consistent with any vegetation community identified by the desktop survey.

The *Plains Mallee Box* TEC is primarily diagnosed by the dominance of the box-barked eucalypt species *Eucalyptus porosa* (Black Mallee Box) or *E. behriana* (Bull Mallee). In broad terms, *E. porosa* typically occurs in the northern and western parts of the ecological community's range, and *E. behriana* typically occurs in the southern and south-eastern parts of the ecological community's range. However, *E. calycogona* (Square-fruited Mallee), or *E. Dumosa* (White Mallee) may be dominant in some areas where they share understorey and other characteristics that are consistent with the ecological community. *Eucalyptus odorata* (Peppermint Box) may be codominant in some areas. *Allocasuarina luehmannii* (Buloke) and *Casuarina pauper* (Belah) can also be locally abundant, but not dominant across an entire patch.

The description for the Plains Mallee Box TEC is not consistent with any vegetation community identified by the desktop survey.

The *Mallee Bird Community of the Murray Darling Depression Bioregion* (MBC) TEC is a fauna community found in the Murray Darling Depression bioregion. It is an assemblage of bird species that are dependent on the mallee vegetation that characterises this bioregion. Mallee vegetation communities which provide habitat for the MBC species listed in the TEC are generally associated with unconsolidated aeolian sands in low rainfall zones, typically within the 200-350mm annual rainfall isohyets, though some areas receive up to 500mm rainfall (DAWE 2021, see Appendix 4 for further details).

The key diagnostics for determining whether the MBC TEC may be present are:

- It is present only within the Murray Darling Depression;
- Vegetation patches must be at least 10 hectares in size;
- Vegetation patches must have at least 5 hectares which are dominated by mallee which has at least 5% canopy cover which is dominated by Mallee Eucalypts; and
- At least three species of the Mallee bird community specialists or mallee dependants must be recorded at the site or within 20 km within the last ten years.

The MBC TEC uses the concept of a 'patch' which is a discrete and mostly continuous area of native vegetation as defined by the description and key diagnostics. It can include small-scale variations, gaps and disturbances within this area.

The vegetation types that are identified by DAWE (2021) as habitat for the *Mallee Bird Community of the Murray Darling Depression Bioregion* TEC are consistent with the four floristic groups identified in the Nature Maps desktop survey results. This community is discussed further in section 4.1.

### 3.1.2. Field Survey

The majority of the survey area consists of cropping lands with occasional scattered trees. The native vegetation communities present within survey area are dominated by mallee woodlands of various types as influenced by topography and soil characteristics (Enviro Data SA 2021). Modified vegetation communities include shrublands and introduced grasslands with or without the presence of emergent eucalypts.

The flora survey recorded six benchmark vegetation communities used for the Bushland Assessment Methodology as follows:

- MDBSA 2.1 Open Mallee / Low Open Woodland with Chenopod Shrub Understorey (3 sites) (Figure 5);
- MDBSA 2.2 Chenopod Open Shrublands (1 site) (Figure 6)
- MDBSA 3.1 Mallee with Very Open Sclerophyll / Chenopod Shrub Understorey (8 sites) (Figure 7);
- MDBSA 3.2 Mallee with Open Sclerophyll / Chenopod Shrub Understorey (5 sites) (Figures 8 and 11);
- MDBSA 3.3 Mallee with Open Sclerophyll / Chenopod shrub Understorey / *Triodia* Sandy Loam Flats / Swales (7 sites) (Figure 9);
- MDBSA 6.2 Tall Shrublands on Limestone Soils (1 site) (Figure 10).

The Mallee over sclerophyll / chenopod understorey communities (MDBA 2.1, 3.1, 3.2 and 3.3) were the dominant communities and are generally equivalent to the communities MM14.01, MM17.01 and MM 18.01 as identified in Nature Maps. The canopy layer was dominated by *Eucalyptus calycogona*, *Eucalyptus gracilis*, *Eucalyptus incrassata*, *Eucalyptus leptophylla*, *Eucalyptus oleosa*, *Eucalyptus phenax*, and *Eucalyptus socialis* (Appendix 1). The understorey was dominated by chenopods (*Rhagodia preissii*, *Maireana erioclada*, *Maireana brevifolia*, *Enchylaena tomentosa*, *Salsola australis*, *Sclerolaena diacantha*); myrtaceae (*Melaleuca lanceolata*, *Leptospermum coriaceum*), grasses (*Triodia irritans*, *Eragrostis sp.*, *Rytidosperma sp.* and *Austrostipa spp.*) as well as *Carpobrotus rossii* (Appendix 1 and Appendix 8, Ecosphere 2022).

A total of 127 species were recorded during the 25 bushland assessment surveys, of which 92 are native species and 35 introduced species (Appendix 1).

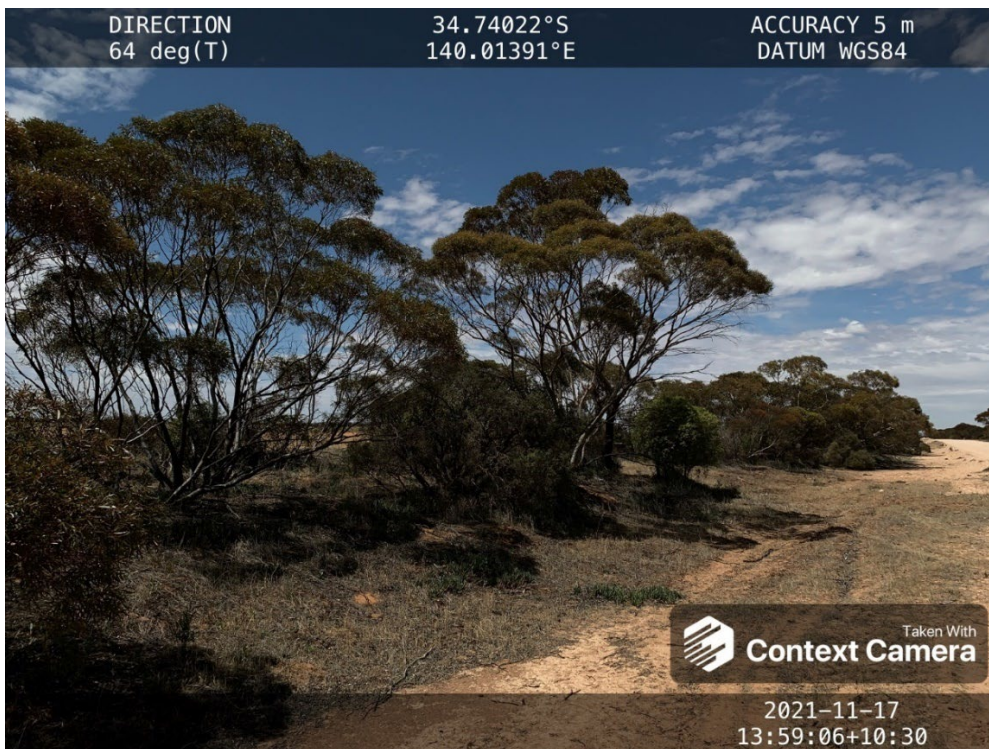
No threatened flora species listed under the EPBC Act 1999 or the NPW Act 1971 were recorded during the surveys.

A summary of the flora data is provided in Table 8 and large blocks and roadside vegetation is highlighted. The highest diversity of native species was in the larger vegetation blocks (A, B, P, R) and along roadside vegetation (C, D, H). The recorded diversity of these larger blocks ranged from of 19 species at Site A1 to 34 species at Site P1 which is a regenerating shrubland following clearance approximately 10 or so years ago (Table 8, 3). The diversity of native species within smaller blocks ranged from two species at Site M1 to 15 species at Site F1. Site H2 had a recorded native

species diversity of 14 species which is low and similar to smaller blocks however it is a highly modified shrubland with no canopy layer and a high diversity of weeds (Table 8).

Vegetation cover totals are generally higher for larger blocks and roadside vegetation with totals ranging from 16 to 26 (Table 8). This compares with a range of 3 to 20 for smaller blocks and indicates that larger diversity of lifeforms and greater cover of these lifeforms are present in the larger blocks. It is notable that the mature tree density scores are not significantly different between the larger and smaller blocks which reflects that the blocks still retain most of the canopy layer. The lower vegetation cover totals in the smaller blocks is therefore a result of loss of cover in the mid-storey and understorey layers. This is attributed to higher grazing pressure in these smaller blocks resulting a loss of palatable species with grasses, sedges and mat plants appearing to be most impacted (Table 8). These blocks are all located within fenced paddocks and are therefore exposed to periodic grazing.

It is notable that all blocks, apart from Block P, have some hollows (Table 8) regardless of size or grazing history. Remnant vegetation blocks retain an overstorey and have either not been cleared or were cleared sufficiently long ago for hollows to form. Cover of fallen timber / leaf litter is not significantly different between larger and smaller blocks as this is primarily influenced by tree cover which is also similar (Table 8).



**Figure 5. Open Mallee / Low Open Woodland with Chenopod Shrub Understorey (vegetation community MDBSA 2.1) at Site D1**



**Figure 6** *Chenopod Open Shrublands (vegetation community MDBSA 2.2) at Site H2*



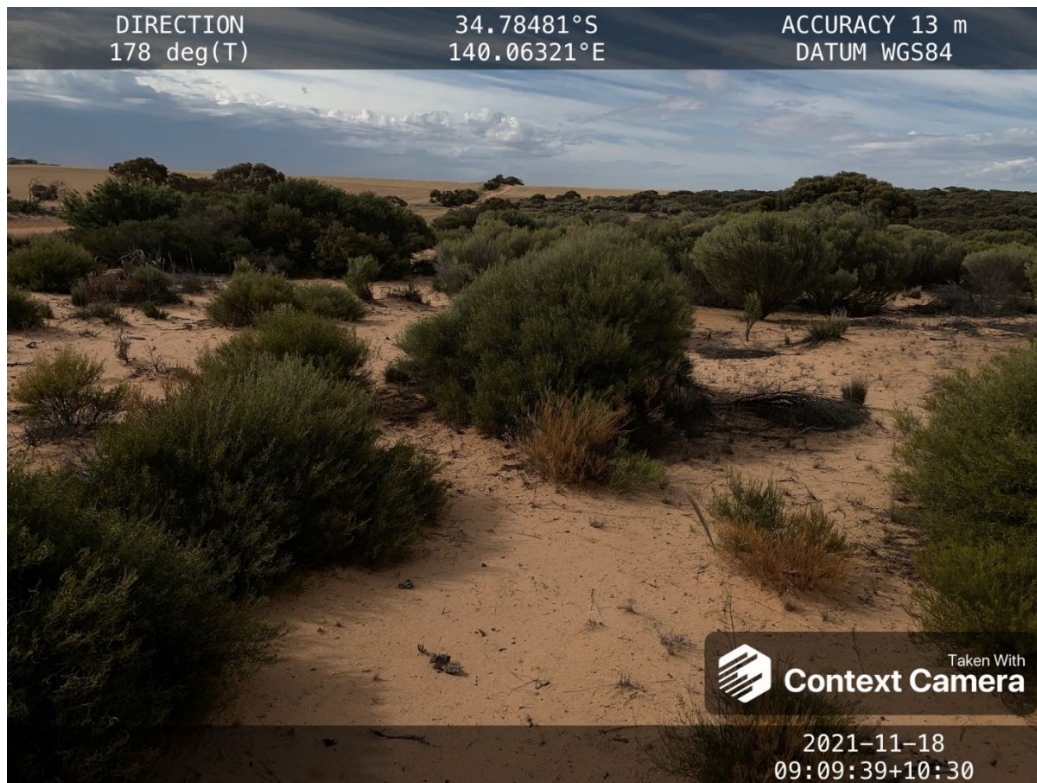
**Figure 7.** *Mallee with Very Open Sclerophyll / Chenopod Shrub Understorey (vegetation community MDBSA 3.1) at Site I1*



**Figure 8. Mallee with Open Sclerophyll / Chenopod Shrub Understorey (vegetation community MDBSA 3.2) at Site B2**



**Figure 9. Mallee with Open Sclerophyll / Chenopod shrub Understorey / Triodia Sandy Loam Flats / Swales (vegetation community MDBSA 3.3) at Site A1**



**Figure 10. Tall Shrublands on Limestone Soils (vegetation community MDBSA 6.2) at Site P1**



**Figure 11. Mallee with Open Sclerophyll / Chenopod Shrub Understorey (vegetation community MDBSA 3.2) at Site R1**



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**Table 8 – Flora survey results summary. Larger blocks and roadside vegetation sites are shaded. Note that some blocks and sites are outside of the project footprint and are therefore not considered in the SEB calculation.**

Site	A1	A2	B1	B2	C1	C2	D1	D2	E	F	G	H1	H2	I	J	K	L	M	N	O	P	Q	R1	R2	R3	
<b>Tenement</b>	ML6137																ML 6225	MPL76	MPL78	MPL 77 & 79	MPL 77					
<b>Species diversity</b>																										
<b>MBDS Veg Community</b>	3.3	3.3	3.3	3.2	3.3	3.3	2.1	2.1	3.2	3.2	3.1	3.3	2.2	3.1	3.1	3.1	3.1	3.1	3.1	3.1	6.2	2.1	3.2	3.2	3.3	
<b>Total Species diversity</b>	23	28	28	20	34	25	29	40	27	22	19	38	27	14	9	16	25	3	9	17	37	19	17	34	9	
<b>Native species diversity</b>	19	26	24	18	24	22	21	30	14	15	10	26	14	9	4	10	17	2	5	13	34	11	7	24	4	
<b>Introduced species diversity</b>	4	2	4	2	10	3	8	10	13	7	9	12	13	5	5	6	8	1	4	4	3	8	10	10	5	
<b>Vegetation life form - cover ratings</b>																										
1 = not many, cover < 1%; 2 = 1 - %; 3 = 6-25%; 4 = 26-50%; 5 = 51-75%; 6 = >75%																										
<b>Mallee &gt;5m</b>	2	2	2	3	4	4	3	3	1	3	3	2	2	3	4	3	2	1	1	3		3				
<b>Mallee &lt;5m</b>	4	5	5	5	4	3	4	5	2	5	4	5	2	4	3	3	5	2	2	3	1	3		3	3	
<b>Shrubs &gt;2m</b>	3	3	3	1	3	2	4	2	3	2	1	3	1				1		1	2	4	2	1	2	2	
<b>Shrubs 0.5-2m</b>	3	2	3	2	4	3	4	4	2	4	2	3	3			2	1			2	4	1	1	2		
<b>Shrubs &lt;0.5m</b>	2	2	2	2	3	2	3	2	3	3	2	2	4	1	2	2	2		1	1	2	2		2	1	
<b>Forbs</b>	1	2	1	1	1			1	2			1	1	1	1		1				2	1	1	2	1	
<b>Mat plants</b>					3	2	2	3				2	1													
<b>Grasses &gt;0.2m</b>	1	1	1	1	1	1	1	2				1	1				1				2		1			
<b>Grasses &lt;0.2m</b>	1	2	1	1	1	1	1	1	1	2		1	1				1				2	1		2		
<b>Sedges</b>	1	1	1		1							1									1					

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Site	A1	A2	B1	B2	C1	C2	D1	D2	E	F	G	H1	H2	I	J	K	L	M	N	O	P	Q	R1	R2	R3	
<b>Hummock Grass</b>	4	4	4		1	1	1	1		1	1	1								1	2					
<b>Vines/ climbers</b>	1	2	1					1												1				1		
<b>Cover Total</b>	23	26	24	16	26	19	23	25	14	20	13	22	16	9	10	10	14	3	5	13	20	13	4	14	7	
<b>Vegetation/Habitat Structure Scores (from Bushland Assessment Method)</b>																										
<b>Mature Tree Density (0 to 8)</b>	4	6	6	5	8	8	8	6	5	8	8	8	2	4	3	6	6	3	2	3	1	6	0	4	3	
<b>Native: Weed (0 - 5)</b>	5	5	4	5	4	5	4	4	3	4	3	4	3	0	3	0	3	0	0	3	5	3	1	4	0	
<b>Fallen Timber/ Leaf Litter (0 to 5)</b>	3.5	3.5	4	4	5	4	5	4	4	4	3.5	4	0.5	3	4.5	3.5	3.5	3	3	3.5	1.5	4	0	3	3.5	
<b>Hollows (0 to 5)</b>	2	2	3	4	2	2	2	3	4	4	4	2	2	1	3	4	1	3	3	2	0	3	0	2	0	

### 3.1.3. Weeds

Thirty species of weeds were recorded during the flora survey (Appendix 1). The most commonly recorded weeds are listed below. Four weed species recorded are listed as Declared weeds under the *Landscapes South Australia Act 2019*, and one is a Weed of National Significance as identified below:

- *Aira cupaniana* (Small Hair-grass)
- *Avena barbata* (Bearded Oat)
- *Brassica tournefortii* (Wild Turnip)
- *Echium plantagineum* (Salvation Jane): **Declared**
- *Euphorbia terracina* (False Caper)
- *Hordeum vulgare* (Barley)
- *Lycium ferocissimum* (African Boxthorn): Declared and Weed of National Significance
- *Marrubium vulgare* (Horehound): **Declared**
- *Mesembryanthemum crystallinum* (Common Iceplant)
- *Reichardia tingitana* (False Sowthistle)
- *Salvia verbenaca* (Wild Sage).
- *Tribulus terrestris* (Caltrop): **Declared.**

## 3.2. Fauna

A total fauna diversity of 87 species was recorded for the combined desktop survey (with a 5 km radius from the centre of the survey area) and the two field surveys conducted over five days from 15 to 19 November 2021 and on 27 July 2022. This consists of 76 species of birds, seven species of mammals and four reptile species. These results are discussed in more detail below.

### 3.2.1. Desktop Review

The desktop review of the NatureMaps records for a 5 km radius of the project area returned 52 species of birds, four species of mammals and three species of reptiles (Enviro Data SA 2021, Appendix 2). No species of amphibians or fish were included in the results. Desktop results are discussed further within each fauna group below.

EPBC and state listed fauna species are discussed in Section 3.3 along with birds which are listed in the Threatened Ecological Community; *Mallee Bird Community of the Murray Darling Depression Bioregion*.

### 3.2.2. Field survey summary

Survey results for vertebrate animals are summarised in Table 9 with detailed results provided by site in Appendix 2. In Appendix 2, records are shown for each fauna survey site and opportunistically within the survey area according to the methodology used as follows:

- O = observed
- S = songmeter record
- D = diggings
- T/S = Tracks and scats

**Table 9 – Summary of fauna taxa recorded during the filed survey**

<b>Fauna group</b>	<b>EPBC</b>	<b>NPW SA</b>	<b>Introduced</b>	<b>Native</b>	<b>Study total</b>
Birds		3	4	57	61
Terrestrial mammals			5	2	7
Reptiles				4	4
<b>Total</b>	<b>0</b>	<b>2</b>	<b>9</b>	<b>63</b>	<b>72</b>

A total of 72 species of vertebrate animal species were recorded during the field survey with 61 species of birds, two native terrestrial mammal, five introduced terrestrial mammals, and four reptiles (Table 9, Appendix 2). No amphibian or fish species were recorded during the survey which is consistent with the absence of any wetlands in the survey area apart from occasional clay lined pastoral dams.

These results reflect the intensive agricultural use of the area, the small size of retained vegetation blocks and the observational nature of the study with no trapping conducted.

The greatest recorded fauna diversity was in the largest vegetation blocks (Appendix 2) which had songmeters located in them; Block A (28 species), Block B (38 species) and Block L (24 species). The survey area is not large and many of the sites are in close proximity, (at a landscape level). Block R is the most distant block from the Mercunda Strandline at approximately 8 kms from the western end (Figure 3). A large degree of overlap in wildlife use between these is therefore to be expected, particularly for birds. Block P is part of a large vegetation block adjoining Bandon Conservation Park which appears to have varied vegetation communities including dense shrubland and mature mallee. It was however not intensively surveyed as any potential disturbance within this block is limited to a thin strip at the edge (for MPL 78).

The results for each fauna group are discussed further below.

### 3.2.3. Birds

Typical of most Australian landscapes, birds were the most recorded fauna group observed making up 86% of the species recorded and the great majority of records.

A total of 61 native species of birds were recorded during the surveys (Appendix 2). This compares with 52 species listed in the 5 km NatureMaps desktop search for the Mercunda survey area (Appendix 2, Enviro Data SA 2021). Bird fauna was characterised by pigeons, parrots, thornbills, honeyeaters, Grey Butcherbird, Australian Magpie, corvids (crows and ravens) and woodswallows (Appendix 2). Three species of nightbirds were recorded, Australian Owlet Nightjar, Tawny Frogmouth, and Barn Owl of which the first two were commonly recorded on songmeters each night at most sites.

Two state listed bird species were recorded during the surveys, White-winged Chough *Corcorax melanorhamphos* and Jacky Winter *Microeca fascinans fascinans* as shown in Figure 12. White-winged Chough was recorded in five blocks (A, B, C, H and Q) all of which are larger vegetation remnants or roadside vegetation. It is likely to be resident in the areas where it was observed (Figure 12). White-winged Chough nests were recorded in Block A and Block B. Jacky Winter was observed in Block B only and was observed two times and heard on songmeter recordings over two days.

Three recorded species of birds are listed as mallee dependant species under the Threatened Ecological Community; *Mallee Bird Community of the Murray Darling Depression Bioregion* (see Appendix 4 for full description). These species are Spotted Pardalote *Pardalotus punctatus* (recorded in Blocks A, B, C and D), Yellow-plumed Honeyeater *Ptilotula ornata* (recorded in Blocks A and B) and Jacky Winter (recorded in Block A). Vegetation blocks were systematically searched for Malleefowl mounds and other signs of Malleefowl presence but no mounds, tracks, or other signs of Malleefowl were observed during the survey.

Recorded bird diversity was highest in Block B (34 species) which is the largest of the vegetation blocks surveyed and had two songmeters located within it. The other larger blocks, A and L had recorded bird diversities of 24 and 21 species respectively. Roadside vegetation along Walker Flat Road (Blocks C and D) and Jacka road (Block H) had 13 and 8 bird species recorded respectively which is low compared to larger sites. Many birds are likely to use roadside vegetation as corridors between patches and these areas may contain fewer resident birds due to their linear shape. Recorded bird diversity in Block R was 17 species (Appendix 8, Ecosphere 2022).

Small, degraded vegetation blocks with little understorey (such as blocks E, J, M and N) typically had recorded bird diversity of less than five species. Block P is part of a large vegetation block that extends out of the survey zone however only a small strip of vegetation would potentially be impacted, and it was not fully surveyed for birds. Malleefowl has historically been recorded in this block (Enviro Data SA 2021) and it is expected to have a higher fauna diversity than blocks surveyed.

The most recorded species within vegetation blocks surveyed are identified in Table 10. A number of species such as Richards Pipit *Anthus australis*, Brown Songlark

*Megalurus cruralis* and Eurasian Skylark *Alauda arvensis* are typical of open areas and were primarily recorded in paddocks.

Some breeding activity was observed with a Masked Woodswallow *Artamus personatus* nest containing two eggs recorded in Block B. The mallee woodlands contained many hollows suitable for nesting and roosting for a range of fauna species including bats, smaller arboreal mammals such as pygmy possums, and birds such as parrots, owl-nightjars, pardalotes and martins.

Observations of listed fauna species are discussed in Section 3.3.2.

**Table 10 – The most commonly recorded bird species at vegetation blocks surveyed**

<b>Common Name</b>	<b>Scientific Name</b>	<b>No of Block recorded at (n = 18)</b>
Australian Magpie	<i>Gymnorhina tibicen</i>	10
Masked Woodswallow	<i>Artamus personatus</i>	8
Singing Honeyeater	<i>Lichenostomus virescens</i>	8
Blue Bonnet	<i>Northiella haematogaster</i>	7
Galah	<i>Cacatua roseicapilla</i>	7
Australian Ringneck	<i>Barnardius zonarius</i>	6
Yellow-throated Miner	<i>Manorina flavigula</i>	6
Grey Butcherbird	<i>Craticus torquatus</i>	6
Crested Pigeon	<i>Ocyphaps lophotes</i>	6
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	6
Weebill	<i>Smicronis brevirostris</i>	6
Willie Wagtail	<i>Rhipidura leucophrys</i>	6
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	5
White-browed Woodswallow	<i>Artamus superciliosus</i>	5
*Common Starling	<i>Sturnus vulgaris</i>	5
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	5
Common Bronzewing	<i>Phaps chalcoptera</i>	4
Tawny Frogmouth	<i>Podargus strigoides</i>	4
Rainbow Bee-eater	<i>Merops ornatus</i>	4
Spotted Pardalote	<i>Pardalotus punctatus</i>	4
Red Wattlebird	<i>Anthochaera carunculata</i>	4
Little Crow	<i>Corvus bennetti</i>	4
White-winged Chough	<i>Corcorax melanorhamphos</i>	4
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	4
Banded Lapwing	<i>Vanellus tricolor</i>	3
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	3
Striated Pardalote	<i>Pardalotus striatus</i>	3
* House Sparrow	<i>Passer domesticus</i>	3

### 3.2.4. Mammals

The desktop fauna survey contained records of only two native species, Western Grey Kangaroo *Macropus fuliginosus* and Echidna *Tachyglossus aculeatus* within 5 km of the survey area (Enviro Data SA 2021). When the desktop search buffer was increased to 20 km an additional two species of kangaroos (Red Kangaroo *Macropus rufus*, Swamp Wallaby *Wallabia bicolor*) and two species of bats (Gould’s Wattle Bat *Chalinolobus gouldii*, Lesser Long-eared Bat *Nyctophilus geoffroyi*) were included. No small mammal species have been recorded within 20km of the Mercunda project area (Enviro Data SA 2021) however Silky Mouse *Pseudomys apodemoides*, Fat-tailed

Dunnart *Sminthopsis crassicaudata* and Common Dunnart *Sminthopsis murina* are widespread, although generally uncommon, in the Murray Mallee region (Foulkes and Gillen 2000; Owens and Graham 2009). Hairy-nosed Wombat *Lasiorhinus latifrons*, was previously common in the Murray Mallee (Foulkes and Gillen 2000) but is now not known to occur south of the Murray River. Additional species of bats that are widespread in the Murray Mallee include Chocolate Wattled Bat *Chalinolobus morio*, Southern Free-tailed Bat *Mormopterus planiceps*, Southern Forest Bat *Vespadelus regulus*, Little Forest Bat *Vespadelus vulturnus*, and White-striped Free-tailed Bat *Austronomus australis* (Foulkes and Gillen 2000; Owens and Graham 2009).

Introduced mammals are widespread in the Murray Mallee area with the most common and widespread species being Rabbit *Oryctolagus cuniculus*, Brown Hare *Lepus europaeus*, Domestic Cat *Felis catus*, Red Fox *Vulpes vulpes*, House Mouse *Mus musculus*, Black Rat *Rattus rattus* (Foulkes and Gillen 2000; Owens and Graham 2009).

During the field survey one native mammal species, Western Grey Kangaroo, was observed twice. Kangaroo numbers appeared to be low within the survey area which is likely to reflect active management through culling to reduce competition with sheep. Echidna diggings, which are distinctive, were observed in four of the largest vegetation blocks (A, B, H, L).

Additional mammal species may occur in the survey area, most likely in Bandon Conservation Park and the adjacent blocks of native vegetation to the north-east which extend to Block P.

Evidence of introduced mammals was commonly observed, especially rabbit diggings and warrens, cat tracks (in sandy areas) and scats of foxes. Brown Hare was opportunistically observed twice.

### 3.2.5. Reptiles

The desktop survey contained records of three reptile species Mallee Dragon *Ctenophorus fordii*, Sleepy Lizard *Tiliqua rugosa* and Bearded Dragon *Pogona* sp. within 5 km of the survey area (Appendix 2, Enviro Data SA 2021). When the desktop search buffer was increased to 20 km records of an additional seven species of terrestrial reptiles were included as follows; Bynoe's Gecko *Heteronotia binoei*, Bougainville's Skink *Lerista bougainvillii*, Mallee Snake-eye *Morethia obscura*, Western Brown Snake *Pseudonaja nuchalis*, Eastern Brown Snake *Pseudonaja textilis*, Common Barking Gecko *Underwoodisaurus milii* and Sand Goanna *Varanus gouldii*.

Few reptiles were observed during the survey which were mostly larger diurnal species such as Sleepy Lizard *Tiliqua rugosa* and Bearded Dragon *Pogona vitticeps*. One species of dragon (*Ctenophorus* sp.) and unidentified skink were also observed opportunistically. As with mammal additional reptile species may occur in the survey area most likely in Bandon Conservation Park and the adjacent blocks of native vegetation to the north-east which extend to Block P.



## 4. Threatened Ecological Community and species impact assessment

### 4.1. Threatened Ecological Communities

None of the floristic communities identified in the desktop survey results were consistent with the descriptions of the *Buloke Woodlands Threatened Ecological Community* or the *Plains Mallee Box Threatened Ecological Community*. The field survey results confirmed that neither of these TECs are present within the Mercunda Strandline survey area and these TECs are not considered further in the impact assessment and are not included in the SEB calculation.

The *Mallee Bird Community of the Murray Darling Depression Bioregion* TEC was identified as present within four native vegetation blocks in the Mercunda strandline (see Table 11). The whole survey area is within the Murray Darling Depression and more than three mallee dependant bird species recorded within 20 km (Table 12). The MBC TEC conservation advice uses the term 'patches' rather than 'blocks' which is used in the NVC Bushland Assessment Methodology. Blocks are contiguous areas of native vegetation which may have a more than one vegetation community. The definition of a patch that may support the MBC TEC is:

- Native vegetation areas greater than 10 ha; and
- at least five hectares with an overstorey (canopy) dominated by mallee and at least 5% cover but typically not closed; and
- an understorey dominated by native vegetation; and
- allows for other non-mallee trees within the patch as long as mallee is dominant; and
- allows for breaks of up to 100 m and for narrow strips of different vegetation and different fire histories within a patch.

Vegetation blocks A, B, C and H1 were confirmed as meeting these patch definition requirements and are therefore identified as areas where the MBC TEC may be present (Table 11).

Three mallee dependant bird species were recorded during the field survey (Table 12). An additional two mallee specialist bird species and eight mallee dependent bird species have been recorded within 20 km of the project area within 10 years (Table 12). An additional species, Grey-fronted Honeyeater was recorded within 20 km but more than 10 years ago. Consequently, these blocks are identified as *Category A: High number of Mallee Bird Community species* as at least five MBC species, with any mix of mallee specialist and dependent species have been recorded within 20 km less than ten years ago. This TEC is therefore included in the SEB calculation.

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**Table 11: Assessment of key diagnostics for the Mallee Bird Community of the Murray Darling Depression Bioregion Threatened Ecological Community (MBC TEC) against each vegetation block/patch to be cleared within the Mercunda Strandline to determine which are habitat for the MBC TEC.**

	Key Diagnostic	BLOCK No.								
		A	B	E	G	H1	H2	R1	R2	R3
1	Is the area of interest within, or partially within any of the following IBRA bioregions or subregions? <ul style="list-style-type: none"> <li>MDD bioregion (all seven subregions)</li> <li>Riverina subregions (RIV03, RIV05, RIV06)</li> <li>Darling Riverine Plains subregions (DRP08 and DRP09)?</li> </ul>	The entire survey area and all the survey blocks are within The Murray Darling Depression (MDD) Bioregion and the Murray Mallee subregion.								
2	Is a patch of native vegetation of at least 10 ha (either wholly or partially within a site)? <ul style="list-style-type: none"> <li>where native species are the dominant or most common species present in each, both the canopy and the understorey.</li> </ul>	Yes	Yes	No - less than 10 hectares	No - less than 10 hectares	Yes	No	Yes	Yes	No- native species are not dominant in the understorey
3	Does the patch of native vegetation contain an area, or areas of at least 5 hectares dominated by mallee? <ul style="list-style-type: none"> <li>Vegetation structure is a native woodland to shrubland where a tree canopy is present that is at least sparse (5% crown cover) but not typically closed; AND</li> <li>Mallee eucalypt trees are the dominant tree canopy type present. Other non-mallee trees (i.e. non-mallee eucalypts or non-eucalypt native species) may be present in the tree canopy but do not represent the most common structural type averaged across the remnant or site; AND</li> <li>Native species dominate the understorey with at least 50% of the total perennial vegetation cover of the ground layer plus mid layer below</li> </ul>	Yes	Yes	No - less than 10 hectares	No - less than 10 hectares	Yes	No - Tree canopy is less than 5% cover	Yes	No - Tree canopy is less than 5% cover	No - native species are not dominant in the understorey

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	Key Diagnostic	BLOCK No.								
		A	B	E	G	H1	H2	R1	R2	R3
	2 metres height on average across the patch; AND • The vegetation is mostly continuous with “breaks” of 100 m, or less, between areas that meet the habitat description. Such breaks may be the result of watercourses or drainage lines, water bodies e.g. farm dams, tracks, paths, roads, gaps made by exposed areas of soil or litter, and areas of localised variation in vegetation that do not meet the description. (Section 2.3.2.1 in conservation advice).									
4	Does the patch support at least 3 MBC species (any mix of mallee specialist and dependent species) have been recorded from current bird surveys and/or from existing bird observation records within 20 km of the site and within the last ten years?	Yes, for all blocks: <ul style="list-style-type: none"> <li>• Three species of Mallee dependant bird species recorded during the survey within the Mercunda Strandline survey area;</li> <li>• two species of Mallee specialists, and eight species of Mallee dependants recorded within 20 km less than 10 years ago (as identified in Table 12).</li> </ul>								
5	Does the vegetation block meet the key diagnostic requirements to be designated as a patch of the Mallee Bird Community of where the Murray Darling Depression Bioregion Threatened Ecological Community may be present.	<b>Yes</b>	<b>Yes</b>	<b>No</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>No</b>

**Table 12 Specialist and Mallee dependent bird species listed under the Mallee Bird Community of the Murray Darling Depression Bioregion Threatened Ecological Community. Desktop records are included with the date of the last record within 20 km of the survey site and dates of records obtained during the field survey are given. Records are required to be within the last ten years as per the MBC TEC definition. Shaded date cells are not within this time period.**

Common name	Species name	EPBC Status	SA Status	Date of desktop records within 20 km	Observed in Mercunda survey area
<b>Mallee Specialists</b>					
Black-eared Miner	<i>Manorina melanotis</i>	E	E		
Chestnut Quail-thrush	<i>Cinclosoma castanotum ssp castanotus</i>		R	29-Apr-2015	
Mallee Emu-wren	<i>Stipiturus mallee</i>	E	E		
Malleefowl	<i>Leipoa ocellata</i>	V	V	29-Apr-2015	
Red-lored Whistler	<i>Pachycephala rufogularis</i>	V	R		
Scarlet-chested Parrot	<i>Neophema splendida</i>		R		
Striated Grasswren	<i>Amytornis striatus</i>		R		
Mallee Western Whipbird	<i>Psophodes nigrogulari</i>	V	E		
<b>Mallee dependents</b>					
Crested Bellbird	<i>Oreoica gutturalis</i>			29-Apr-2015	
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>			22-Jan-2002	
Jacky Winter	<i>Microeca fascinans</i>		R	28-Apr-2015	16-Nov-22
Purple-gaped Honeyeater	<i>Lichenostomus cratitius</i>		R	26-Oct-2012	
Regent Parrot	<i>Polytelis anthopeplus</i>	V	E	20-Jul-2012	
Shy Heathwren	<i>Hylacola cauta cauta</i>		R	23-Oct-2012	
Southern Scrub-robin	<i>Drymodes brunneopygia</i>			29-Apr-2015	
Splendid Fairy-wren	<i>Malurus splendens</i>			27-Apr-2015	
Spotted Pardalote	<i>Pardalotus punctatus</i>			27-Apr-2015	16-Nov-22
White-eared Honeyeater	<i>Nesoptilotis leucotis</i>			29-Apr-2015	
White-fronted Honeyeater	<i>Purnella albifrons</i>			25-Oct-2012	
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>			29-Apr-2015	16-Nov-22

## 4.2. Listed Flora Species

No flora species listed under the EPBC Act 1999 or the NPW Act 1971 were recorded during the surveys.

The NatureMaps desktop search returned no records of threatened species listed under the NPW Act 1972 or EPBC Act 1999 within the 5 km radius desktop survey area (Appendix 1, Enviro Data SA 2021). The Protected Matters 5 km radius search did however return five EPBC listed flora species (Table 13, Appendix 3). The five species were all identified as 'May occur' in the area (Appendix 3) rather than as 'Species or species habitat known to occur within area' which is the highest confidence level for a species presence in a search area. The five species are discussed below.

*Lepidium monolocoides* is an annual herb which has been recorded from the Murray Mallee region although the vegetation communities it occurs in are not well described. It is known from Bimble box communities in western New South Wales, a habitat that is not present in the Mercunda area (Jessop and Toelken 1986; Cunningham et al. 1992). Its presence in the survey area is considered unlikely due to the lack of its primary habitat. The nearest record in Naturemaps is along the River Murray approximately 72 km to the north-east (Enviro Data SA 2021). This assessment concludes that *Lepidium monolocoides* is unlikely to occur in the survey area.

*Swainsona pyrophila* is a short-lived perennial shrub to 1m tall but usually only found after fire. It grows in mallee scrub on sandy or loamy soil and is known from disturbed sites such as previously burnt *Eucalyptus dumosa* mallee, disturbed woodland in sheltered aspects, firebreaks adjacent to wheat paddocks, roadsides, and claypans area (Jessop and Toelken 1986; Cunningham et al. 1992). Has been recorded in small to moderately large populations, from a few to several hundred plants which are often scattered. The nearest record in Naturemaps is approximately 62 km to the north-east (Enviro Data SA 2021). This assessment concludes that *Swainsona pyrophila* is unlikely to occur in the survey area.

*Caladenia tensa* occurs in mallee with a shrublayer of *Melaleuca uncinata* and *Callitris* spp., *Eucalyptus leucoxylon* woodlands on Tertiary and Quaternary aeolian sandy loams in the Murray-Darling Depression bioregion. It is known to occur in Billiat Conservation Park (Todd 2000). These habitats were not recorded in the survey area but may have occurred historically prior to wide scale clearance for agriculture and disturbance by grazing. It is possible that this species historically occurred in the survey area but is sensitive to grazing and soil disturbance which reduces mycorrhizal fungi in the soil on which the orchids depend. The nearest record in Naturemaps is approximately 26 km to the south-west (Enviro Data SA 2021). This assessment concludes that *Caladenia tensa* is unlikely to occur in the survey area.

*Pterostylis xerophila* occurs singly or in small populations in mallee scrub with fertile soils on or around granite or quartzite rock outcrops, less commonly on fertile alluvial flats. Flowering time for this species is in spring. It is a cryptic species its presence in

the survey area is considered unlikely due to the lack of rock outcrops and the disturbed nature of the understorey area (Jessop and Toelken 1986; Cunningham et al. 1992). The nearest record in Naturemaps for this species are in the Murray-Sunset region in Victoria (Atlas of Living Australia 2022). This assessment concludes that *Pterostylis xerophila* is unlikely to occur in the survey area.

*Dodonaea subglandulifera* grows to a height of one to two meters tall in mallee woodland, often with *Callitris preissii* and *Allocasuarina sp.* and has also been found in acacia shrubland area (Jessop and Toelken 1986). It occurs in low hills and plains on loamy soils with rocky (limestone, slate, shale) outcrops. A population is known to occur at Walkers Flat approximately 40 km to the west (Enviro Data SA 2021). Given its size and distinctive foliage it would be easily detected. The preferred habitat type for this species was not recorded within the survey area. This assessment concludes that *Dodonaea subglandulifera* is unlikely to occur in the survey area.

**Table 13 –Threatened flora species desktop search results for a 5 km radius from the centre of survey area from the EPBC listed search. EPBC and NPW Act categories are: E = endangered, V = Vulnerable, R = rare.**

Family Name	Species	Common Name	EPBC Rating	NPW SA Rating	EPBC Likelihood	Mercunda Impact Assessment Conclusion
Cruciferae	<i>Lepidium monophlooides</i>	Winged Pepper-cress	E	E	May occur	Unlikely to occur
Leguminosae	<i>Swainsona pyrophila</i>	Yellow Swainson-pea	V	R	May occur	Unlikely to occur
Orchidaceae	<i>Caladenia tensa</i>	Greencomb Spider-orchid	E		May occur	Unlikely to occur
Orchidaceae	<i>Pterostylis xerophila</i>	Desert Greenhood	V	V	May occur	Unlikely to occur
Sapindaceae	<i>Dodonaea subglandulifera</i>	Peep Hill Hop-bush	E	E	May occur	Unlikely to occur

### 4.3. EPBC Act (1999) Listed Fauna Species

A desktop review of EPBC listed species through the Protected Matters Search Tool (PMST, DAWE 2021) returned 12 fauna species for the 5 km radius search (Appendix 3). Of the 12 fauna species, only one (Malleefowl *Leipoa ocellata*) has been recorded within 5 km of the survey area (Enviro Data SA 2021) and two other species (Grey Falcon *Falco hypoleucos*, Regent Parrot *Polytelis anthopeplus monarchoides*) are identified as 'likely to occur' (Table 14). Species included in the PMST results that are identified as marine or migratory (M) are not included in this assessment as they are not endangered and therefore not considered in the NVC Bushland Assessment Methodology (2020). The remaining nine species are listed as 'may occur or may have species habitat occurring' in the survey area (Table 14) and therefore in accordance with the NVC Bushland Assessment Methodology (2020) are not considered in the SEB calculation.

The Malleefowl is found in semi-arid shrublands and woodlands, especially those dominated by mallee and/or acacias (Benshemesh 2007). It was once wide-spread throughout large continuous semi-arid areas of western and southern Australia (Foulkes and Gillen 2000). In the Murray Mallee they have been recorded in various mallee-type habitats ranging from coastal mallee with a heath or thicket understorey in the south to semi-arid mallee with a saltbush, bluebush or *Triodia spp.* understorey in the north (Foulkes and Gillen 2000). Densities of the birds are generally greatest in areas of higher rainfall and on more fertile soils where habitats tend to be thicker and there is an abundance of food plants (Benshemesh 2007). Malleefowl eat seeds, buds, lerps, herbaceous plant matter and invertebrates and do not require permanent water (Benshemesh 2007, Marchant and Higgins 1993). Important grazing plants include shrubs such as *Acacia spp.*, *Cassia spp.*, *Beyeria spp.* and *Lomandra spp.* as well as a wide range of herbs (Marchant and Higgins 1993). They are known to feed on spilt wheat and other grain crops where adjacent to mallee and also feed on weed species such as *Brassica tournefortii* (Marchant and Higgins 1993). A sandy substrate and abundance of leaf litter are required for breeding. Malleefowl build mounds out of decomposing organic matter for the incubation of its eggs, and after egg laying, the male tends to the nest. Nests are large and conspicuous and therefore easily detected.

Much of the best habitat for Malleefowl has already been cleared or has been modified by grazing by sheep, cattle, rabbits and goats. The species has been shown to be highly sensitive to grazing by sheep and probably other introduced herbivores (Benshemesh 2007). Predation of young by introduced cats and foxes is considered to be impacting Malleefowl and in many areas and may be a major cause of decline. The degree of fragmentation of the remaining Malleefowl habitat is of particular concern and presents a major limiting factor to halting and reversing the decline of the species (Benshemesh 2007). Remnant native vegetation blocks remaining in the Mercunda Strandline survey area are considered to be poor quality habitat for Malleefowl as they are heavily grazed by sheep, generally small and highly fragmented. The understorey is open to sparse in all blocks and contains a low density of food plants for the species. Suitable habitat is likely to occur within Bandon Conservation Park and the species has been recorded in Block P, adjacent to MPL 78. These blocks are likely to be too small and isolated to support a population of Malleefowl. Malleefowl are generally sedentary occurring within home ranges but may disperse over larger areas due to environmental conditions or population pressures. They are known to use well vegetated corridors during dispersal (Benshemesh 2007). There are a number of Malleefowl populations within 30 to 50 km of the survey area to the north, south-east, south-west and north-west of the project area (Enviro Data SA 2021) and they may temporarily occur in suitable habitat adjacent to the project area during dispersal.

This assessment concludes that the Mercunda Strandline project area is poor quality habitat for the Malleefowl and as such is unable to support resident Malleefowl but that they are likely to occasionally use the survey area as they disperse throughout the landscape between suitable areas. As such this species is included in SEB calculations.

The eastern race of the Regent Parrot is endemic to the Murray Darling Depression and it is distributed through north-western Victoria, south-eastern South Australia and southwestern NSW (Baker-Gabb and Hurley 2011). It breeds exclusively in hollows in large, senescent or dead River Red Gums within the river floodplain along the Murray River from Boundary Bend in NSW to Morgan in South Australia (Burbidge 1985). It occurs in River Red Gum forests and woodlands and in nearby open mallee woodland dominated by *Eucalyptus largiflorens* and in mixed mallee woodlands of *E. dumosa*, *E. oleosa*, *E. incrassate*, *E. socialis*, *Casuarina cristata*, *Allocasuarina lehmanniana* and *Callitris pressii* often with an understorey of *Triodia* (Higgins 1999). Regent Parrot primarily feeds on seeds of grasses (including crops) and herbaceous plants as well as on fruits, buds flowers and occasionally insect larvae and lerps (Higgins 1999). They feed in mallee as well as orchards, cereal crops and vineyards (Garnett 1992). It is a nomadic species which disperses to areas of mallee to feed following breeding. Regent Parrot was not recorded during the survey. Mallee habitats present in the survey area are considered to be sub-optimal for Regent Parrot due to the sparse and degraded nature of the understorey although they may feed in adjacent crops. NatureMaps contains 56 records within a 50 km radius of the survey area and the closest record is approximately 19 km to the north-east (Enviro Data SA 2021). It is unlikely but possible that the eastern race of the Regent Parrot species may occasionally use the survey area as a transient visitor, and it is therefore included in the SEB calculations.

Grey Falcon is a widespread species that occurs at very low densities. It primarily occurs over open country such as plains with tree-lined watercourses in arid areas however is also found in open woodlands such as mallee, lightly timbered plains and grasslands (Marchant and Higgins 1993). The survey area is not considered to provide significant habitat for Grey Falcon and the species would only use the area on an occasional and transient basis. Grey Falcon is not considered to be dependent on the area at a local or regional scale however is considered in the SEB calculations to reflect its possible short-term use of the survey area on occasions.

Plains Wanderer *Pedionomus torquatus* occurs in sparsely vegetated tree-less plains dominated by sparse native grasses and chenopods (Marchant and Higgins 1993, Bellchambers and Baker-Gabb 2006). A small extent of chenopod shrubland was recorded at site H2 however it is not considered suitable habitat as the shrubs and grasses were too dense and the area too small to support a population of this species. There are no records of Plains Wanderer in the Murray Mallee (Marchant and Higgins 1993). This assessment concludes that Plains Wanderer is very unlikely to occur within the Mercunda Strandline study area and this species is not considered further in the impact assessment.

Night Parrot *Pezoporus occidentalis* lives in spinifex grasslands or shrubby samphire and chenopod associations in arid and semi-arid regions of Australia (Higgins 1999). There are no records of Night Parrot in the Murray Mallee (Higgins 1999). There is no suitable habitat in the survey area. This assessment concludes that Night Parrot is very unlikely to occur within the Mercunda Strandline study area and this species is not considered further in the impact assessment.



Black-eared Miner *Manorina melanotis* occurs in extensive areas of mallee eucalypt woodlands and shrublands with a preference for areas that have not been burnt for over 40 years (Baker-Gabb 2003, Clarke et al. 2005, Higgins et al. 2001). They are found to occur in areas with much leaf-litter and with taller mallee, especially in swales on land that is marginal for stock grazing (Higgins et al. 2001). In South Australia their current range is restricted to areas north of the Murray River (Higgins et al. 2001, Baker-Gabb 2003) and they have not been recorded south of the Murray River for many decades. This assessment concludes that Black-eared Miner is very unlikely to occur within the Mercunda Strandline study area and this species is not considered further in the impact assessment.

Corben's Long-eared Bat *Nyctophilus corbeni* is found in a wide range of inland woodland vegetation types including box / ironbark / cypress pine woodlands, Buloke woodlands, Brigalow woodland, Belah woodland, smooth-barked apple woodland, river red gum forest, black box woodland, and various types of tree mallee (Schulz and Lumsden 2010). The species is more abundant in extensive stands of vegetation in comparison to smaller woodland patches (DAWE 2013). It appears that old-growth vegetation is a critical habitat component in the Victorian distribution (DAWE 2013). The species has also been found to be much more abundant in habitats that have a distinct tree canopy and a dense, cluttered understorey layer (DAWE 2013). The habitats of the Mercunda survey area appear to be sub-optimal for this species based on the habitat descriptions available. In South Australia there are no records south of the Murray River (Atlas of Living Australia 2022) and the closest record to the survey area in NatureMaps is 105 km to the North (Enviro Data SA 2021). This assessment concludes that Corben's Long-eared Bat is unlikely to occur within the Mercunda Strandline study area and this species is not considered further in the impact assessment.

The remaining five species are either fish or wetland birds and therefore do not have any suitable habitat within the survey area. This includes the Growling Grass Frog *Litoria raniformis*; Flathead Galaxias *Galaxia rostratus* and wetland dependant bird species Curlew Sandpiper *Calidris ferruginea*, Far Eastern Curlew *Numenius madagascariensis* and Australian Painted Snipe *Rostratula australis*. These species are not considered in the SEB calculations in accordance with the Bushland Assessment Manual (DEW 2020).

The 5 km Protected Matters Search identified nine additional migratory bird species whose likelihood of occurrence is described as 'Species or species habitat may occur within area' and identified with an M in the EPBC column in. One of these species Fork-tailed Swift *Apus pacificus* is entirely aerial and is not known to land in Australia. Another species Satin Flycatcher *Myiagra cyanoleuca* lives in woodland but has not been recorded within 20 km of the survey area (Enviro Data SA 2021). The remaining seven species are wetland species. These species are not considered in the SEB calculations which only consider threatened species.

#### 4.4. State (NPW Act 1972) Listed Fauna Species

In addition to species discussed above, the NatureMaps 5 km radius desktop search (Enviro Data SA 2021) for the survey area included five species of birds listed as Rare under the *NPW Act 1972* that have been recorded in the survey area: Chestnut Quailthrush *Cinlosoma castanotum ssp castanotus*; Hooded Robin *Melanodryas cucullata cucullata*; Jacky Winter *Microeca fascinans fascinans*; Purple-gaped Honeyeater *Lichenostomus cratitius occidentalis* and White-winged Chough *Corcorax melanorhamphos* (Figure 12). These species are included in the SEB calculations. No terrestrial reptiles or mammals listed as threatened have been recorded within 5 km of the project footprint (Enviro Data SA 2021).

Two of the state listed bird species were recorded during the surveys, White-winged Chough and Jacky Winter as shown in Figure 12. White-winged Chough was recorded in five blocks (A, B, C, H and Q) all of which are larger vegetation remnants or roadside vegetation. It is likely to be resident in the areas observed (Figure 12). White-winged Chough nests were recorded in Block A and Block B. Jacky Winter was observed in Block B only and was observed two times and heard on songmeter recordings over two days. No listed species were recorded in Block R (Ecosphere 2022).

The remaining three state listed bird species identified in Table 14 (Chestnut Quailthrush, Hooded Robin, and Purple-gaped Honeyeater) are typical of mallee habitats and are considered to potentially occur in the survey area, most likely in Block P. These species may undergo local or seasonal movements across the landscape. This study conclude that these three species are not resident in the Mercunda Strandline project area but may occur temporarily, especially following good rains (Menkhorst et al. 2017).

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**Table 14. Threatened Species Desktop Review Results for EPBC listed species and NPW Act listed Species with likelihood of occurrence indicated or the date of records within 5km of the centre of the Mercunda survey area. EPBC and NPW Act categories are: CE = critically endangered, E = endangered, V = Vulnerable, R = rare, M = marine/migratory.**

Class	Common Name	Scientific name	EPBC	NPW Act 1972	No. of records (5 km radius)	EPBC Likelihood of Occurrence or Last Record date	Mercunda Impact Assessment Conclusion	Considered in SEB calculation
Amphibian	Growling Grass Frog	<i>Litoria raniformis</i>	V	V	0	May occur	Unlikely to occur	Not considered due to lack of habitat
Fish	Flathead Galaxias	<i>Galaxias rostratus</i>	CE		0	May occur	Unlikely to occur	Not considered due to lack of habitat
Bird	Australian Painted Snipe	<i>Rostratula australis</i>	E	E	0	May occur	Unlikely	Not considered due to lack of habitat
Bird	Black-eared Miner	<i>Manorina melanotis</i>	E	E	0	May occur	Unlikely	Not considered, very range restricted
Bird	Common Sandpiper	<i>Actitis hypoleucos</i>	M	R	0	May occur	Unlikely	Not considered, as not threatened
Bird	Curlew Sandpiper	<i>Calidris ferruginea</i>	CE, M	E	0	May occur	Unlikely to occur	Not considered due to lack of habitat
Bird	Chestnut Quailthrush	<i>Cinclosoma castanotum ssp castanotus</i>		R	5	25-Oct-2009	Possible occurrence	Considered, records in adjacent area
Bird	Far Eastern Curlew	<i>Numenius madagascariensis</i>	CE	E	0	May occur	Unlikely to occur	Not considered due to lack of habitat
Bird	Fork-tailed Swift	<i>Apus pacificus</i>	M		0	May occur	May occur	Not considered, as not threatened

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<b>Class</b>	<b>Common Name</b>	<b>Scientific name</b>	<b>EPBC</b>	<b>NPW Act 1972</b>	<b>No. of records (5 km radius)</b>	<b>EPBC Likelihood of Occurrence or Last Record date</b>	<b>Mercunda Impact Assessment Conclusion</b>	<b>Considered in SEB calculation</b>
Bird	Grey Falcon	<i>Falco hypoleucos</i>	V	R	0	Likely to occur	Possible occurrence	Considered
Bird	Hooded Robin	<i>Melanodryas cucullata cucullata</i>		R	1	25-Oct-2009	Possible occurrence	Considered, records in adjacent area
Bird	Jacky Winter	<i>Microeca fascinans fascinans</i>		R	3	25-Oct-2009	Known to occur	Included, observed during survey
Bird	Latham's Snipe	<i>Gallinago hardwickii</i>	M	R	0	May occur	Unlikely to occur	Not considered, as not threatened
Bird	Malleefowl	<i>Leipoa ocellata</i>	V	V	1	25-Oct-2009	Possible occurrence	Considered, records in adjacent area
Bird	Night Parrot	<i>Pezoporus occidentalis</i>	E	E	0	May occur	Unlikely to occur	Not considered due to lack of habitat
Bird	Pectoral Sandpiper	<i>Calidris melanotos</i>	M	R	0	May occur	Unlikely to occur	Not considered, as not threatened
Bird	Plains-wanderer	<i>Pedionomus torquatus</i>	CE	E	0	May occur	Unlikely to occur	Not considered due to lack of habitat
Bird	Purple-gaped Honeyeater	<i>Lichenostomus cratitius occidentalis</i>		R	1	25-Oct-2009	Possible occurrence	Considered, records in adjacent area
Bird	Regent Parrot	<i>Polytelis anthopeplus monarchoides</i>	V	V	0	Likely to occur	Possible occurrence	Included, suitable habitat present
Bird	Satin Flycatcher	<i>Myiagra cyanoleuca</i>	M	E	0	May occur	Unlikely to occur	Not considered, as not threatened
Bird	Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	M		0	May occur	Unlikely to occur	Not considered, as not threatened

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<b>Class</b>	<b>Common Name</b>	<b>Scientific name</b>	<b>EPBC</b>	<b>NPW Act 1972</b>	<b>No. of records (5 km radius)</b>	<b>EPBC Likelihood of Occurrence or Last Record date</b>	<b>Mercunda Impact Assessment Conclusion</b>	<b>Considered in SEB calculation</b>
Bird	White-winged Chough	<i>Corcorax melanorhamphos</i>		R	2	25-Oct-2009	Known to occur	Included, observed during survey
Bird	Yellow Wagtail	<i>Motacilla flava</i>	M		0	May occur	Unlikely to occur	Not considered, as not threatened
Mammal	Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	V	V	0	May occur	Unlikely to occur	Not considered

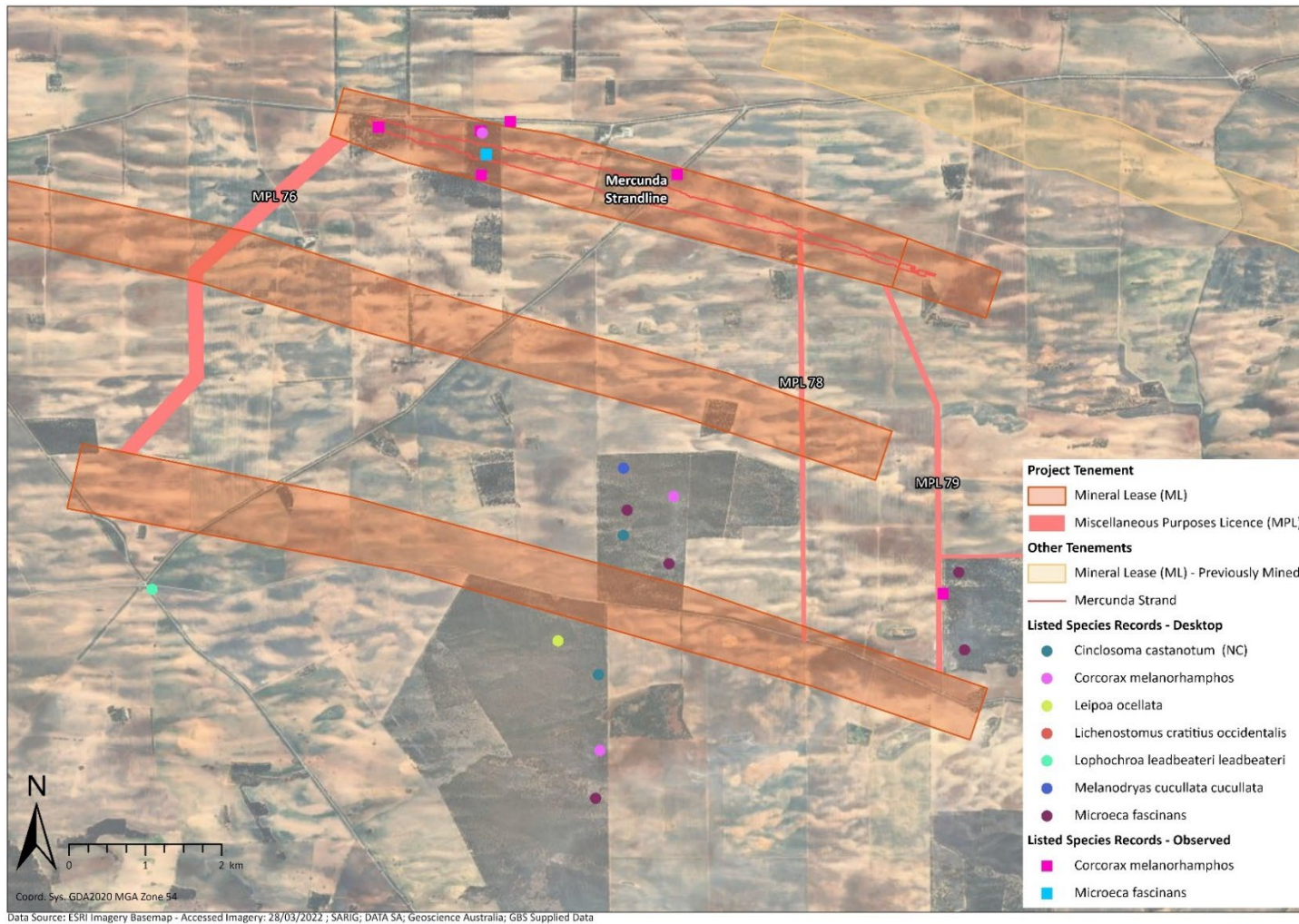


Figure 12. Listed Species recorded during field surveys (November 2021) and identified during from the desktop surveys

## 5. Native Vegetation Management Plan

### 5.1. Clearance Footprint

The majority of the Mercunda Strandline project footprint is located within cleared paddocks where no vegetation clearance is required. Seven vegetation blocks are within the proposed project footprint of the Mercunda Strandline (ML 6137 and ML6225) and are proposed to be partially or completely cleared. The proposed vegetation clearance area for the project is a total of 30.39 ha. The clearance footprint for each of impacted vegetation blocks is presented numerically in Table 15 and shown in Figure 13 and Appendix 5. Clearance is primarily associated with the strandline footprint and associated stockpiles as this is required to recover the resource. However, 3.11 hectares of clearance is required for a powerline within MPL 77. Three vegetation communities are present within the cleared area, and these are labelled as R1, R2 and R3 (see Figure 4 in Appendix 5). Mining infrastructure such as processing plant, dams, offices etc have been located in cleared areas to minimise the clearance required however some clearance is required for tracks and other purposes.

Four blocks within the clearance footprint are identified as habitat for the Mallee Bird Community of the Murray Darling Depression Bioregion Threatened Ecological Community. These are Block A with a clearance area of 11.96 hectares, Block B (including B1 and B2) with a clearance area of 13.97 hectares, Block H1 with a clearance area of 0.47 hectares, and Block R1 with a clearance area of 0.09 hectares. The total clearance area for these blocks is 26.49 hectares.

### 5.2. SEB Calculations

The Universal Biodiversity Scores (UBS) area of clearance proposed, Total Biodiversity Score (TBS), SEB points required, cost per hectare, SEB payment cost and administration fee are presented for each of these vegetation blocks in Table 15. Two blocks (B and H) have two distinct vegetation communities, and these were both surveyed and are costed separately (Table 15). Vegetation communities within blocks A and C have a degree of variability which was considered to warrant two survey sites. The sites within each block were considered to represent the same vegetation communities and results of these were averaged to determine the SEB costs for the block.

Universal Biodiversity Scores (UBS), and therefore the cost per hectare, varied between vegetation blocks which is likely to reflect variations within the vegetation and soils, and grazing history. Vegetation blocks A, B, H and R meet the definition of the Mallee Bird Community TEC and have a UBS which reflects this with a TEC having

a multiplier effect of 1.4 on the UBS score. Roadside vegetation on the southern side of Walker Flat Road (Block C) and along Jacka Road (Site H1) had the highest UBS (and therefore cost to clear per hectare) with an average score of 107.25 and 107.08 respectively (Table 15). The variability in the UBS for sites along Jacka Road (Block H) reflects the difference in vegetation structure with H1 representing mallee with a relatively intact canopy and a shrub understorey. Site H2 consists of an open chenopod shrubland with no mallee canopy.

Mallee vegetation blocks which are less than 10 hectares do not meet the definition of the Mallee Birds Community TEC and therefore have a lower UBS per hectare than blocks which are greater than 10 hectares (Table 15). Two smaller blocks (E and G) have a UBS of less than 50 reflecting their small size (less than 10 hectares), heavy grazing pressure, depauperate shrub layer and high weed loads. Block F has the highest UBS of the smaller blocks (65.0) reflecting a relatively intact canopy layer and shrub layer.

A loss factor of 1 was used for vegetation clearance in all areas except for block R where a vegetation is to be trimmed rather than cleared and a loss factor of 0.8 is used.

Rehabilitation of all cleared areas is expected to occur within three years of clearance reflecting the strip-mining method. The method progresses along the strandline with sections of the orebody mined out and then mining moving on to the next section. The SEB calculation reflects this time frame to rehabilitation by applying a 0.5 reduction factor to all areas of clearance within the strandline and MPL 77.

The SEB offset cost for clearance of vegetation blocks within the Mercunda Strandline (using the Bushland Assessment Method) and MPL 77 has been calculated at \$468,897.40 which consists of an SEB Payment of \$444,452.51 plus an administration fee of \$24,444.89.

Five scattered trees are also within the proposed project footprint with a cost of \$3,378.49 plus \$185.82 administration fee to clear these (Table 16).

A total SEB payment of \$472,461.70 which consists of an SEB Payment of \$447,831.00 plus an administration fee of \$24,630.70 would be required for the clearance of all 34.5 hectares and the five scattered trees proposed for the project footprint (Table 17, see Appendices 6 and 7 for details of the SEB Calculation). Should an on-ground SEB offset be pursued a total of 1,627.03 SEB points would be required to be offset.

The clearance summary tables for the Mercunda project identifies that the proposed clearance is a Risk Level 4 (Appendix 6). Completed Bushland Assessment Scoresheets used for the Mercunda SEB calculation are provided in Appendix 7.

### 5.3. Provision of Significant Environmental Benefit

No existing options are available for on-ground delivery of a Significant Environmental Benefit within the region of the project. Murray Zircon does not have access to land that could be used as an SEB offset area. Considering the small scale of the project,



and the high value of the land which is used for agricultural production in the region, it is not considered to be economically viable to establish a new SEB offset area. The Significant Environmental Benefit will therefore be delivered through a payment into the Native Vegetation Fund.

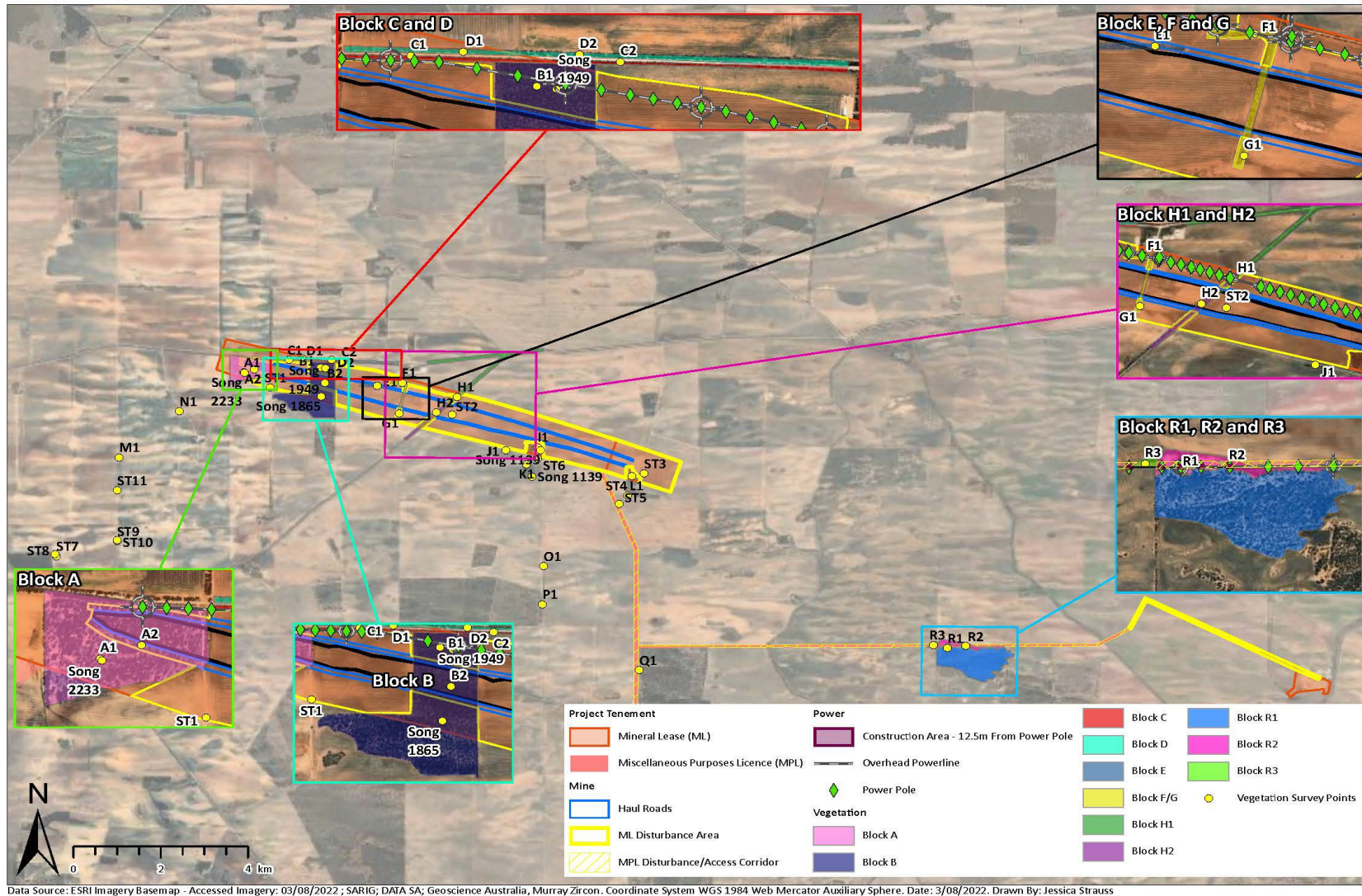


Figure 13. Mercunda Mine vegetation clearance areas

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**Table 15. SEB calculations for vegetation blocks that are within the project footprint for Mercunda Strandline and will be wholly or partially cleared.**

Block	UBS	Area (ha)	Biodiversity score	Loss factor	Loadings	Reductions	SEB Points required	SEB payment	Admin Fee	Total
A	103.665	11.96	1239.83	1		0.5	650.91	\$179,160.18	\$9,853.81	\$189,013.99
B1	102.92	6.5	668.98	1		0.5	351.21	\$96,669.91	\$5,316.84	\$101,986.75
B2	91.25	7.47	681.64	1		0.5	357.86	\$98,498.96	\$5,417.44	\$103,916.40
E	49.87	1.63	81.29	1		0.5	42.68	\$11,746.41	\$646.05	\$12,392.46
G	44.32	1.42	62.93	1		0.5	33.04	\$9,094.24	\$500.18	\$9,594.42
H1	107.08	0.47	50.33	1		0.5	26.42	\$7,272.51	\$399.99	\$7,672.50
H2	56.77	1.94	110.13	1		0.5	57.82	\$15,914.71	\$875.31	\$16,790.02
R1	5.08	0.09	0.46	0.8		0.5	0.19	\$52.85	\$2.91	\$55.76
R2	76.54	2.92	223.50	0.8		0.5	93.87	\$25,836.84	\$1,421.03	\$27,257.87
R3	17.81	0.1	1.78	0.8		0.5	0.75	\$205.89	\$11.32	\$217.21
<b>Total</b>		<b>34.5</b>	<b>3120.87</b>				<b>1614.75</b>	<b>\$444,452.51</b>	<b>\$24,444.89</b>	<b>\$468,897.40</b>

**Table 16. SEB calculations for scattered trees that are within the project footprint for the Mercunda Strandline.**

Tree or Cluster ID	Number of trees	Fauna Habitat score	Biodiversity score	Loss factor	SEB Points required	SEB Payment	Admin Fee	Total
ST1-1	1	1	1.18	1	1.24	\$341.03	\$18.76	\$359.78
ST2-1	1	1	1.98	1	2.08	\$572.23	\$31.47	\$603.71
ST2-2	1	1	4.02	1	4.22	\$1,161.81	\$63.90	\$1,225.71
ST2-3	1	1	2.22	1	2.33	\$641.60	\$35.29	\$676.88
ST3-1	1	1	2.29	1	2.40	\$661.83	\$36.40	\$698.23
<b>Total</b>	<b>5</b>		<b>11.69</b>		<b>12.27</b>	<b>\$3,378.49</b>	<b>\$185.82</b>	<b>\$3,564.31</b>

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*Table 17. Total SEB offset required for clearance of native vegetation and scattered trees within the Mercunda strandline footprint.*

	<b>Clearance area</b>	<b>No. of scattered trees</b>	<b>Total Biodiversity score</b>	<b>Total SEB points required</b>	<b>SEB Payment</b>	<b>Admin Fee</b>	<b>Total Payment</b>
Mercunda Strandline (ML6137 & ML6255) and MPL 77	34.5	5	3,132.6	1,627.0	\$447,831.00	\$24,630.70	\$472,461.70

## 5.4. Mitigation Hierarchy

The Native Vegetation Regulations (DEW 2017) require the use of the Mitigation Hierarchy for applications to clear native vegetation which consists of the following:

- a) Avoidance – measures should be taken to avoid clearance of native vegetation wherever possible.

The project area contains a mixture of remnant vegetation and cleared paddocks. Clearance for mining is determined by the location of the resource and related factors such as depth to mining. Where the resource is economic to mine, opportunities for avoidance of native vegetation are limited. Location of infrastructure and access corridors is more flexible and therefore offers the greatest opportunity to minimise vegetation clearance. by locating it in areas which are already cleared. Infrastructure and stockpiles of resource, topsoils and overburden have been located in cleared paddocks to avoid native vegetation (Figure 13)

- b) Minimisation – if clearance of native vegetation cannot be avoided, measures should be taken to minimise the extent, duration and intensity of impacts of the clearance on biological diversity to the fullest possible extent (whether the impact is direct, indirect or cumulative).

The vegetation clearance areas have been reduced through a number of refinements of the mine plan and placement of infrastructure and haul roads. This has reduced clearance by almost 50% since the detailed mine planning began. Active mining of the Mercunda Strandline will be progressive and is expected to occur for two to three years for each section of the strandline. As mining progresses rehabilitation will commence in sections of the strandline once mining and backfilling has been completed. This will allow the period between vegetation clearance and rehabilitation to be as short as practical.

- c) Rehabilitation or restoration – measures should be taken to rehabilitate ecosystems that will be degraded, and to restore ecosystems that will be destroyed, due to impacts of clearance that cannot be avoided or minimised.

Rehabilitation and restoration of disturbed areas is required by the Mining Act 1971 both progressively during operations and finally at closure of operations. Conceptual plans for rehabilitation and restoration will be required in the Mining Proposal and final rehabilitation plans will be required in the Program for Environment Protection and Rehabilitation (PEPR). Rehabilitation planning should aim to restore the pre-existing vegetation communities and habitats. A range of techniques exist to maximize the possibility of successful restoration of pre-existing vegetation communities including appropriate storage of topsoil to retain soil properties and the seedbank within the soil, and retention of large woody debris for use in rehabilitation. Active mining of the Mercunda Strandline is expected to be short term (two to three years) which increases the potential for successful restoration as topsoil maintains much of its seedbank and quality if

stored correctly over short time frames. Murray Zircon will commence rehabilitation of the Mercunda Strandline sections with three years of clearance of each section. Murray Zircon has experience in rehabilitation following closure of sections of the Mindarie Strandline.

- d) Offset – any adverse impact on native vegetation or ecosystems that cannot be avoided or minimised should be offset by implementing an SEB that outweighs that impact.

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## Appendix 1: Flora – Desktop search and field survey results

The desktop survey was undertaken for a 5 km radius of the centre of the survey area. Desktop survey records for this area are indicated in the 'Desktop' column. Field records are indicated in the 'Field' column and presented according to survey site. Introduced species are indicated in the 'Intro.' Column. The number of blocks each species was recorded in is given in the 'No. of Bl.' column.

No species listed under the EPBC Act 1999 or NPW Act 1971 were included in the results.

<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	<b>Total Species</b>		79	127		43	42	37	40	27	22	19	46	14	9	16	25	3	9	17	37	19	42
	<b>Native Species</b>		67	92		33	35	27	29	14	15	10	30	9	4	10	17	2	5	13	34	11	27
	<b>Introduced Species</b>		12	35		10	7	10	11	13	7	9	16	5	5	6	8	1	4	4	3	8	15
<b>AIZOACEAE</b>																							
<i>Psilocaulon granulicaule</i>	Match-head plant	*		x	3						x	x				x							
<i>Carpobrotus rossii</i>	Native Pigface		x	x	5	x	x		x				x								x		
<i>Mesembryanthemum crystallinum</i>	Common Iceplant	*	x	x	12	x		x	x	x		x	x	x	x	x	x			x		x	
<b>AMARANTHACEAE</b>																							
<i>Ptilotus seminudus</i>	Rabbit-tails		x	x	1		x																
<b>ASCLEPIACEAE</b>																							
<i>Gomphocarpus cancellatus</i>	Broad-leaf Cotton-bush	*		x	1																		x
<b>BORAGINACEAE</b>																							

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Amsinckia calycina</i>	Hairy Fiddle-neck	*		x	1																	x	
<i>Echium plantagineum</i>	Salvation Jane	*	x	x	1																		x
<i>Halgania andromedifolia</i>	Scented Blue-flower		x																				
<b>CAMPANULACEAE</b>																							
<i>Wahlenbergia sp.</i>	Native Bluebell			x	1						x												
<b>CASUARINACEAE</b>																							
<i>Casuarina pauper</i>	Black Oak			x	1														x				
<b>CHENOPODIACEAE</b>																							
<i>Atriplex stipitata</i>	Bitter Saltbush		x	x	2			x					x										
<i>Chenopodium desertorum ssp. desertorum</i>	Frosted Goosefoot			x	4		x				x		x				x						
<i>Einadia nutans ssp. nutans</i>	Climbing Saltbush			x	1		x																
<i>Enchylaena tomentosa var. tomentosa</i>	Ruby Saltbush		x	x	14	x	x	x	x	x	x	x	x	x		x	x			x		x	x
<i>Maireana brevifolia</i>	Short-leaf Bluebush		x	x	11			x	x	x	x	x	x		x	x				x		x	x
<i>Maireana erioclada</i>	Rosy Bluebush		x	x	4	x	x	x									x						
<i>Maireana trichoptera</i>	Hairy-fruit Bluebush			x	2		x		x														
<i>Osteocarpum sp.</i>	Bonefruit			x	1												x						
<i>Rhagodia crassifolia</i>	Fleshy Saltbush			x	3				x				x										x

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Rhagodia preissii</i> ssp. <i>preissii</i>	Mallee Saltbush		x	x	11	x	x	x	x	x	x	x	x				x			x			x
<i>Salsola australis</i>	Buckbush			x	14	x		x	x	x	x	x	x	x		x	x		x	x		x	x
<i>Sclerolaena decurrens</i>	Green Bindyi			x	2		x										x						
<i>Sclerolaena diacantha</i>	Grey Bindyi		x	x	7	x	x	x	x				x	x			x						
<b>COMPOSITAE</b>																							
<i>Arctotheca calendula</i>	Cape Weed	*		x	2					x	x												x
<i>Blennospora drummondii</i>	Dwarf Button-flower		x																				
<i>Brachyscome ciliaris</i> var. <i>ciliaris</i>	Variable Daisy			x	2		x						x										
<i>Calotis hispidula</i>	Hairy Burr-daisy			x	2		x														x		
<i>Calotis lappulacea</i>	Yellow Burr-daisy			x	1																		x
<i>Carthamus lanatus</i>	Saffron Thistle	*	x	x	1								x										
<i>Centaurea</i> sp.	Thistle	*		x	3	x			x								x						
<i>Chondrilla juncea</i>	Skeleton Weed	*	x	x	7	x		x		x	x	x	x									x	
<i>Chrysocephalum apiculatum</i>	Common Everlasting			x	1																		x
<i>Dittrichia graveolens</i>	Stinkweed	*	x																				
<i>Helichrysum leucopsidium</i>	Satin Everlasting		x	x	3	x	x														x		
<i>Hypochaeris glabra</i>	Smooth Cat's Ear	*		x	4	x	x						x				x						

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Olearia lepidophylla</i>	Clubmoss Daisy-bush		x	x	1																x		
<i>Podolepis rugata</i> var. <i>rugata</i>	Pleated Copper-wire Daisy			x	3	x	x														x		
<i>Podolepis</i> sp.	Copper-wire Daisy				1																		x
<i>Polycalymma stuartii</i>	Poached-egg Daisy			x	3			x		x												x	
<i>Reichardia tingitana</i>	False Sowthistle	*		x	12	x	x	x	x	x	x	x	x	x	x	x				x			x
<i>Senecio glossanthus</i>	Annual Groundsel			x	1				x														
<i>Sonchus oleraceus</i>	Common Sow-thistle	*		x	1																		x
<i>Symphotrichum subulatum</i>	Aster-weed	*		x	1																		x
<i>Vittadinia cuneata</i> .	Fuzzy New Holland Daisy			x	3				x				x										x
<b>CRUCIFERAE</b>																							
<i>Brassica tournefortii</i>	Wild Turnip	*	x	x	15		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x
<i>Carrichtera annua</i>	Ward's Weed	*		x	0																		
<i>Sisymbrium</i> sp.	Wild Mustard	*	x	x	4		x			x			x									x	
<b>CUCURBITACEAE</b>																							
<i>Cucumis myriocarpus</i> ssp. <i>myriocarpus</i>	Paddy Melon	*		x	3	x		x		x													
<b>CUPRESSACEAE</b>																							
<i>Callitris verrucosa</i>	Scrub Cypress Pine		x	x	2		x			x													
<b>CYPERACEAE</b>																							

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Lepidosperma concavum/ congestum/ laterale</i>	Sword-sedge			x	3	x	x														x		
<i>Lepidosperma viscidum</i>	Sticky Sword-sedge		x																				
<b>DILLENIACEAE</b>																							
<i>Hibbertia devitata</i>	Smooth Guinea-flower			x	1																x		
<i>Hibbertia sericea var. sericea</i>	Silky Guinea-flower		x																				
<i>Hibbertia virgata</i>	Twiggy Guinea-flower		x																				
<b>EUPHORBIAEAE</b>																							
<i>Bertya tasmanica ssp. vestita</i>	Mitchell's Bertya		x																				
<i>Beyeria lechenaultii</i>	Pale Turpentine Bush		x																				
<i>Beyeria opaca</i>	Dark Turpentine Bush		x	x	1																		x
<i>Euphorbia terracina</i>	False Caper	*	x	x	7		x	x	x	x							x					x	x
<b>GRAMINEAE</b>																							
<i>Aira cupaniana</i>	Small Hair-grass	*		x	6		x		x			x		x			x				x		

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Amphipogon strictus</i>	Spreading Grey-beard Grass			x	1																x		
<i>Aristida holathera</i> var. <i>holathera</i>	Tall Kerosene Grass			x	1																		x
<i>Austrostipa elegantissima</i>	Feather Spear-grass			x	5	x	x	x	x														x
<i>Austrostipa mollis</i> group	Soft Spear-grass			x	1																x		
<i>Austrostipa nodosa</i>	Tall Spear-grass			x	8	x	x	x	x		x		x				x				x		
<i>Austrostipa scabra</i>	Spear-grass			x	6	x	x	x	x				x				x						
<i>Austrostipa</i> sp.	Spear-grass		x		1																		x
<i>Avena barbata</i>	Bearded Oat	*	x	x	8	x	x	x	x	x	x	x	x										x
<i>Bromus</i> sp.	Brome			x	6			x	x	x	x		x		x								
<i>Enneapogon nigricans</i>	Black-head Grass			x	3			x	x				x										
<i>Eragrostis curvula</i>	African Lovegrass	*		x	1								x										
<i>Eragrostis</i> sp.	Love-grass			x	6			x	x	x	x		x									x	
<i>Hordeum vulgare</i>	Barley	*		x	14	x		x	x	x	x	x	x	x	x	x	x		x	x		x	
<i>Lolium</i> sp.	Ryegrass	*		x	2					x					x								
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass			x	2	x	x																
<i>Rytidosperma</i> sp.	Wallaby-grass		x	x	6	x			x				x				x				x		x
<i>Triodia irritans</i> complex	Spinifex		x	x	10	x	x	x	x	x	x	x	x							x	x		

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Triodia scariosa</i>	Spinifex		x	x	1																		x
<i>Triticum aestivum</i>	Wheat	*		x	3					x								x	x				
<i>Vulpia sp.</i>	Fescue	*		x	1								x										
<b>HALORAGACEAE</b>																							
<i>Haloragis sp.</i>	Raspwort			x	1																x		
<b>IRIDACEAE</b>																							
<i>Moraea setifolia</i>	Thread Iris	*	x																				
<i>Romulea sp.</i>	Onion-grass	*		x	1																		x
<b>LABIATAE</b>																							
<i>Marrubium vulgare</i>	Horehound	*	x	x	4							x	x									x	x
<i>Westringia rigida</i>	Stiff Westringia		x	x	1								x										
<b>LAMIACEAE</b>																							
<i>Salvia verbenaca</i>	Wild Sage	*		x	5	x		x	x				x								x		x
<b>LAURACEAE</b>																							
<i>Cassytha melantha</i>	Coarse Dodder-laurel		x	x	2	x														x			
<b>LEGUMINOSAE</b>																							
<i>Acacia brachybotrya</i>	Grey Mulga-bush		x	x	1	x																	x
<i>Acacia calamifolia</i>	Wallowa			x	1	x																	
<i>Acacia ligulata</i>	Umbrella Bush			x	1																		x
<i>Acacia pycnantha</i>	Golden Wattle		x	x	1	x																	
<i>Acacia rigens</i>	Nealie		x	x	2			x													x		x
<i>Acacia sclerophylla var. sclerophylla</i>	Hard-leaf Wattle		x	x	2			x					x										
<i>Acacia spinescens</i>	Spiny Wattle		x																				



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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Acacia wilhelmiana</i>	Dwarf Nealie		x	x	1																x		
<i>Bossiaea walkeri</i>	Cactus Pea			x	1								x										
<i>Daviesia arenaria</i>	Sand Bitter-pea			x	2	x															x		
<i>Dillwynia uncinata</i>	Silky Parrot-pea			x	2		x														x		
<i>Eutaxia microphylla</i>	Common Eutaxia		x																				
<i>Medicago sativa</i>	Lucerne	*		x	1								x										
<i>Senna artemisioides</i>	Desert Senna		x	x	2			x	x														
<i>Trifolium sp.</i>	Clover	*		x	1												x						
<b>LILIACEAE</b>																							
<i>Asparagus asparagoides</i>	Bridal Creeper	*		x	1																		x
<i>Asphodelus fistulosus</i>	Onion Weed	*	x	x	5	x		x	x				x										x
<i>Dianella revoluta var. revoluta</i>	Black-anther Flax-lily		x	x	5	x		x	x				x								x		
<i>Lomandra densiflora</i>	Soft Tussock Mat-rush			x	1																x		
<i>Lomandra effusa</i>	Scented Mat-rush			x	3	x	x						x										
<i>Lomandra juncea</i>	Desert Mat-rush			x	1																x		
<i>Lomandra leucocephala ssp. robusta</i>	Woolly Mat-rush		x	x	3	x		x													x		
<i>Thysanotus baueri</i>	Mallee Fringe-lily			x	2	x	x																

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Thysanotus patersonii</i>	Twining Fringe-lily		x		0																		
<i>Tricoryne elatior</i>	Yellow Rush-lily			x	1																x		
<b>MYOPORACEAE</b>																							
<i>Eremophila crassifolia</i>	Thick-leaf Emubush		x	x	1			x															
<i>Eremophila glabra</i> ssp. <i>murrayana</i>	Small Tar Bush		x																				
<i>Myoporum brevipes</i>	Warty Boobialla		x																				
<i>Myoporum platycarpum</i> ssp. <i>platycarpum</i>	False Sandalwood		x																				
<b>MYRTACEAE</b>																							
<i>Eucalyptus brachycalyx</i>	Gilja		x																				
<i>Eucalyptus calycogona</i> var. <i>calycogona</i>	Square-fruit Mallee		x	x	9		x	x	x			x	x			x		x		x		x	
<i>Eucalyptus dumosa</i>	White Mallee		x	x	1															x			
<i>Eucalyptus gracilis</i>	Yorrell		x	x	8		x	x					x	x	x	x	x				x		
<i>Eucalyptus incrassata</i>	Ridge-fruited Mallee		x	x	12	x			x	x	x	x				x	x		x	x	x	x	x
<i>Eucalyptus leptophylla</i>	Narrow-leaf Red Mallee		x	x	12	x	x	x	x	x	x	x				x	x			x	x	x	
<i>Eucalyptus oleosa</i> ssp. <i>oleosa</i>	Red Mallee		x	x	6		x				x		x	x		x						x	

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Eucalyptus phenax</i>	Sessile-fruit White Mallee		x	x	9		x	x	x			x	x	x	x	x		x					
<i>Eucalyptus porosa</i>	Mallee Box		x		0																		
<i>Eucalyptus socialis ssp. socialis</i>	Beaked Red Mallee		x	x	14	x	x	x	x	x	x	x	x	x			x		x	x	x	x	
<i>Hysterobaeckea behrii</i>	Silver Broombush		x	x	3	x															x		x
<i>Leptospermum coriaceum</i>	Dune Tea-tree		x	x	7	x	x			x							x			x	x		x
<i>Melaleuca acuminata ssp. acuminata</i>	Mallee Honey-myrtle		x	x	2	x															x		
<i>Melaleuca lanceolata ssp. lanceolata</i>	Dryland Tea-tree		x	x	13	x	x	x	x	x	x		x				x		x	x	x	x	x
<i>Rinzia orientalis</i>	Desert Heath-myrtle		x																				
<b>ONAGRACEAE</b>																							
<i>Oenothera stricta ssp. stricta</i>	Common Evening Primrose	*		x	2								x										x
<b>PITTIOSPORACEAE</b>																							
<i>Billardiera cymosa ssp. cymosa</i>	Sweet Apple-berry		x	x	2		x		x														
<i>Billardiera sp.</i>	Apple-berry				1																		x
<i>Pittosporum angustifolium</i>	Native Apricot			x	2		x																x
<b>PORTULACACEAE</b>																							

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Calandrinia sp.</i>	Purslane/Parakeelya		x																				
<b>PROTEACEAE</b>																							
<i>Grevillea ilicifolia var. ilicifolia</i>	Holly-leaf Grevillea		x																				
<i>Grevillea huegelii</i>	Comb Grevillea			x	1								x										
<i>Grevillea pterosperma</i>	Dune Grevillea		x	x	2																x		x
<b>RANUNCULACEAE</b>																							
<i>Clematis microphylla var. microphylla</i>	Old Man's Beard			x	1	x																	
<b>RHAMNACEAE</b>																							
<i>Cryptandra tomentosa</i>	Heath Cryptandra			x	1																x		
<i>Spyridium subochreatum</i>	Velvet Spyridium			x	1																x		
<i>Stenanthemum leucophractum</i>	White Cryptandra			x	1																x		
<b>RUTACEAE</b>																							
<i>Phebalium bullatum</i>	Silvery Phebalium		x																				
<b>SANTALACEAE</b>																							
<i>Exocarpos sparteus</i>	Slender Cherry			x	1																		x
<i>Santalum murrayanum</i>	Bitter Quandong			x	3		x		x							x							
<b>SOLANACEAE</b>																							

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<i>Species</i>	Common Name	Intro.	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<i>Lycium ferocissimum</i>	African Boxthorn	*		x	2											x			x				
<b>STERCULIACEAE</b>																							
<i>Lasiopetalum baueri</i>	Slender Velvet-bush		x																				
<i>Lasiopetalum behrii</i>	Pink Velvet-bush		x	x	1																		x
<b>SAPINDACEAE</b>																							
<i>Dodonaea bursariifolia</i>	Small Hop-bush		x																				
<i>Dodonaea hexandra</i>	Horned Hop-bush		x																				
<i>Dodonaea stenozyga</i>	Desert Hop-bush		x																				
<i>Dodonaea viscosa ssp. angustissima</i>	Narrow-leaf Hop-bush		x	x	1	x																	
<b>VIOLACEAE</b>																							
<i>Pigea floribunda</i>	Shrub Spade Flower		x																				
<b>ZYGOPHYLLACEAE</b>																							
<i>Roepera (Zygophyllum) apiculata</i>	Pointed Twinleaf			x	1									x									
<i>Roepera (Zygophyllum) aurantiaca ssp. aurantiaca</i>	Shrubby Twinleaf			x	2				x					x									
<i>Tribulus sp.</i>	Caltrop	*		x	2				x	x													



## Appendix 2: Fauna - Desktop search and field survey results

The desktop survey was undertaken for a 5 km radius of the centre of the survey area results. Desktop survey records for this area are indicated in the 'Desktop' column. Species listed under the NPW Act 1971 are included in the NPW column. Results include only one species, Malleefowl, which is listed under the EPBC Act 1999.

Field records are indicated in the 'Field' column and presented according to fauna survey site and opportunistically for the survey area according to the methodology used as follows; O = observed, S = songmeter record, T = tracks observed, and D = Diggings observed. The number of blocks each species was recorded in is given in the 'No. of Bl.' column.

The MBC column identifies bird species which are listed under the Mallee Bird Community Threatened Ecological Community, under the EPBC Act 1999, and therefore contribute to the definition of the of this TEC.

Common Name	Scientific Name	NPW	MBC	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	O pp	
<b>BIRDS</b>																										
Emu	<i>Dromaius novaehollandiae</i>			x																						
Malleefowl	<i>Leipoa ocellata</i>	V	X	x																						
Stubble Quail	<i>Coturnix pectoralis</i>			x																						
Wedge-tailed Eagle	<i>Aquila audax</i>				x	1					O															
Spotted Harrier	<i>Circus assimilis</i>				x	0																				O
Brown Falcon	<i>Falco berigora</i>			x	x	0																				O
Nankeen Kestrel	<i>Falco cenchroides</i>				x	2												S						O	O	

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Common Name	Scientific Name	NPW	MBC	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	O pp
Banded Lapwing	<i>Vanellus tricolor</i>				x	3	S	S							S										
Black-fronted Dotterel	<i>Euseyornis melanops</i>				x	1									S										
*Rock Dove	<i>Columba livia</i>				x	1												O							O
Crested Pigeon	<i>Ocyphaps lophotes</i>			x	x	6	O S	O S					O		O S			O S						O	O
Common Bronzewing	<i>Phaps chalcoptera</i>			x	x	4	O S	S										O S			O				O
Peaceful Dove	<i>Geopelia placida</i>				x	1																		O	
Galah	<i>Cacatua roseicapilla</i>			x	x	7	O S	O S		O					O S		O	O S						O	O
Australian Ringneck	<i>Barnardius zonarius</i>			x	x	6	O S	O S		O				O	S			O							
Blue Bonnet	<i>Northiella haematogaster</i>			x	x	7	O S					O		O	O S		O	O S			O				O
Mulga Parrot	<i>Psephotus varius</i>			x	x	2	O S	O S																	
Horsefield's Bronze-cuckoo	<i>Chrysococcyx basalis</i>			x	x	1																O			
Pallid Cuckoo	<i>Cacomantis pallidus</i>			x																					
Barn Owl	<i>Tyto alba</i>				x	1		S																	
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>				x	3	S	S							S										
Tawny Frogmouth	<i>Podargus strigoides</i>				x	4	S	S							S			S							
Rainbow Bee-eater	<i>Merops ornatus</i>			x	x	4	O	O S	O									O							



Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

Common Name	Scientific Name	NPW	MBC	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	O pp
Variegated Fairy-wren	<i>Malurus lamberti</i>			x	x	2			O	O															
Splendid Fairywren	<i>Malurus splendens</i>		X	x																					
Superb Fairywren	<i>Malurus splendens</i>				x	1																		O	
Striated Pardalote	<i>Pardalotus striatus</i>			x	x	3		O S					O					O							
Spotted Pardalote	<i>Pardalotus punctatus</i>		X	x	x	4	O S	O S	O	O															
Inland Thornbill	<i>Acanthiza apicalis</i>			x																				O	
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>			x	x	4			O	O			O							O				O	
Yellow Thornbill	<i>Acanthiza nana</i>			x																					
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>				x	1																		O	
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>			x	x	5	O	O	O	O											O			O	
Weebill	<i>Smicronis brevirostris</i>			x	x	6	O S	O S	O	O			O											O	
Southern Whiteface	<i>Aphelocephala leucopsis</i>				x	1	O																		
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>			x	x	5	O S	O S		O		O	O												
Red Wattlebird	<i>Anthochaera carunculata</i>			x	x	4	O S	O S	O	O															O
Yellow-throated Miner	<i>Manorina flavigula</i>			x	x	6	O S	S						O	O S		O	O S							

Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

Common Name	Scientific Name	NPW	MBC	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Op
Singing Honeyeater	<i>Gavicalis virescens</i>			x	x	8			O	O	O	O	O	O								O		O	O
Purple-gaped Honeyeater	<i>Lichenostomus cratitius occidentalis</i>	R	X	x																					
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>			x	x	2		O														O			
White-eared Honeyeater	<i>Nesoptilotis leucotis leucotis</i>			x																					
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>		X	x	x	2	O	O	S																
White-fronted Chat	<i>Epthianura albifrons</i>			x	x	1												S							
Red-capped Robin	<i>Petroica goodenovii</i>			x	x	2		S																O	
Hooded Robin	<i>Melanodryas cucullata cucullata</i>	R		x																					
Southern Scrub Robin	<i>Drymodes brunneopygia</i>		X	x																					
Jacky Winter	<i>Microeca fascinans</i>	R	X	x	x	1		O	S																
Varied Sitella	<i>Daphoenositta chrysoptera</i>				x	1			S																
Magpie Lark	<i>Grallina cyanoleuca</i>				x	2	O								O	S									
Willie Wagtail	<i>Rhipidura leucophrys</i>			x	x	6		S	O			O	O							O				O	O
White-browed Babbler	<i>Pomatostomus superciliosus</i>			x	x	1																		O	

Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

Common Name	Scientific Name	NPW	MBC	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	O pp
Chestnut Quailthrush	<i>Cinlosoma castanotum ssp castanotus</i>	R	X	x																					
Masked Woodswallow	<i>Artamus personatus</i>			x	x	8	O S	O S	O	O	O	O	O					O S							O
White-browed Woodswallow	<i>Artamus superciliosus</i>				x	5		O			O	O	O					O							O
Grey Butcherbird	<i>Craticus torquatus</i>			x	x	6	O S	O S	O					O			O	O S							
Australian Magpie	<i>Gymnorhina tibicen</i>			x	x	1 0	O S	O S	O	O				O	S		O	O S		O				O	O
Grey (Black-winged) Currawong	<i>Strepera versicolor</i>			x	x	1		S																	
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>			x	x	1		O S																	
Australian Golden Whistler	<i>Pachycephala pectoralis</i>			x																					
Grey Shrike-thrush	<i>Colluricincla harmonica</i>			x	x	3		O S		O		O												O	
Corvid	<i>Corvus sp.</i>				x	2	O							O S											
Little Crow	<i>Corvus bennetti</i>				x	4		O					O					O S					O		O
Australian Raven	<i>Corvus coronoides</i>			x																					
Little Raven	<i>Corvus mellori</i>			x	x																			O	

Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

Common Name	Scientific Name	NPW	MBC	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	O pp
White-winged Chough	<i>Corcorax melanorhamphos</i>	R		x	x	5	O S	O S	O					O									O		
Silvere	<i>Zosterops lateralis</i>				x	1		S																	
*Common Starling	<i>Sturnus vulgaris</i>				x	5							O	O				S	O	O					O
White-backed Swallow	<i>Cheramoeca leucostema</i>				x	1		O																	
Welcome Swallow	<i>Hirundo neoxena</i>				x	2									O S			O							O
* Eurasian Skylark	<i>Alauda arvensis</i>			x	x	2									S			S							O
Brown Songlark	<i>Megalurus cruralis</i>			x	x	1												S							O
Rufous Songlark	<i>Megalurus mathewsi</i>				x	1											O								
* House Sparrow	<i>Passer domesticus</i>				x	3						O							O	O					O
Zebra Finch	<i>Taeniopygia guttata</i>			x																					
Richard's Pipit	<i>Anthus novaeseelandiae</i>			x	x	0																			O
<b>Bird Species Total</b>		6	9	52	61		24	34	13	13	4	8	11	8	13	0	6	21	2	5	3	3	2	17	21
<b>TERRESTRIAL MAMMALS</b>																									
Echidna	<i>Tachyglossus aculeatus</i>			x	x	3	D	D						D											
Western Grey Kangaroo	<i>Macropus fuliginosus</i>			x	x	1												O							
*Fox	<i>*Vulpes vulpes</i>			x	x	4	T	T			O							O							

Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

Common Name	Scientific Name	NPW	MBC	Desktop	Field	No. of Bl.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Opp
*Sheep	* <i>Ovis aries</i>				x	0																			0
*European Rabbit	* <i>Oryctolagus cuniculus</i>				x	1	D			D	D	D	D	D			D	D		D		D	D		0
*European Brown Hare	* <i>Lepus capensis</i>			x	x	1		O																	0
*Feral Cat	* <i>Felis catus</i>				x	2	T			T															0
<b>Terrestrial Mammal Total</b>				<b>4</b>	<b>7</b>		<b>4</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>REPTILES</b>																									
Dragon	<i>Ctenophorus sp</i>				x	0																			0
Mallee Dragon	<i>Ctenophorus fordi</i>			x																					
Skink	<i>Ctenotus sp</i>				x	0																			0
Eastern Bearded Dragon	<i>Pogona barbata</i>			x	x	0																			0
Sleepy Lizard	<i>Tiliqua rugosa</i>			x	x	4		O						O							O	O			0
<b>Reptile species Total</b>				<b>3</b>	<b>4</b>		<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>VERTEBRATE GRAND TOTALS</b>				<b>59</b>	<b>67</b>		<b>28</b>	<b>38</b>	<b>13</b>	<b>14</b>	<b>7</b>	<b>9</b>	<b>12</b>	<b>10</b>	<b>13</b>	<b>0</b>	<b>7</b>	<b>24</b>	<b>2</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>17</b>	<b>29</b>

## Appendix 3 EPBC Act (1999) Protected Matters Search for the Mercunda Survey Area with a 5km buffer zone.



# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 04-Aug-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	3
<a href="#">Listed Threatened Species:</a>	17
<a href="#">Listed Migratory Species:</a>	10

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	16
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have

<a href="#">State and Territory Reserves:</a>	2
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">EPBC Act Referrals:</a>	3
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	None
<a href="#">Bioregional Assessments:</a>	None
<a href="#">Geological and Bioregional Assessments:</a>	None



# Details

## Matters of National Environmental Significance

### Listed Threatened Ecological Communities

[\[ Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions</a>	Endangered	Community may occur within area	In feature area
<a href="#">Mallee Bird Community of the Murray Darling Depression Bioregion</a>	Endangered	Community likely to occur within area	In feature area
<a href="#">Plains mallee box woodlands of the Murray Darling Depression, Riverina and Naracoorte Coastal Plain Bioregions</a>	Critically Endangered	Community likely to occur within area	In feature area

### Listed Threatened Species

[\[ Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
<b>BIRD</b>			
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Manorina melanotis</a> Black-eared Miner [449]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Pedionomus torquatus</a> Plains-wanderer [906]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Polytelis anthopeplus monarchoides</a> Regent Parrot (eastern) [59612]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
<b>FISH</b>			
<a href="#">Galaxias rostratus</a> Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area	In feature area
<b>FROG</b>			
<a href="#">Litoria raniformis</a> Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat may occur within area	In feature area
<b>MAMMAL</b>			
<a href="#">Nyctophilus corbeni</a> Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
<b>PLANT</b>			
<a href="#">Caladenia tensa</a> Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Dodonaea subglandulifera</a> Peep Hill Hop-bush [11956]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Lepidium monoplocoides</a> Winged Pepper-cress [9190]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Pterostylis xerophila</a> Desert Greenhood [7997]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Swainsona pyrophila</a> Yellow Swainson-pea [56344]	Vulnerable	Species or species habitat may occur within area	In feature area

### Listed Migratory Species [ [Resource Information](#) ]

Scientific Name	Threatened Category	Presence Text	Buffer Status
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#### Migratory Marine Birds

<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
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#### Migratory Terrestrial Species

<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
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<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
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<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat may occur within area	In feature area
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#### Migratory Wetlands Species

<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
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<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
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<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
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Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In feature area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

## Other Matters Protected by the EPBC Act

Listed Marine Species			[ Resource Information ]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
<a href="#">Bubulcus ibis as Ardea ibis</a> Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Chalcites osculans as Chrysococcyx osculans</a> Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat may occur within area	In feature area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Neophema chrysostoma</a> Blue-winged Parrot [726]		Species or species habitat likely to occur within area overfly marine area	In feature area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Rostratula australis as Rostratula benghalensis (sensu lato)</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

## Extra Information

State and Territory Reserves			[ Resource Information ]
Protected Area Name	Reserve Type	State	Buffer Status
Bandon	Conservation Park	SA	In buffer area only
Unnamed (No.HA667)	Heritage Agreement	SA	In buffer area only

EPBC Act Referrals					[ Resource Information ]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status	
Not controlled action					
<a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a>	2015/7522	Not Controlled Action	Completed	In feature area	
<a href="#">INDIGO Central Submarine Telecommunications Cable</a>	2017/8127	Not Controlled Action	Completed	In feature area	
Not controlled action (particular manner)					
<a href="#">INDIGO Marine Cable Route Survey (INDIGO)</a>	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area	

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
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- [-Australian Tropical Herbarium, Cairns](#)
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- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.



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Department of Agriculture Water and the Environment

GPO Box 858

Canberra City ACT 2601 Australia

+61 2 6274 1111

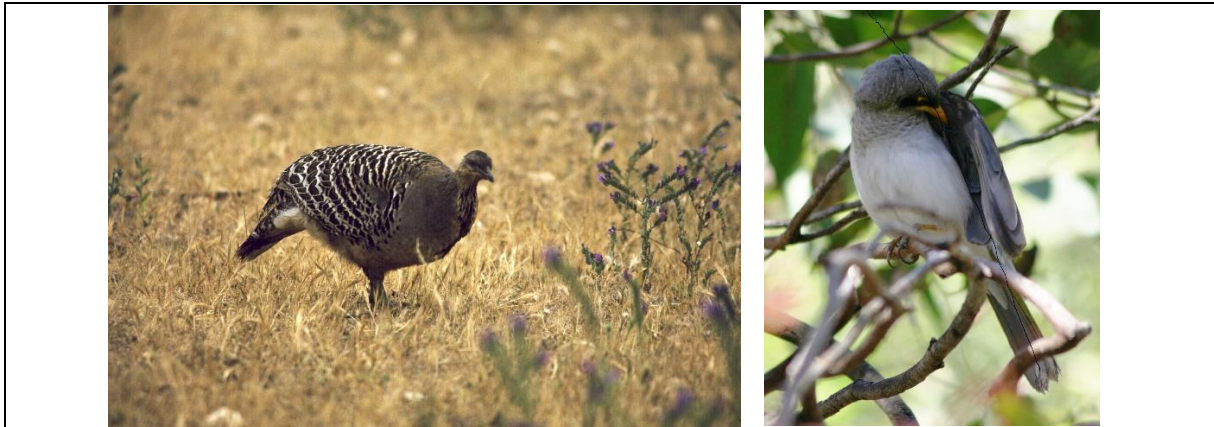
## Appendix 4: Conservation advice for listing of the Mallee Bird Community of the Murray Darling Depression Bioregion



## **Approved Conservation Advice for the Mallee Bird Community of the Murray Darling Depression Bioregion**

**In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 7 December 2021.**

This document combines the approved conservation advice and listing assessment for the threatened ecological community (TEC). It provides a foundation for conservation action and further planning.



Malleefowl (*Leipoa ocellata*) [left] and Black-eared Miner (*Manorina melanotis*) [right].  
© Brian Furby, used with permission

The TEC occurs within country (the traditional lands) of the Wongaibon, Wiradjuri, Yorta Yorta, Barapa Barapa, Ngurraillam, Wemba Wemba, Wadi Wadi, Nari Nari, Dadi Dadi, Madi Madi, Djadjawurung, Jardwadjali, Dindjali, Ngardad, Wergai, Latje Latje, Kureinji, Barkindji, Danggali, Wiljali and Ngadjuri peoples. We acknowledge their culture and continuing link to the ecological community and the country it inhabits.

### **Conservation Status**

The Mallee Bird Community of the Murray Darling Depression Bioregion is listed in the Endangered category of the threatened ecological communities list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective from 7 December 2021.

The ecological community was assessed by the Threatened Species Scientific Committee to be eligible for listing as Endangered under criteria 3, 4 and 5. The Committee's assessment is at [Section 7](#).

The main factors that make the threatened ecological community eligible for listing in the Endangered category are: severe loss of a functionally important species over much of the landscape; severe loss of ecological integrity from the combined actions of several threats; and a severe rate of continuing detrimental change shown by many members of the ecological community.

Ecological communities can also be listed as threatened under state and territory legislation. At the time of this advice, the ecological community corresponds closely with the *Victorian Mallee Bird Community* (VSAC 2002) listed as threatened in Victoria. More information is at [section 5](#).

### **Recovery Plan Decision**

The Minister decided, in line with the Committee's recommendation, that a recovery plan is not required at this time. The Committee's recommendation is at [section 7](#).

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# 1 ECOLOGICAL COMMUNITY NAME AND DESCRIPTION

## 1.1 Name

The ecological community was nominated as the *Woodland and Heathland Bird Community of the Murray Mallee Bioregion*. It was based on a threatened ecological community listed in Victoria as the *Victorian Mallee Bird Community* (VSAC 2002). The nominated community comprised an assemblage of 21 bird taxa considered dependent on mallee with a distribution limited to the Murray Mallee of north-western Victoria and south-eastern South Australia.

Information on bird distributions and habitats (Birdlife Australia 2015a; Atlas of Living Australia 2020) identified a similar mallee bird assemblage with 20 mallee-dependent species that has a wider distribution over the entire Murray Darling Depression IBRA bioregion<sup>1</sup>. The name of the ecological community is the **Mallee Bird Community of the Murray Darling Depression Bioregion**, hereafter referred to as the “Mallee Bird Community” or “the ecological community”. The name identifies it as a faunal community with strong affinities to mallee in a specific bioregion dominated by such vegetation.

The term ‘mallee’ refers to

“the distinctive growth form of dominant trees, characterized by multiple stems arising from a woody subterranean regenerative organ or lignotuber” (Keith et al. 2020).

Such trees are typically eucalypt species from the sections *Bisectaria* and *Dumaria* (Keith et al. 2020). Mallee also refers more widely to the vegetation systems and biome dominated by plants with this growth form (McCusker 1999) and is a characteristic feature of the bioregion where the ecological community occurs.

## 1.2 Description of the ecological community and the area it inhabits

The ecological community described in this conservation advice is a type of fauna community found in the Murray Darling Depression bioregion. It is an assemblage of bird species that are dependent on the mallee vegetation that characterises this bioregion.

This section describes the natural and largely undisturbed state of the ecological community and its habitat. More information to assist in identifying patches of habitat and occurrences of the ecological community is provided in [section 2](#). As a result of past disturbance, not all occurrences of the ecological community and its habitat still exist in the benchmark state. [Section 2.2](#) provides information to identify which occurrences retain sufficient conservation values to be considered a matter of national environmental significance.

### 1.2.1 Location and climate

Mallee ecosystems occur in the drier parts of Australia, south of the arid zone in Western Australia (WA), South Australia (SA), New South Wales (NSW) and Victoria (Yates et al. 2017; Keith et al. 2020). These ecosystems face severe summer water deficits, nutritional poverty, and fire regimes that govern their responses and traits (Keith et al. 2020). Within south-eastern Australia, mallee is generally associated with unconsolidated aeolian sands in low rainfall zones, typically within the 200-350mm annual rainfall isohyets, though some areas receive up to 500mm rainfall.

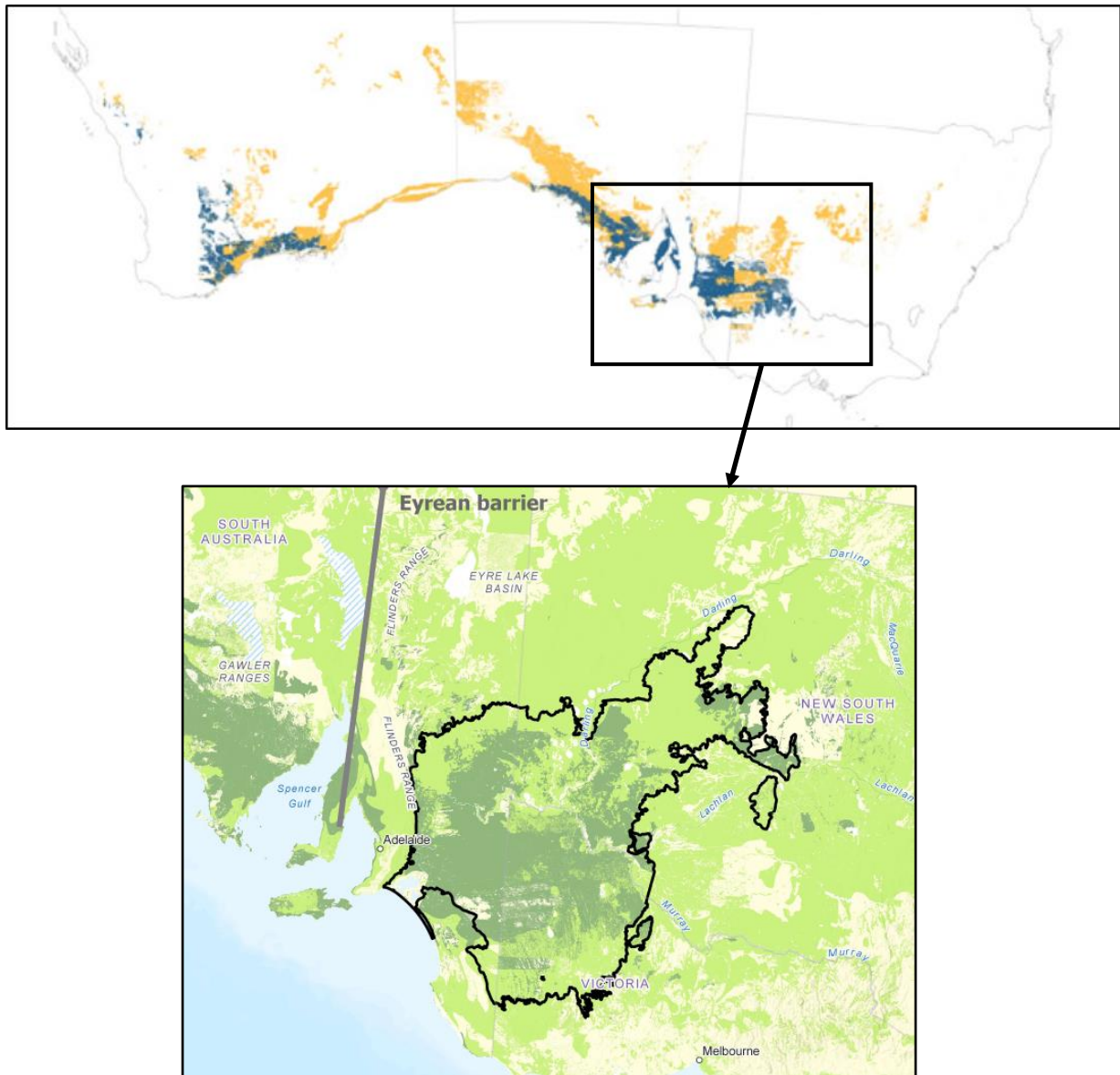
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<sup>1</sup> IBRA bioregion refers to the Interim Biogeographical Regionalisation of Australia. IBRA bioregions are large geographically distinct areas of similar climate, geology and landform with corresponding similarities in their vegetation and animal communities. The version current at the time of this advice is IBRA v7 (DoE, 2013), which divides Australia into 89 bioregions and 419 subregions, including offshore islands.

**Figure 1.1.** Distribution and extent of mallee vegetation across southern Australia.

Top: Extent of MVG14 *Mallee woodlands and shrublands*.

Bottom: detail showing pre-1750 native vegetation, the MDD bioregion, and the Eyrean faunal barrier.



Top map. Source: Map reproduced from DoEE (2017a).

**Legend:** Orange polygons show the current extent of MVG14. Blue polygons show the change in extent of MVG14, i.e. areas of mallee likely present in 1750 but since removed or heavily modified.

Bottom map. Source: Compiled by DAWE from NVIS<sup>2</sup> v5.1 (DAWE 2020b).

**Legend:** Black outline shows the MDD bioregion with intervening riverine subregions that delineates the geographic extent of the Mallee Bird Community.

Grey line indicates the Eyrean barrier that lies to the west of the Flinders and Lofty Ranges and influences a divergence of faunal genotypes across the barrier (after McElroy et al. 2018).

The background shows pre-1750 native vegetation MVGs grouped as follows: dark green - Mallee vegetation (MVGs 14 and 32); light green - Key non-mallee woodland and shrubland MVGs; and yellow - Other native vegetation MVGs.

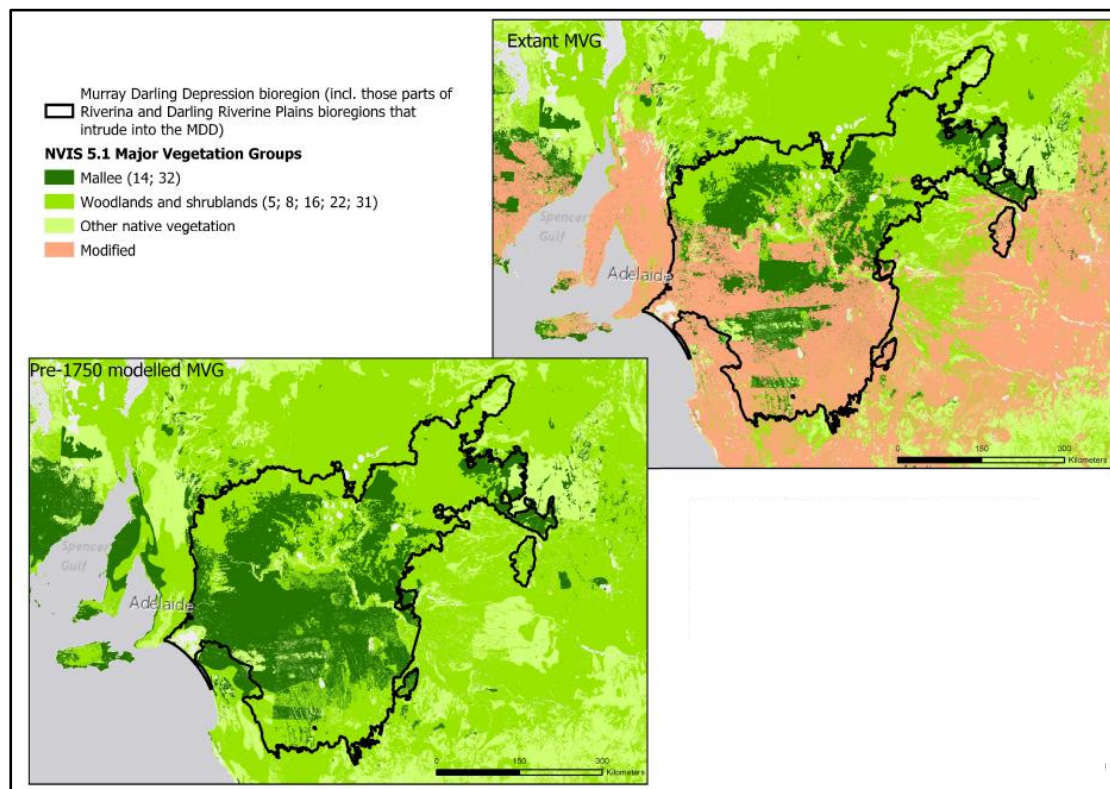
<sup>2</sup> NVIS refers to the National Vegetation Information System v5.1, a national system for describing Australia's natural vegetation at various scales. A consistent continental-wide vegetation dataset is currently available only at the broadest scale of Major Vegetation Group (MVG). MVGs presently divide native vegetation into 32 broad groups.

Extensive areas of mallee occur in mainland south-eastern Australian states (SA, NSW, Victoria) mostly in the Murray Darling Depression (MDD), Eyre Yorke Block (EYB), Gawler (GAW) and Great Victoria Desert (GVD) bioregions ([Figure 1.1](#)). The distribution of mallee is not continuous, however. One discontinuity occurs between the mallee of the MDD and the mallee further west that formerly stretched from Spencer Gulf, to the coastline south of the Nullarbor to connect with the mallee of south-western Western Australia, notably in the Great Western Woodlands. Another discontinuity is associated with the Eyrean barrier, one of the recognised barriers related to environmental features that influence a divergence in faunal species composition and genotype across Australian regions (McElroy et al. 2018). The Eyrean Barrier is marked by the Flinders-Lofty Ranges and Spencer Gulf up to Kati Thanda-Lake Eyre and demarcates some of the fauna of the mallee and woodlands of the Murray region from those on the Eyre Peninsula and further west ([Figure 1.1](#)).

The distribution of the Mallee Bird Community is limited to these IBRA bioregions and subregions that identify the major area of mallee habitats east of the Eyrean barrier ([Figure 1.1](#)):

- Murray Darling Depression (MDD): all seven subregions;
- Riverina (RIV) subregions where the Murray River intrudes into the MDD: Murray Fans (RIV03, west of Swan Hill), Robinvale Plains (RIV05), and Murray Scroll Belt (RIV06); and
- Darling Riverine Plains (DRP) subregions where the Darling River anabranches intrude into the MDD: Great Darling Anabranch (DRP08); and Pooncarie-Darling (DRP09).

**Figure 1.2.** Distribution of Major Vegetation Groups around the Murray Darling Depression bioregion. Maps compare modelled pre-1750 vegetation extent with extant (2016) vegetation.



Source: Maps compiled by DAWE based on data from NVIS v5.1 (DAWE 2020b). The black outline shows the MDD bioregion plus intervening riverine subregions that delineate the geographic extent of the Mallee Bird Community.

The climate of the MDD bioregion is described as Mediterranean to semi-arid, marked by long hot summers and mild winters with significant moisture limits on growth (Hutchinson et al. 2005). There is a gradient of increasing aridity, and differences in land use from the northern and southern parts of the MDD bioregion ([Figure 1.2](#)). The northern area, delineated by IBRA

subregions MDD01, MDD06, MDD07, has a semi-arid climate that generally is too dry to support cropping but is subject to pastoral land uses. The landscapes here are relatively less cleared but the flora and fauna in this area have been, and continue to be, impacted by multiple threats, some of them severe. The southern area, delineated by IBRA subregions MDD02, MDD03, MDD04 and MDD05 has a Mediterranean climate with peaks of growth in winter and spring. Much of the landscape is suitable for agriculture and targeted for clearing. Native vegetation is now highly fragmented in this landscape outside of extensive conservation areas.

### 1.2.2 Mallee Bird Community

The Mallee Bird Community is an assemblage of 20 bird species that rely on mallee habitats for their continued persistence within the MDD bioregion. The assemblage represents 11 families ([Table 1.1](#)), the most common being the honeyeaters (Meliphagidae; six species) and wrens (Maluridae; three species). Thirteen species are individually listed as threatened by at least one jurisdiction, and six are listed as nationally threatened, either at the species or an infraspecific level ([Table 1.1](#)). At the time of this advice, seventeen species are part of the State-listed threatened Victorian Mallee Bird Community.

Two groupings of species (specialists and dependents) are broadly recognised within the assemblage, based on species' reliance on mallee habitats as determined by available biological information and metrics on observations collated by Birdlife Australia (2015) and the Atlas of Living Australia. [Appendix A](#) summarises data and metrics from various sources about the distribution and habitats for bird species associated with mallee in the MDD bioregion.

- *Mallee specialists*. Bird species found almost exclusively in mallee habitats, especially within the MDD bioregion. The loss of suitable mallee habitats for these birds can potentially lead to their extinction, certainly at a local or regional scale. This group comprises eight bird species, all of which are recognised as threatened by at least two State jurisdictions, with five taxa listed as nationally threatened at the time of this advice ([Table 1.1](#)). These species are uncommon, with low reporting rates, and difficult to detect without extensive or specialist survey knowledge.
- *Mallee dependents*. Bird species that are dependent on mallee where it is present, but have a wider range extending into non-mallee woodland and shrubland habitats that intergrade with mallee vegetation. The loss of all suitable mallee habitats for these species may not necessarily lead to extinction but could result in substantial declines in abundance in the MDD, as well as loss of ecological diversity in the assemblage. This group comprises twelve bird species, five of which at the time of this advice are recognised as threatened species in at least one State jurisdiction, and one – the Regent Parrot – is listed as nationally vulnerable ([Table 1.1](#)).

Most mallee specialist species have low bird reporting rates<sup>3</sup>, typically less than 5% ([Table 1.2](#)) with higher reporting rates in Key Biodiversity Areas (KBAs) and conservation reserves where extensive areas of mallee persist and survey efforts have been relatively greater ([Appendix A](#)).

---

<sup>3</sup> The bird reporting rate (RR) is a measure of the frequency with which a bird species is observed based on given parameters (time period, survey method and location). The RR is calculated as the percentage of surveys in which a species was recorded out of the total number of surveys undertaken (Birdlife Australia 2020a). RR can be sensitive to low survey efforts, when, for instance, the frequency can be negligible (e.g. no observations) to maximum (50 or 100%) in the case of birds observed from only one or two surveys.



**Table 1.1.** Component bird species of the Mallee Bird Community and their conservation status.

Common name	Species name	Family	EPBC status	NSW status	SA status	Vic. Status	Vic. mallee bird community
<b>Mallee specialists</b>							
Black-eared Miner	<i>Manorina melanotis</i>	Meliphagidae	E	CE	E	CE *	MD
Chestnut Quail-thrush	<i>Cinclosoma castanotum</i>	Cinclosomatidae		V	R	NT	MD - ssp <i>castanotus</i>
Mallee Emu-wren	<i>Stipiturus mallee</i>	Maluridae	E		E	E *	MD
Malleefowl	<i>Leipoa ocellata</i>	Megapodiidae	V	E	V	E *	MD
Red-lored Whistler	<i>Pachycephala rufogularis</i>	Pachycephalidae	V	CE	R	E *	MD
Scarlet-chested Parrot	<i>Neophema splendida</i>	Psittacidae		V	R	V *	
Striated Grasswren	<i>Amytornis striatus</i>	Maluridae		V	R	NT	MD
Mallee Western Whipbird	<i>Psophodes nigrogularis</i>	Psophodidae	V		E	CE *	MD – ssp <i>leucogaster</i>
<b>Mallee dependents</b>							
Crested Bellbird	<i>Oreoica gutturalis</i>	Oreoidae				NT *	MA – ssp <i>gutturalis</i>
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>	Meliphagidae				V	MD – ssp <i>graingeri</i>
Jacky Winter	<i>Microeca fascinans</i>	Petroicidae					MD – ssp <i>assimilis</i>
Purple-gaped Honeyeater	<i>Lichenostomus cratitius</i>	Meliphagidae		V		V	MD
Regent Parrot	<i>Polytelis anthopeplus</i>	Psittacidae	V	E	E	V *	MD – ssp <i>monarchoides</i>
Shy Heathwren	<i>Calamanthus cautus</i>	Acanthizidae		V	R		MD – ssp <i>cautus</i>
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	Petroicidae		V			MD
Splendid Fairy-wren	<i>Malurus splendens</i>	Maluridae					MD
Spotted Pardalote	<i>Pardalotus punctatus</i>	Pardalotidae					MD – ssp <i>xanthopyge</i>
White-eared Honeyeater	<i>Nesoptilotis leucotis</i>	Meliphagidae					MD – ssp <i>novaenorca</i>
White-fronted Honeyeater	<i>Purnella albifrons</i>	Meliphagidae					MA
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>	Meliphagidae					MD

Sources: DAWE (2020c); VSAC (2002) for the Victorian Mallee Bird Community.

Determinations of conservation status are based on assessments against criteria for environmental legislation that is specific to each jurisdiction as at June 2021.

**Legend:** For species' conservation status: NT = Near Threatened; R = Rare; V = Vulnerable; E = Endangered; CE = Critically endangered; \* = Threatened.

Two separate listings currently apply for Victoria. The conservation status shown refers to those under the Victorian Advisory List for Threatened Vertebrate Fauna. This is separate to formal listings under the *Flora and Fauna Guarantee Act 1988* that only identifies species as Threatened and are denoted here by an asterisk \*. The process to consolidate the lists is incomplete as at April 2021.

For the Victorian Mallee Bird Community listed as Threatened in Victoria, MD = mallee-dependent species included in the Victorian community; MA = mallee-associated bird species identified by VSAC (2002) but not part of the formal listing. Some species were listed at the subspecies level and these are identified as recognised for the 2002 listing, noting that accepted taxonomy may have changed since then.

The name recognised for *Calamanthus cautus* in the Australian Faunal Directory (AFD), at the time of writing, is *Hylacola cauta* with the subspecies being *cauta*. Similarly, the name applied to *Psophodes nigrogularis* in the AFD is *Psophodes leucogaster*.

**Table 1.2.** Average reporting rates<sup>3</sup> (RR %) for component bird species of the Mallee Bird Community by NRM regions that lie within or substantially overlap the MDD bioregion. RR provides an indication of relative abundance for each species across parts of their range in the MDD bioregion.

Common name	Natural Resource Management (NRM) Region			
	SA MDB	NSW Western*	Vic Mallee	Vic Wimmera
<b><i>Mallee Specialist</i></b>				
Black-eared Miner	1.17		0.50	
Chestnut Quail-thrush	2.77	2.23	5.70	0.04
Mallee Emu-wren			1.77	
Malleefowl	0.17	0.22	0.98	0.23
Red-lored Whistler	0.30		0.65	
Scarlet-chested Parrot	0.12			
Striated Grasswren	0.86	1.29	0.89	
Mallee Western Whipbird				
<b><i>Mallee Dependent</i></b>				
Crested Bellbird	7.58	10.96	12.81	0.08
Grey-fronted Honeyeater	0.22	2.15	0.02	
Jacky Winter	9.06	7.63	12.94	10.83
Purple-gaped Honeyeater	0.60		0.33	0.28
Regent Parrot	1.15	1.65	5.53	0.42
Shy Heathwren	1.17	1.70	3.45	2.19
Southern Scrub-robin	2.43	3.05	2.43	3.53
Splendid Fairy-wren	2.73	4.81	9.18	0.60
Spotted Pardalote	9.89	4.58	21.32	16.41
White-eared Honeyeater	5.73	8.17	16.52	14.78
White-fronted Honeyeater	8.57	9.56	6.71	3.12
Yellow-plumed Honeyeater	16.70	13.36	29.33	1.82

Source: Birdlife Australia - Birddata online public database, accessed January 2021.

Database search parameters were: Program = General Birddata; Survey types = 2ha 20 minute + 500m area search collated data; Period = 1 January 2000 to 31 December 2019; Area layer = NRM for the regions shown. The NRM regions are: South Australian Murray Darling Basin (now known as Murraylands and Riverland Landscape Board); Mallee Catchment Management Authority; Wimmera Catchment Management Authority (both Victoria); and Western Local Land Services (NSW). \*Since NSW Western LLS covers all western NSW between the Queensland and Victorian borders, only the region south of Menindee was analysed to broadly cover the NSW extent of the MDD bioregion.

Reporting rates are defined in footnote<sup>3</sup> on page 6. Reporting rates shown represent averages for four 5-year time periods (2000-04, 2005-09, 2010-14, and 2015-19) per species in each NRM and KBA region. Blank cells indicate no observations in an area, based on the database search parameters. Note this does not mean that a given species is entirely absent

The Mallee Western Whipbird was the only bird species not detected by standardised surveys in any of the NRM areas though it was detected at very low numbers generally, from parts of Wyperfeld-Big Desert-Ngarkat that lie outside of the SA MDB NRM region.

Mallee dependent bird species generally had higher reporting rates than specialist species but with a similar trend of higher reporting rates in mallee KBAs and conservation reserves ([Table 1.2; Appendix A](#)). Species that are relatively more abundant (RR > 10%), at least in parts of their range, include the: Crested Bellbird, Jacky Winter, Spotted Pardalote, White-eared Honeyeater, White-fronted Honeyeater, and Yellow-plumed Honeyeater.

The range of traits exhibited by the 20 Mallee Bird species is discussed and presented under [Criterion 3, Section 7](#), specifically [Table 7.4](#). A summary of the key traits of the Mallee Bird assemblage is presented here for descriptive purposes.

- The assemblage has a high proportion of small birds, with sixteen species weighing under 60g; eleven of which are very small, weighing under 30g. Only two birds are large, reaching over 100g: the Regent Parrot and the Malleefowl.
- Most species have nests in a supported location, i.e. where the base rests on standing vegetation. A few species are ground nesters, notably the Chestnut Quail-thrush, Malleefowl and Southern Scrub-robin, while the Spotted Pardalote nests in burrows. The two parrot species that are part of the assemblage are hollow-nesters. The eastern subspecies of the Regent Parrot generally nests in River Red Gum (*Eucalyptus camaldulensis*), sometimes Black Box (*E. largiflorens*) trees close to a permanent water source, from which they range into nearby mallee, belah, buloke and other woodlands to forage (Baker-Gabb and Hurley 2011). The preferences of Scarlet-chested Parrots are less well-known, other than they nest in smaller trees of mulga (*Acacia aneura*) and mallee eucalypts and forage on the ground for seeds of grasses, herbs and wattles (OEH 2020).
- Most species prefer feeding on invertebrates. The six honeyeater species favour nectar and pollen in addition to invertebrate prey. Eleven species include seeds and/or fruit in their diets. The two parrot species in the Mallee Bird Community feed only on seeds, fruit or foliage, and typically do not include invertebrates in their diet.
- Data from the Australian Bird and Bat Banding Scheme (ABBBS) indicate variability in maximum mobility and recapture intervals among assemblage species. Species such as the Mallee Emu-wren, Purple-gaped Honeyeater and Southern Scrub-robin appear to move only short distances. However, species such as the Regent Parrot and Spotted Pardalote have been recaptured over long distances, well over 100 km.
- Most species in the assemblage have a maximum lifespan of ten years or less and reach reproductive age within their first one to two years. Three species, the Malleefowl and the two parrots, are the only assemblage birds with a maximum longevity exceeding twenty years and the Malleefowl is the only species with an age to first reproduction of over two years.

Some of the Mallee Bird Community species, notably the Mallee Specialists, are difficult to detect in the field. So, in addition to the 20 species of the Mallee Bird assemblage, a group of Mallee-associated bird species has also been identified. These species are not formally part of the bird community, but their presence may help determine if the Mallee Birds are likely to be present at a site. Details on Mallee-associated bird species and how they may help determine the likely presence of the community are appropriately given in [Section 2, Table 2.3](#).

### 1.2.3 Vegetation habitats for the Mallee Bird Community

A brief outline of the broad vegetation groups in the MDD bioregion and of the four major types of mallee woodland and shrubland within which the ecological community may be found is provided here.

At a broad level, mallee vegetation can be grouped under two NVIS Major Vegetation Groups (MVGs; a high-level Australia-wide classification) (DoEE 2017a, b). These are:

- MVG 14 - *Mallee woodlands and shrublands* that features a more developed tree canopy with a projective foliage cover<sup>4</sup> of 10 to 30 percent; and
- MVG 32 - *Mallee open woodlands and sparse mallee shrublands* that has a very open to sparse tree canopy with a projective foliage cover of less than 10 percent.

The distribution of mallee and other key Major Vegetation Groups in and around the MDD bioregion is shown in [Figure 1.2](#). Mallee was the most common vegetation type across the MDD bioregion and remains so ([Table 1.3](#)).

**Table 1.3.** Extent of vegetated habitats within the MDD bioregion based on NVIS Major Vegetation Groups (MVG).

IBRA Bioregion	Pre-1750 extent	Current extent
Mallee Woodlands and Shrublands	9,724,798	5,601,930
Non-eucalypt Forest and Woodland	4,596,624	3,596,397
Non-forest Vegetation	3,363,280	2,859,708
Non-mallee Eucalypt Forest and Woodland	2,071,247	475,466
<i>Total Native Vegetation</i>	<i>19,755,949</i>	<i>12,533,501</i>
% mallee in MDD bioregion	48.7	28.1
Cleared, Non-native, Regrowth or Modified		7,209,427
% MDD bioregion cleared or modified		36.1
<b>Area of bioregion (ha)</b>	<b>19,958,349</b>	

Source: DAWE (2020b) NVIS v5.1 dataset for Major Vegetation Groups.

Note: MVGs were aligned into broad habitat groups, as follows:

- Mallee Woodlands and Shrublands = MVGs 14 & 32
- Non-mallee Eucalypt Forest and Woodland = MVGs 3, 4, 5 & 11
- Non-eucalypt Forest and Woodland = MVGs 6, 7, 8, 9, 10, 13, 15, 23 & 31
- Non-forest Vegetation = MVGs 16, 17, 18, 19, 20, 21 & 22
- Cleared, Non-native, Regrowth or Modified = MVGs 25 & 29
- MVGs 1, 2 & 12 are naturally absent from the MDD bioregion.

There are four broad types of mallee based on understorey features and environmental variables (Yates et al. 2017; Keith et al. 2020). Each type provides habitat and resources for different bird species, as well as for other animals that reside in mallee systems.

- **Triodia Mallee.** This type typically has a relatively open understorey with hummock grass and sparse sclerophyll shrubs with an arid affinity. Key species present include *Eucalyptus socialis* and *E. dumosa* in the tree canopy, the hummock grass *Triodia scariosa*, and shrubs in the genera *Acacia* and *Beyeria*. Herbs, including ephemeral Asteraceae and grasses such as *Austrostipa* may be abundant after rains. This type develops in areas with the lowest relative rainfall, around 150-300 mm/year.
- **Chenopod (and Tussock Grass) Mallee.** This type typically has a relatively open understorey with semi-succulent chenopod shrubs and tussock grasses. Key species present include *Eucalyptus gracilis*, *E. behriana* (bull mallee, broad-leaved mallee box) and *E. oleosa* in the tree canopy. The understorey has chenopod genera such as *Maireana*, *Atriplex*, *Rhagodia*,

<sup>4</sup> Projective foliage cover is the percentage of the sample site occupied by the vertical projection of foliage and woody branches only (National Committee on Soil and Terrain, 2009).

*Sclerolaena*, and *Chenopodium*, plus some non-chenopod shrubs such as *Olearia* and *Zygophyllum*. Tussock grasses, e.g. from the genera *Austrostipa* and *Rytidosperma*, and ephemeral forbs may be abundant, especially after rainfall. This type develops in areas with more moderate rainfall, around 200-300 mm/year.

- Shrubby Mallee. This type typically has a relatively open understorey of sclerophyll shrubs with an arid affinity. The shrubs tend to be long lived with regenerative organs. Key species include *Eucalyptus socialis*, *E. dumosa* and *E. gracilis* in the tree canopy, an understorey of taller shrubs in the genera *Acacia*, *Dodonaea*, *Eremophila* and *Senna*. This type develops in areas with more moderate rainfall, around 200-300 mm/year.
- Heathy Mallee. This type typically has a relatively dense understorey of sclerophyll shrubs with temperate affinities, with grasses and forbs being less common. Key species include *Eucalyptus incrassata*, *E. diversifolia*, *E. dumosa* and *Callitris verrucosa* in the tree canopy, and a diverse range of small shrubs in the understorey from genera such as *Acacia*, *Cryptandra*, *Daviesia*, *Grevillea*, *Hakea*, *Hibbertia*, *Leucopogon*, *Leptospermum*, *Melaleuca*, *Phebalium* and *Spyridium*. This type develops in areas with the highest relative rainfall, around 300-600 mm/year. The recruitment of trees and shrubs is closely tied to fire.

These types of mallee may be mapped using finer-scale vegetation classification schemes, noting these vary among States.

## 2 IDENTIFYING THE ECOLOGICAL COMMUNITY

Section 1 describes the Mallee Bird Community and the area it inhabits. This section provides additional information to assist with identifying occurrences of the ecological community in the field.

The Mallee Bird Community intergrades with other bird communities, notably the avifauna of the Eastern Mallee that overlaps the MDD and extends into the mallee areas of the Eyre Yorke Block and Gawler bioregions further west in SA; and the avifauna of the Southeast Mainland that lies to the east and south of the MDD (Birdlife Australia 2015; Simmonds et al. 2019). These adjacent avifaunal communities are identified as broad assemblages of terrestrial birds linked to a geographic region and not to specific vegetation types; and hence include a larger number of bird species.

Key diagnostics are used to help identify if an occurrence of a bird assemblage is the Mallee Bird Community, and defines the features that distinguish it from other communities, noting that additional information to assist with identification is provided in the other sections of this document, particularly the description (section 1) and Appendix B.

### 2.1 Key diagnostics

The ecological community is defined as occurrences of bird taxa that meet the description in section 1, and that meet the key diagnostics specified below. Occurrences of bird assemblages that do not meet the key diagnostics are not the nationally listed ecological community.

A step-wise identification approach is applied to identify if the Mallee Bird Community is likely to be present at a given site. Three key pieces of information are necessary.

Where is the site located?

In order to answer this, you need to know the location of your site and how it fits with the geographic boundary for the Mallee Bird Community described in section 1.2.1. Geographic co-ordinates for the site and IBRA boundary layers may be required if sites are close to, or on the bioregional boundary.

Are mallee habitats present on the site?

In order to answer this, you will need on-ground truthing to determine what native vegetation occurs at the site and whether mallee is dominant (see section 2.3.2 Consideration of mallee habitats).

What terrestrial bird species are recorded?

In order to answer this, you will require access to existing records for bird observations (available online) and reliable bird survey data (preferably collected by expert ornithologists and in line with bird survey guidance at section 2.3.1). You also need to refer to several lists of birds presented in this conservation advice, especially the list of birds that comprise the Mallee Bird Community (Table 1.1); the kinds of birds to exclude from consideration (pages 16-17, Tables 2.1 and 2.2) in developing a list of relevant terrestrial birds; and the list of mallee-associated birds (Table 2.3) that may help identification if a low number of Mallee Bird Community species are detected. Appendix B also provides all relevant bird lists.

### Where is the site located?

1. Is the area of interest within, or partially within any of the following IBRA bioregions or subregions? (see [section 1.2.1](#) for more detail):

- Murray Darling Depression (MDD): all seven subregions;
- Riverina (RIV) subregions where the Murray River intrudes into the MDD: Murray Fans (RIV03, west of Swan Hill), Robinvale Plains (RIV05), and Murray Scroll Belt (RIV06);
- Darling Riverine Plains (DRP) subregions where the Darling River anabranches intrude into the MDD: Great Darling Anabranch (DRP08); and Pooncarie-Darling (DRP09).

YES (or uncertain)	- Go to step 2
NO	- The ecological community is not present. The site lies outside its range.

### Are mallee habitats present on the site?

2. Is a patch of native vegetation of at least 10 hectares present (either wholly or partially within the site)?

Native vegetation is vegetation where native species are the dominant<sup>5</sup> or most common species present in each both the canopy and the understorey.

YES	- Go to step 3
NO	- The ecological community is not present. Habitat for the birds is absent.

3. Does the patch of native vegetation contain an area or areas of at least 5 hectares dominated by mallee?

Mallee vegetation is defined as having the following combination of features within an area of native vegetation:

- Vegetation structure is a native woodland to shrubland where a tree canopy is present that is at least sparse (5% crown cover<sup>6</sup>) but not typically closed; AND
- Mallee eucalypt trees are the dominant tree canopy type present. Other non-mallee trees (i.e. non-mallee eucalypts or non-eucalypt native species) may be present in the tree canopy but do not represent the most common structural type averaged across the remnant or site.

YES	- Go to step 4
NO	- The ecological community is not present. Key habitat for the birds is absent.

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<sup>5</sup> Dominance within the tree canopy is defined as the most common tree structural type, typically representing 50% or more of the crown cover<sup>5</sup> of the tree canopy or, if not, the majority of trees present are mallees.

Dominance of the understorey refers to 50% (on average across the patch) of the total perennial vegetation cover of the ground layer plus mid layer below 2 metres height. Note that areas which have a significant weed cover may fall out of this diagnostic feature but could still be restorable to a more intact condition.

<sup>6</sup> Crown cover is measured as the percentage covered by the total area within the vertical projection of the periphery of the tree crowns, where the tree crowns are considered to be solid (National Committee on Soil and Terrain 2009). Mallee woodlands typically have a crown cover of >20% while that for open mallee vegetation is <20%. However the vegetation of the MDD bioregion can be spatially heterogenous, with open areas of shrubland with sparse tree cover to denser groves of non-mallee woodland, sometimes interspersed within mallee. There is also the influence of disturbances, notably fire regimes, that can temporarily remove the tree canopy or stimulate regeneration with impacts on some of the component bird species. See section 2.3.2 for more advice on identifying vegetation habitat.

What terrestrial bird species are recorded?

4. How many species of the Mallee Bird Community (MBC) (see [Table 1.1](#)) have been recorded from current bird surveys and/or from existing bird observation records within 20km of the site and within the last ten years?

**Refer to section 2.3. Additional information** for guidance on how to get existing records and/or undertake appropriate bird surveys to develop a bird list.

At least 3 MBC species, any mix of mallee specialist and dependent species	- Yes, the ecological community may be present.
Less than 3 MBC species.	- The ecological community is not present. If the species observed are listed threatened species then the site should be managed as species habitat rather than an occurrence of a threatened assemblage.

## 2.2 Condition categories and thresholds

The Mallee Bird Community can exist in a number of forms, ranging from assemblages with a high diversity of mallee specialist or dependent species to assemblages with less mallee specialist or dependent species but a high number of mallee associated or other terrestrial bird species. Meeting the requirements of any of these condition categories and thresholds suggests that the area is good bird habitat for the MBC at this time and/or has the best potential to support even more of the MBC birds in the future if managed and/or restored appropriately. The categories below reflect these different conditions, but do not represent a gradient of condition; all are of equal value.

**Refer to section 2.3. Additional information** for guidance on how to get existing records and/or undertake appropriate bird surveys to develop a bird list.

Category	Thresholds
	Bird species recorded from current bird surveys or collated existing records within 20km of the site and within the past ten years.
Category A: High number of MBC species	At least 5 MBC species, any mix of mallee specialist and dependent species (see <a href="#">Table 1.1</a> )
Category B: Moderate number of MBC species including a mallee specialist species	3 to 4 MBC species INCLUDING at least one mallee specialist species (see <a href="#">Table 1.1</a> )
Category C: Moderate number of MBC species as well as mallee associated species	3 to 4 MBC species PLUS at least 5 mallee associated species (see <a href="#">Table 2.3</a> )
Category D: Moderate number of MBC species as well as terrestrial bird species	3 to 4 MBC species PLUS at least 20 or more terrestrial bird species, as defined in the survey guidelines at <a href="#">Section 2.3.1</a>



## 2.3 Additional information to assist in identifying the ecological community

### 2.3.1 *Surveys of the bird assemblage.*

A combination of accessing available recent records and undertaking new surveys at or around a site can help determine what terrestrial birds are present at a site.

Land managers who need to identify whether or not the ecological community is present at a particular site are strongly encouraged to talk with bird ecologists for advice. Birdlife Australia and State groups such as Birds SA, Birding NSW and the Field Naturalists Club of Victoria are key organisations to approach about advice and local contacts. It is strongly recommended that the results of any new expert surveys be contributed to public databases such as Birddata collated by Birdlife Australia, e-Bird, and the Atlas of Living Australia, to build on citizen science efforts.

#### Accessing existing bird records and local knowledge.

Existing records can be obtained through online databases held by Birdlife Australia (Birddata), e-Bird, Atlas of Living Australia or museums. Local bird ecologists may also know about bird species they have observed, outside of formal databases. Existing observations supplement current surveys, especially when a site is subject to recent disturbance, such as a fire or clearing event, or seasonal conditions that may limit bird observations, such as prolonged drought.

It is noted that bird surveys are not evenly spread through the landscape. While some areas may be relatively well surveyed (e.g. key conservation areas, major roadsides), other areas are poorly surveyed, notably remote areas of the bioregion and where the landscape is now largely modified with scattered native vegetation remnants.

The process to follow when accessing available records is:

- Collate all bird observations recorded at a site and within at least a 20-kilometre radius around the area of interest.
- Collate observations dating back to the past ten years.
- Follow the data handling guide below to get a list of terrestrial birds relevant to a site.

If existing records result in a comprehensive list of 20 or more terrestrial bird species, then new surveys may not be necessary, except to confirm the observations remain current.

#### Undertaking new systematic bird surveys.

Some mallee bird species are difficult to detect and can require specialist survey knowledge. Attempting to categorise the Mallee Bird Community using unsuitable bird survey techniques could lead to the incorrect down-grading of many valuable mallee sites. Many mallee bird species are recognised as threatened and some occur in highly localised populations, so will not be easily encountered.

Survey guidelines for nationally listed threatened birds are available (DEWHA 2010) that provide specific guidance for surveying nationally listed members of the Mallee Bird Community. Generic guidance also is provided for surveying particular groups and families of birds that extends the value of these guidelines to birds not formally listed. These guidelines should be followed, especially at or near to sites where threatened species are, or were, known or occur.

The following advice (Birdlife Australia pers. comm) is suggested as the minimum survey effort to determine if the Mallee Bird Community is present.

- All bird species observed should be recorded, not just species linked to the Mallee Bird Community.
- Multiple standardised surveys should be undertaken with sufficient surveys to account for variable conditions.
  - Standardised surveys include 2 ha 20-minute surveys, and 500 metre area searches that are more than 30 minutes duration per site. The 500m area searches are preferred.

- A minimum of three repeat surveys should be undertaken in each area sampled, taking note of how large and fragmented the site is.
- Surveys should be timed to maximise the diversity of bird species recorded:
  - Survey during August to November;
  - Only survey in optimal weather conditions (low wind <25 km/hr, not too hot <32°C, avoid rainy days);
  - Survey in the morning, ideally between 30 mins before sunrise to 6 hours after sunrise.
- Adjust the number of sites sampled by size of the mallee woodland fragment:
  - For fragments under 200 ha, survey a minimum of three sites;
  - For patches 200-1,000 ha, survey a minimum of ten sites;
  - For patches > 1,000 ha survey more than 20 sites.
  - Select sites that are representative of the broader patch in terms of fire-age, soil type, understorey type (e.g. chenopod mallee, shrubby mallee, *Triodia* mallee).
  - Avoid surveys on the edge of patches, especially in smaller patches that adjoin modified landscapes.
- Where possible, avoid surveys in areas recently burnt (<1 year) or affected by other recent disturbances. Components of the bird fauna impacted by disturbance will re-establish as mallee habitats recover to the seral stages favoured by particular species though this may take some time. For instance, bird species that require a developed *Triodia* understorey need many years for the spinifex hummocks to establish after fires. Their recolonisation to a site also depends on the proximity and maintenance of viable source populations from where re-establishment can occur, whether naturally or through assisted translocations.
- In times and areas affected by drought, survey effort should be increased to account for the potential impacts of drought on the bird community.

#### Determining the suite of terrestrial birds present

The Mallee Bird Community is an assemblage of terrestrial native birds that generally reside and feed within the mallee and intergrading woodland vegetation of the MDD bioregion. It does not include any birds that are aquatic (e.g. ducks, egrets), marine species (e.g. seagulls, petrels), birds of prey (e.g. falcons, owls), or exotic species (e.g. sparrows). These certainly can be found in mallee ecosystems but are not reliant on them to persist. As noted, the key feature shared by bird species that define the Mallee Bird Community is a requirement for mallee habitat, in some form or post-fire successional stage, to provide the variety of resources required for all these species to persist within the MDD bioregion.

Based on data from available existing records and current surveys undertaken:

Collate a total bird species list. Historical observations become increasingly important when the season, conditions or other factors make it difficult to perform new surveys reliably. This is especially so for Mallee specialist species that are hard to detect. Therefore, past records should also be included in the list, with a note on which records are based solely on past records.

Identify and exclude all species that are:

- aquatic (e.g. ducks, egrets, waterfowl);
- marine (e.g. seagulls, petrels);
- birds of prey (e.g. falcons, eagles, owls);
- exotic species (i.e. established species not native to Australia – see Table 2.1); and
- species identified as common in the Eastern Mallee, including MDD region - see Table 2.2.

**Table 2.1.** Exotic terrestrial bird species recorded from the MDD bioregion.

Common name	Scientific name
Common Blackbird	<i>Turdus merula</i>
Common Greenfinch	<i>Chloris chloris</i>
Common Mynah	<i>Acridotheres tristis</i>
Common Starling	<i>Sturnus vulgaris</i>
Eurasian Skylark	<i>Alauda arvensis</i>
Eurasian Tree Sparrow	<i>Passer montanus</i>
European Goldfinch	<i>Carduelis</i>
Helmeted Guineafowl	<i>Numida meleagris</i>
House Sparrow	<i>Passer domesticus</i>
Indian Peafowl	<i>Pavo cristatus</i>
Ostrich	<i>Struthio camelus</i>
Rock Dove, Common Pigeon	<i>Columba livia</i>
Spotted Dove	<i>Spilopelia chinensis</i>

Source: Birdlife Australia (2021) Birddata online public database accessed January 2021. Note these are the exotic species noted in standardised surveys over a particular timeframe and area. It is possible that other non-native and naturalised terrestrial species may be present; if observed these should also be excluded. Most vagrant and migratory species are likely to be aquatic or marine species that will be excluded as such.

Database search parameters were: Program = General Birddata; Survey types = 2ha 20 minute + 500m area search; Period = 1 January 2000 to 31 December 2019; Area layer = NRM, for the regions: South Australian Murray Darling Basin (now known as Murraylands and Riverland Landscape Board); Mallee Catchment Management Authority; Wimmera Catchment Management Authority (both Victoria); and Western Local Land Services (NSW) south of Menindee.

**Table 2.2.** Common native terrestrial bird species identified for the Eastern Mallee region, including the MDD bioregion. These species are common across many other bird communities and habitats within and outside of the MDD bioregion.

Common name	Scientific name
Australian Magpie	<i>Gymnorhina tibicen</i>
Australian Raven	<i>Corvus coronoides</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>
Eastern Rosella	<i>Platycercus eximius</i>
Galah	<i>Eolophus roseicapilla</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Laughing Kookaburra	<i>Dacelo novaeguineae</i>
Little Corella	<i>Cacatua sanguinea</i>
Little Crow	<i>Corvus bennetti</i>
Little Raven	<i>Corvus mellori</i>
Long-billed Corella	<i>Cacatua tenuirostris</i>
Magpie-lark	<i>Grallina cyanoleuca</i>
Noisy Miner	<i>Manorina melanocephala</i>
Pied Butcherbird	<i>Cracticus nigrogularis</i>
Pied Currawong	<i>Strepera graculina</i>
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>

Source: Simmonds et al. (2019).

List the native bird species that remain. This should represent the terrestrial native species linked to natural vegetation in and around a site.

Calculate from the list of terrestrial native bird species:

1. The total number of terrestrial bird species identified.
2. The total number of bird species that are members of the Mallee Bird Community, separating them into numbers of Mallee Specialist and Mallee Dependent bird species.
3. The number of other bird species identified as mallee-associated in Table 2.3.

**Table 2.3.** Bird species considered to be mallee-associated but not part of the Mallee Bird Community.

Common name	Vic Mallee Bird status
Australian Ringneck	Mallee Associated
Blue Bonnet	Mallee Associated
Brown Treecreeper	Mallee Associated
Brown-headed Honeyeater	Mallee Dependent
Chestnut-rumped Thornbill	Mallee Associated
Gilbert's Whistler	Mallee Associated
Inland Thornbill	Mallee Associated
Major Mitchell's Cockatoo	Mallee Associated
Mulga Parrot	Mallee Associated
Red-capped Robin	Mallee Associated
Slender-billed Thornbill	Mallee Dependent
Spiny-cheeked Honeyeater	Mallee Associated
Spotted Nightjar	Mallee Associated
Striped Honeyeater	Mallee Associated
Weebill	Mallee Associated
White-browed Treecreeper	Mallee Associated

Source: VSAC (2002) lists of bird species identified as mallee dependent and mallee associated for the Victorian Mallee Bird Community listed as threatened in Victoria. A full species list for the Victorian community is given in Table B1, Appendix B.

### 2.3.2 Consideration of mallee habitats.

The following information should also be taken into consideration when applying the key diagnostics and condition thresholds to assess if appropriate habitats for the Mallee Bird Community are present. Land use and disturbance history will influence the state in which an occurrence of habitat is currently expressed.

#### 2.3.2.1 IDENTIFYING A PATCH

The concept of patch best applies to the mallee habitats that the Mallee Bird Community relies on. A patch is a discrete and mostly continuous area of native vegetation as defined by the description and key diagnostics. It can include small-scale variations, gaps and disturbances within this area.

When it comes to defining a patch of habitat, allowances are made for “breaks” up to 100 metres between areas that meet the habitat description. The 100m gap or less allows for the ability of many birds in the community to traverse this distance. Such breaks may be the result of watercourses or drainage lines, water bodies e.g. farm dams, tracks, paths, roads, gaps made by exposed areas of soil or litter, and areas of localised variation in vegetation that do not meet the description. For example, a single patch could include two areas that are separated by a narrow strip of different vegetation along a drainage line or by areas locally dominated by weeds. Such limited breaks do not significantly alter the overall functionality of the habitat and form a part of the patch. Wider areas, especially due to human-made disturbances, should be excluded from the calculation of patch size and condition. Where there is a break in mallee habitats of 100m or more then the gap indicates that separate patches are present. Human-made structures, gardens and commercial crops may occur within a patch, but are not part of the habitat for the ecological community and can be the cause of gaps >100m that create separate patches.

Patches of habitat may contain areas that vary in structural or biological characteristics. For example, one part of a patch may consist of mallee woodlands, whereas another part of the same patch may be dominated other woodland trees; or one part of a patch may have been more recently burnt and therefore at a different stage of regeneration. Variation in vegetation across a patch should not be considered to be evidence of multiple patches, so long as it shows continuity and meets the general description.

Whilst identifying the mallee habitats is possible at most times of the year, consideration must be given to the role that season, rainfall and disturbance history may play in an assessment. The vegetation can vary in its appearance through the year and between years, depending on climatic conditions. Some plant species are easier to detect or identify in certain seasons. In years of low rainfall, assessors should recognise that some plant species may not be detected. In addition, the quality of some habitats may be affected by the time since disturbance. For example, after a fire one or more vegetation layers, or groups of species may not be evident for a time. Timing of habitat surveys should allow for a reasonable interval after a disturbance (natural or human-induced) to allow for initial regeneration of habitats to become evident, noting that some key habitat features may take years to recover from serious disturbances. At a minimum, it is important to note climate conditions and what kind of disturbance may have happened within a patch, and when that disturbance occurred, as far as possible.

#### *2.3.2.2 REVEGETATION, REGROWTH AND REINTRODUCTIONS*

Revegetated or replanted sites or areas of regrowth are included as habitats for the ecological community, so long as these areas meet the description and diagnostics of habitat for the bird assemblage. Reintroductions and translocations of mallee bird species for the purposes of conservation - to improve the chances of species' survival and return at least parts of their formal range – are considered part of the Mallee Bird Community. This allows individuals, agencies and others who work to improve degraded habitats and declining bird abundances, sometimes with Government funding, to improve them to a state where they can be protected under national environment law.

### **2.4. Areas critical to the survival of the ecological community**

The areas critical to the survival of the ecological community are occurrences that meet the key diagnostic characteristics and condition thresholds specified in Section 2 and with:

- Known populations of threatened mallee birds listed individually under national environment law, especially the limited range mallee specialists. The potential loss of populations of these species represents a decline in diversity of the Mallee Bird assemblage at a local or regional scale. The available conservation advices, recovery plans and other management plans for those birds that are listed individually as threatened species may provide advice on key populations, local threats and management actions to maintain these limited range bird species.
- Areas where several members of the Mallee Bird community are known to occur and can act as reservoirs or source populations to colonise other nearby sites, if populations in the latter suffer impacts.

Other areas important to the survival of the ecological community are:

- Areas where several members of the Mallee Bird community were formerly known to occur (recorded) within at least the past ten years and bird populations and/or mallee habitats may regenerate, either naturally over time or with assisted reintroductions and revegetation.
- Areas where there has been long-term monitoring of either bird populations and/or mallee habitats, to preserve their value as scientific sites. Long-term monitoring contributes valuable information toward future survival of the ecological community.

## 2.5. Areas of high value - surrounding environment and landscape context

Occurrences of the ecological community do not occur in isolation. Landscape considerations will also influence how important a patch is to the ecological community as a whole. Areas of native vegetation that are larger and less disturbed are likely to provide greater biodiversity value. Remnants that are spatially linked by their proximity to each other are important for the viability of the ecological community if they harbour reservoir populations of birds that can recolonise after a habitat is disturbed. So, occurrences of the ecological community with connections across several areas of native habitats have a better chance of future survival and restoration success, because they are buffered from disturbance by the surrounding native vegetation and animal populations.

For natural resource management activities or actions that may have 'significant impacts' and require approval under national law (the EPBC Act), it is important to consider the whole environment surrounding occurrences of the ecological community. The following indicators of high value should be considered when assessing the impacts of proposed actions under national law, or when determining priorities for protection, recovery, management and funding.

- Mallee habitats that are most intact, larger and retain mid to old growth mallee trees (particularly those with hollows) and support a diversity of bird species. Features such as tree hollows and bark ribbons are slow to develop, over decades (Haslem et al. 2011; Taylor et al. 2013).
- Occurrences outside of conservation tenure that function as wildlife corridors that connect conservation areas where the Mallee Birds occur, or function as havens for some populations of Mallee Birds.
- Occurrences in habitats that have surrounding, adjacent and/or buffering areas of native vegetation.
- Occurrences that are in areas where the ecological community has been most heavily impacted, or that are at the natural edge of some species' range. These provide important refuges of mallee bird populations that potentially enable dispersal and recolonisation after catastrophic impacts.
- Areas of woodland that contain nationally or state-listed threatened species, not limited to members of the Mallee Bird Community.
- Mallee areas where key threats are relatively low level or where these can be managed efficiently, notably for pest animal impacts such as total grazing pressure and feral cat and fox predation.

### 3 CULTURAL AND COMMUNITY SIGNIFICANCE

Aboriginal communities have traditionally lived, and continue to live, in the areas associated with the ecological community, which corresponds to the traditional lands of many Aboriginal groups from south-west New South Wales, north-west Victoria and south-east South Australia. These include the Wongaibon, Wiradjuri, Yorta Yorta, Barapa Barapa, Ngurraillam, Wemba Wemba, Wadi Wadi, Nari Nari, Dadi Dadi, Madi Madi, Djadjawurung, Jardwadjali, Dindjali, Ngardad, Wergai, Latje Latje, Kureinji, Barkindji, Danggali, Wiljali and Ngadjuri peoples.

Traditional owners and custodians have an ongoing connection to management and use of natural resources associated with the ecological community. The natural landscape and the species that inhabit it, including birds, play a significant role in the culture of Aboriginal peoples of the region. Traditional Aboriginal culture is an oral-culture and storytelling is used to teach social mores, landscape relationships and cultural “Laws” (Tideman and Whiteside 2010).

“Bird stories are a part of the fabric of Aboriginal culture, often indicating expected cultural behaviour, but also account for plumage characteristics, calls, habitat, food, the relationships between Earth and extra-terrestrial objects, as well as interspecific behaviour.” (Tideman and Whiteside 2010)

There are hundreds of stories that involve birds from across Australia, including the birds of the Mallee. For example, lore relating to birds in the mallee have been recorded for the Madi Madi, Wadi Wadi and Wiradjuri. These stories involve the various birds present in the MDD bioregion, including the Malleefowl, Crested Bellbird, and Robins.

Some Aboriginal communities may hold, or be registered to claim, Native Title and/or co-management agreements over areas where the ecological community occurs. All aspire to have input into planning and decision-making process in relation to natural resources and landscape management on Country. For example, the southern portion of the Mallee Parks Landscape is within the Traditional lands of the Wotjobaluk Nations (including Jaadwa, Jadawadjali, Wergaia and Jupagulk) who have prepared a Country Plan: *Growing What is Good Country Plan — Voices of the Wotjobaluk Nations* (BGLC 2017). This document highlights the importance of some birds who feature in a Creation story in relation to the Southern Cross often told under the night sky, when the relevant story features can be seen.

## 4 THREATS

The Mallee Bird Community is impacted by several threats, primarily clearing of mallee habitats and their fragmentation into smaller, degraded remnants that are more susceptible to invasive species, fire impacts and climate change and hence less suitable to sustain a diverse assemblage of birds and the other flora and fauna on which they depend (Arthur Rylah Institute 2003; Mallee CMA 2012; Boulton and Lau 2015).

Table 4.1 outlines the key threats facing the ecological community. The key threats faced by the ecological community are described to help explain why this ecological community merits listing as threatened and supports the assessment against the criteria at section 7. Although presented as a list, these threats often interact rather than act independently.

**Table 4.1.** Summary of threats facing the ecological community

Threat factor	Threat Status*	Impacts and evidence base
<b>Altered fire regimes</b>	<p><i>Timing:</i> Ongoing</p> <p><i>Severity:</i> Most seasons minor, as only some areas impacted. Major during extreme fire seasons.</p> <p><i>Scope:</i> Major impacts to some bird populations and specific areas, especially old growth habitat, if burnt.</p>	<p>Mallee vegetation are fire-prone systems where much of the vegetation is adapted to particular fire regimes. Many plant species show adaptations for recovery after fire through resprouting from regenerative organs or germination from a seed bank.</p> <p>Many birds have no special adaptations to fire other than to temporarily flee to unburnt areas (Boulton and Lau 2015). Fires in the MDD bioregion often burn extensive areas of vegetation remnants: a sequence of such fires collectively accounted for 89% of the Murray Mallee subregion burnt between 1972 and 2007. However, individual fires have never burnt across the entire bioregion and are limited to particular areas. In most areas of the MDD bioregion, mallee ecosystems co-occur in landscape mosaics with less flammable ecosystems, such as belah woodlands and bluebush shrublands (Keith et al. 2020), as well as modified areas. Most fires initiate declines in bird populations due to exposure to heat or smoke during the event, or reduced availability of food and shelter in the early post-fire years. The capacity for bird species to recolonise into recovering burnt areas is variable and can be slow or not possible for certain species because of limited source populations, barriers to movement or limitations on establishment by immigrants (Santos et al. in prep).</p> <p>Some species, such as the Mallee Emu-wren, have a poor capacity to disperse from available refuges. This may contribute to declines and even local extinctions after fire. For instance, the Mallee Emu-wren disappeared from Billiatt and Ngarkat Conservation Areas, while the Black-eared Miner was no longer present at Bronzewing Flora and Fauna Reserve, after all these sites were burnt during the extensive 2014 fires season (Boulton and Lau 2015).</p> <p>Different species respond differently to post-fire changes in vegetation composition and structure. The abundance of mallee birds in the Murray Mallee system generally is positively associated with mid to late post-fire stages where older mallee trees occur, and negatively associated with recently burned sites (Taylor et al. 2012; 2013). Old-growth mallee is more likely to have larger nesting hollows that can take decades to develop. Only two members of the Mallee Bird Community are hollow-nesters though this feature is important to other woodland birds, such as the four hollow-nesting parrot and cockatoo species identified as mallee-associated. Consequently, maintaining and protecting stands of mature trees is vital when considering which sites provide the best longer-term refuges during planned burns and wildfires (Boulton and Lau 2015; Taylor et al. 2013).</p> <p>Lack of fire can also lead to decline in habitat quality for a range of mallee bird species that forage or take shelter in the shrub layer and in hummock-grasses. These features senesce over time and do not regenerate in the absence of occasional fires. A long-term lack of fire is the most common syndrome in small, isolated areas of mallee because wildfires don't often spread to those areas. Many mallee honeyeaters, wrens and other species are positively associated with a diverse shrub layer and decline in old-growth vegetation (Connell et al. 2017).</p> <p>The already fragmented landscape means that fire poses a serious threat to smaller remnants that may be suitable for the bird community (Sluiter et</p>



Threat factor	Threat Status*	Impacts and evidence base
		<p>al. 1997). Inappropriate fire management can change Mallee structure and composition through regular, poorly timed or overly intense hazard reduction burns (Howling et al. 2019). Fire impacts to smaller remnants could result in temporary loss of all suitable habitat locally, as happened at Bronzewing Flora and Fauna Reserve in 2014, or reduce value as refuges for mallee bird species. Smaller remnants may be afforded some protection from larger-scale fires due to their isolation and potential buffering, if the surrounding modified land use is less flammable or fires are actively prevented from spreading there. However, this can also have the impact of insufficient fire leading to senescence of native vegetation and hence loss of suitable habitat and resources, which in turn leads to the local loss of the Mallee Bird Community in long unburnt areas.</p> <p>Fire can also affect ecological processes by affecting pollinators, dispersers and food resources. For example, where birds are not killed outright by catastrophic bushfires, their responses to fire correspond with postfire changes in the vegetation and associated other fauna on which different members of the bird assemblage may rely (Woinarski 1999; Watson et al. 2012; Howling et al. 2019).</p>
<p><b>Fragmentation legacies</b></p>	<p><i>Timing:</i> Ongoing</p> <p><i>Severity:</i> Varies with subregion.</p> <p><i>Scope:</i> Majority, more severe in southern subregions.</p>	<p>Prior to non-Indigenous settlement, mallee habitats were extensive and nearly contiguous across the region. Historic clearance has resulted in fragmentation of the vegetation. The proportion of the MDD landscape that had &gt;60% mallee present has declined from an estimated 44% to 17%. The proportion of the landscape that has &lt;10% mallee increased from an estimated 12% to 33%. The mallee vegetation that remains in the most heavily cleared regions now occurs as smaller, widely scattered patches surrounded by a largely agricultural landscape. However, some extensive remnants of mallee persist, mainly in the MDD North and large conservation areas.</p> <p>Fragmentation can lead to ongoing loss of species diversity, habitat complexity and ecological function of assemblages of plants and animals (Saunders et al. 1991; Howling et al. 2019). Smaller areas of habitat are more vulnerable and have reduced resilience to stochastic events. They are, overall, more difficult to manage for long-term biodiversity.</p> <p>Small fragments of habitat have a high edge-to-area ratio, which makes them more susceptible to edge effects. These include a greater risk of weed and feral animal invasion, alteration of local climate and increased susceptibility during droughts, heatwaves, dust storms and other weather extremes, and encroachment of adjoining land use impacts such as chemical spray drift and livestock grazing.</p> <p>Isolated and smaller areas of mallee habitats are less likely to support the range of resources required to maintain a diverse or abundant bird assemblage. Birds with limited dispersal capability, such as emu-wrens, are more likely to be heavily impacted by fragmentation. Fragmentation can result in populations being broken into many smaller populations which are at greater risk of local extinctions and decreased likelihood of repopulation (Saunders et al. 1991). This has implications for reducing genetic diversity even further for bird species that are already in serious decline.</p>

Threat factor	Threat Status*	Impacts and evidence base
<p><b>Clearing</b></p>	<p><i>Timing:</i> Mostly past / Some Ongoing</p> <p><i>Severity:</i> Major</p> <p><i>Scope:</i> Majority, more severe in southern subregions</p>	<p>Mallee habitats for the ecological community have been cleared since European settlement and the Mallee Bird Community no longer occurs where this has happened.</p> <p>Clearing has been mostly due to agriculture, the main commodities of the region being cereal crops and fruit. The higher clearing in MDD South is due to the climate and soils in this area being more conducive for agricultural land uses.</p> <p>Remnants may be susceptible to ongoing clearance due to:</p> <ul style="list-style-type: none"> <li>- road maintenance and widening;</li> <li>- other rural and peri-urban infrastructure activities; and</li> <li>- potential expanded agricultural activities that could include some further habitat clearing.</li> </ul> <p>There are also valuable mineral sand deposits in the Murray Mallee subregion, especially on the mineral rich and accessible Loxton-Parilla sand deposits. Mining sites that impact on mallee habitats include Mindarie Mineral Sands, a mine in the Loxton region of SA; Snapper Mineral Sands and Gingko mines to the west of Pooncarie in NSW; and mines proposed or approved in the Balranald region of NSW.</p> <p>Large-scale linear clearing, such as for high-voltage transmission lines, has the potential to expose remnants to a range of degradation stresses. Smaller-scale clearing and “tidying” of bushland along roadsides and around houses, buildings and other infrastructure, including for fuel reduction purposes, adds to this threat. Spilt grain on roadsides during wheat harvesting periods can impact granivores such as Regent Parrots through impact from traffic while foraging (Baker-Gabb, 2011).</p> <p>The reduction of mallee vegetation affects the extent and quality of habitats and available resources for bird assemblages. Many of the impacts are exacerbated through fragmentation, as discussed above.</p>

Threat factor	Threat Status*	Impacts and evidence base
<p><b>Climate change and severe weather</b></p>	<p><i>Timing:</i> Ongoing; Future</p> <p><i>Severity:</i> Minor to date; likely Major impacts in future.</p> <p><i>Scope:</i> Whole</p>	<p>Climate change projections are available for the MDD region (CSIRO and BOM, 2015). The forecast over the next century is for higher temperatures, declining rainfall, especially in the cooler seasons, and harsher drought and fire weather.</p> <p>Drought conditions affect reproductive performance and survival of birds, and in extreme situations will suppress breeding of some species such as Malleefowl and Black-eared Miners. Drought conditions will also impact the growth and survival of many plant species and consequently food availability (invertebrates and nectar). Post-fire recovery of mallee heathlands can be hampered by drought conditions. For example, In Ngarkat Conservation Park, Mallee Emu-wren population declines have been attributed to both fire and drought and the interaction between the two (Paton et al. 2009).</p> <p>Projected climatic change is likely to compound the existing impacts from habitat loss, fragmentation, edge effects, invasive species and broad-scale bushfires. Impacts on mallee habitats, such as potentially more severe and frequent fires and constrained capacity for habitats to regenerate are likely to have negative impacts on the Mallee Bird Community. This is especially so if more frequent fires lead to a reduction in resources that support Mallee Bird species or further constrains the capacity of less mobile species to relocate to suitable habitats (Clarke et al (2021).</p> <p>Lowland mallee species appear to be very sensitive to climate change, with the predicted disappearance of Mallee Western Whipbird and Mallee Emu-wren bioclimates from Victoria and a &gt;90% decline in bioclimatic range for Malleefowl and Red-lored Whistler (Bennett et al. 1991; Brereton et al. 1995).</p> <p>The capacity of species to adapt by genetic selection or migration are less likely in areas where ecological communities are highly fragmented, as in the southern MDD. Species most at risk include those with restricted/specialised habitat requirements, poor dispersal abilities and small populations (Mallee CMA 2012). Many members of the Mallee Bird Community fit these criteria, especially those species already recognised as threatened, such as the Mallee Emu-wren. Research on the anticipated effects of climate change on the ecological community is necessary to assist potential adaptation.</p>

<p><b>Pest animals and grazing</b></p>	<p><i>Timing:</i> Ongoing</p> <p><i>Severity:</i> Major</p> <p><i>Scope:</i> Majority</p>	<p>Pest animals are a serious problem that can affect mallee birds in several ways. The key pest herbivores for the Mallee Bird Community are rabbits, goats and deer, the latter in some parts of the range (Foulkes &amp; Heard 2003). Pest herbivores alter the structure and composition of native vegetation communities by exerting selective grazing pressure on native plants and removing large amounts of biomass. They compete with native fauna for grasses, herbs and seeds and affect the regeneration of woody trees and shrubs (Sandell 2009). Their presence can degrade the quality of native vegetation as useful habitat for many bird and other fauna species (Mallee CMA 2012). High densities of goats and rabbits can prevent the regeneration of woody plants (Parks Victoria 2002). Rabbits also severely disturb soil and the biological soil crust and have caused widescale erosion and destruction of vegetation in the landscape of the MDD bioregion through their warrens (White et al. 2003). Control of pest animals such as rabbit and mice through the use of poisoned grain can also impact ground feeding bird species.</p> <p>Goats disperse weeds through their droppings and also can cause considerable soil disturbance and compaction (Mallee CMA 2012). Goat numbers in semi-arid rangelands are estimated to be high, about 3.3 million, with a trend of rising populations in some areas (Boulton and Lau 2015).</p> <p>Kangaroos may become overabundant due to land use changes, such as clearing and creation of artificial water sources, as well as the loss of control by dingos. They also have the potential to exert significant pressure on vegetation, especially understorey grasses and herbs, therefore affecting ground layer regeneration in mallee systems (Mallee CMA 2012; Prowse et al. 2019).</p> <p>Pigs are present in the MDD region, where they trample and disrupt soil and affect the ground layer vegetation. For instance, pigs were observed to damage the Hattah Lakes area in key ways (Stead et al. 2018): digging and trampling soil, especially around lake margins; and helping spread weeds by transporting seeds in their fur and fostering higher weed cover and bare ground in pig impacted areas. Pigs also consumed aquatic macroinvertebrates that were dug up on the lake shores, indicating pigs could compete for food resources against ground-foraging species. They could also destroy and predate nests that are on or close to the ground. Soil turnover by pigs may have one benefit through improving access to soil invertebrates by their diggings, as was observed for brush turkeys in tropical woodlands (Natusch et al. 2017). However, the negative implications of habitat destruction by pigs are likely to outweigh any potential benefits, especially if pigs expand into more intact mallee sites.</p> <p>A review of livestock grazing impacts in Australian rangelands (Eldridge et al. 2016) concluded that grazing by sheep and/or cattle reduced measures of ecosystem structure, function and, to a lesser extent, composition. Plant biomass was particularly impacted by grazing, and even low levels of grazing affected some ecosystem attributes. Grazing impacts on plant biomass and cover were more pronounced in drier environments. This has implications for the MDD bioregion: the semi-arid northern MDD, which is less cleared but subject to pastoral land use, and hence is likely to be more strongly impacted by grazing than the heavily cleared southern MDD. Grazing impacts to vegetation have concomitant impacts to the resources available for Mallee Birds., For instance the Malleefowl is highly sensitive to grazing by sheep, such that breeding densities of Malleefowl are reduced by up to 90% where sheep grazing occurs (Benshemesh 2007). Grazing of seedlings and regrowth after fire affects their regeneration and may limit or delay the re-establishment of key resources for Mallee Birds (Clarke et al 2021). There are indications that total grazing pressure from all herbivores (domestic stock, pest animals and native herbivores) is increasing across parts of south-eastern SA, including within reserves, where conservation of native habitats is the primary land use (Prowse et al. 2019).</p> <p>The main pest predators for the Mallee Bird Community are cats and foxes that prey on native animals. It is estimated that, for a typical year with average rainfall, cats (including feral cats and pet cats) kill 46.9 birds per km<sup>2</sup> per year, and foxes kill 35.3 birds per km<sup>2</sup> per year in the MDD bioregion (Stobo-Wilson and Woinarski unpublished).</p>
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Threat factor	Threat Status*	Impacts and evidence base
		<p>Cats have a great impact on the native bird fauna due to their capability to hunt efficiently on the ground and in trees (Woinarski et al. (2017a)). The impact of cats on the native bird fauna is relatively greater in arid to semi-arid environments probably because the lower and sparser vegetation structure brings birds into closer range of the cat (Woinarski et al. (2017a)). Comparative dietary analyses found that birds were a much more frequent component of cat diets (29-34%) than for fox (17%) and wild dog/dingo (14%) diets (Woinarski et al. 2017a). The birds most likely to be preyed by cats are species that nest and forage on the ground, have an intermediate body mass (60–300 g) and occupy mostly open habitats such as shrublands and woodlands (Woinarski et al. 2017b). Several mallee bird taxa share these features.</p> <p>As a key example of the impacts of fox predation on the Mallee Bird Community, foxes limit the abundance of Malleefowl, causing mortalities at all stages of the bird's life cycle, and in many areas may be a major cause of decline (Benshemesh 2007).</p> <p>Other threats may interact to exacerbate the impacts of feral predation, for instance increasing fragmentation and disturbances that remove the protective shelter of undergrowth may increase the risk of birds falling prey (Woinarski et al. 2017b), as predators take advantage of open areas to more easily move and find native bird prey.</p> <p>At least thirteen exotic bird species are noted to occur within the MDD region (<a href="#">Appendix A, Table A2</a>). These species, however, generally occur at low reporting rates and are more prevalent in modified landscapes outside of intact mallee vegetation. Their direct impacts to mallee birds is considered to be negligible. There is more concern around the potential impacts of miner species: native honeyeaters present in eastern Australia, including the MDD bioregion, that aggressively exclude other native woodland bird species. Two miner species occur in the MDD.</p> <p>The Noisy Miner favours fragmented, open eucalypt woodlands with a simplified understorey structure (Clarke and Grey 2010). While they occur in the MDD, Noisy Miners are not a key presence in mallee habitats though they may have a role in affecting the recovery of mallee birds in some marginal and fragmented landscapes.</p> <p>The Yellow-throated Miner also adversely affects woodland bird communities (Kutt et al 2016) and tree health, including in the MDD bioregion (O'Loughlin et al. 2014). The Yellow-throated Miner is capable of hybridising with the much rarer Black-eared Miner to produce fertile offspring of an intermediate phenotype, where the two species overlap (Clarke et al. 2005). Whilst the Black-eared Miner is most commonly associated with large tracts of continuous Mallee habitat within the central Murray-Darling Depression, the Yellow-throated Miner is typically associated with open-woodland and edge habitat. Extensive clearing of mallee habitat for agriculture has created more open and fragmented habitat, leading to range expansion of the Yellow-throated Miner and increased contact between the two miner species. Increased contact has subsequently led to increased prevalence of hybrid phenotypes such that genetic introgression with the Yellow-throated Miner is considered a key threat facing the Black-eared Miner (Howling et al. 2019).</p>

Threat factor	Threat Status*	Impacts and evidence base
<p><b>Weeds</b></p>	<p><i>Timing:</i> Ongoing</p> <p><i>Severity:</i> Minor</p> <p><i>Scope:</i> Unknown, likely to be localised</p>	<p>Mallee remnants can be impacted by weeds, especially in landscapes where native vegetation has become severely fragmented. Native species in the shrub and ground layers are particularly threatened by competition from invasive plants with the potential for significant changes to flora composition in remnants (Major 2010).</p> <p>Weeds of National Significance present in the region include African Boxthorn (<i>Lycium ferocissimum</i>); Bridal Creeper (<i>Asparagus asparagoides</i>); cactus species (<i>Opuntia</i> spp.); and Athel Pine (<i>Tamarix aphylla</i>). Athel Pine prevents understory vegetation from growing underneath it due to a build-up of salty leaf litter. Coordinated action has currently limited its distribution in the Murray Mallee (Mallee CMA 2010). Bridal Creeper impacts on native vegetation by smothering plants with its twining shoots, and by competitive exclusion of native seedlings from the dense mat of root tubers produced just under the soil surface. However, the extent to which these weeds specifically invade mallee vegetation is not known.</p> <p>Other common weeds include species introduced by agriculture, such as Narrow-leaved Clover (<i>Trifolium angustifolium</i>); pasture grasses such as Wimmera Ryegrass (<i>Lolium rigidum</i>), brome grasses (<i>Bromus</i> spp.) and fescues (<i>Vulpia</i> spp.); mustards (<i>Brassica</i> spp.); and Horehound (<i>Marrubium vulgare</i>). Ward's Weed (<i>Carrichtera annua</i>) is another species that has spread widely along roadsides and public land, even where disturbance is absent (Mallee CMA 2008).</p> <p>Crop trees currently being widely planted across the Mallee and Riverina districts, such as olives and almonds, are also becoming established in remnant vegetation (Mallee CMA 2008). Dense stands of olives crowd out the native understorey and their flammable branches promotes fire (DNR 2015). The fruits are sought after by birds and foxes. Consequently, the spread of olives may lead to changes in the relative abundance of bird assemblages, promoting those that adapt to olives for food at the expense of species that prefer more intact native habitat and resources.</p> <p>Weeds can also impact on the fauna. Their presence can change pollinator relationships, for instance by providing competing sources of nectar that attract insects away from native species. Certain weeds also promote habitat for pest animals (Mallee CMA 2008), for example, the thorny stands of African Boxthorn provide protective habitat for rabbits and foxes. Impacts through predators and potential food resources (insects and plants) are means by which weeds may indirectly impact upon the Mallee Bird Community.</p> <p>Rubbish and garden waste dumping can act as a vector for the introduction and spread of weeds. The degree of this threat is uncertain but is likely to be a problem closer to human habitations.</p>
<p>*<b>Timing</b> – the threat occurs in the <b>past</b> (and unlikely to return), is <b>ongoing</b> (present/continuing), is likely to occur/return in the <b>future</b>, or timing is <b>unknown</b></p> <p><b>Severity</b> – the threat causes or has the potential to cause impacts that are <b>extreme</b> (leading to loss or transformation of affected patches/occurrences), <b>major</b> (leading to degradation of affected patches/occurrences), <b>minor</b> (impacting some components of affected patches/occurrences), <b>negligible</b> or <b>unknown</b></p> <p><b>Scope</b> – the threat is affecting the <b>whole</b> (&gt;90%), a <b>majority</b> (&gt;50%), a <b>minority</b> (&lt;50%), a <b>negligible</b> amount, or <b>unknown</b> amount of the ecological community</p>		

#### **4.1 Key threatening processes**

National environment law (the EPBC Act at time of writing) provides for the identification and listing of key threatening processes. A process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. The following are nationally listed key threatening processes, current at the date of writing, that may be relevant to the ecological community or specific species that comprise it:

- Competition and land degradation by rabbits;
- Competition and land degradation by unmanaged goats;
- Land clearance;
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases;
- Novel biota and their impact on biodiversity;
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants;
- Predation by European red fox;
- Predation by feral cats; and
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.

Any approved threat abatement plans, or advice associated with these items provides information to help landowners manage these threats and reduce their impacts to biodiversity. These can be found at <http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl>.

## 5 EXISTING PROTECTIONS

### 5.1 Existing protection in reserves

The Australian Government collates information on lands under conservation tenure through the Collaborative and Protected Area Database (CAPAD; DAWE 2020a). About 3.3 million hectares, or 58.5%, of the estimated current extent of mallee vegetation in the MDD bioregion occurs within some form of conservation tenure ([Table 5.1](#)), mostly within formal conservation reserves (IUCN IA, IB, II). These include conservation reserves with extensive areas of mallee habitats such as Murray-Sunset, Wyperfeld, Danggali, Ngarkat, Big Desert and Little Desert parks.

However, presence in conservation tenure does not confer full protection because most threats identified in [Section 4](#) operate regardless of land tenure. For instance, weeds, feral animals, wildfires and climate change also occur within national parks and need to be appropriately managed within these landscapes. In addition, many of the birds of the Mallee Bird Community move across the broader landscape, facing threats both in and out of the conservation reserves.

In addition, Birdlife Australia monitors sites known as Key Biodiversity Areas (or Important Biodiversity Areas, KBAs / IBAs) that are habitat refuges for birds and other fauna. KBAs often coincide with conservation areas but also extend into adjacent areas outside of reserves that retain some natural values. Extensive KBAs occur in the Murray Darling Depression bioregion and currently include about 3.1 million hectares of mallee vegetation ([Table 5.2](#)). KBAs are monitored and have regular to occasional landscape health checks, though KBAs in themselves have no additional formal protection measures.

**Table 5.1.** Extent of mallee vegetation across the MDD bioregion present in reserves, by IUCN protected area categories.

IUCN Protected Area Category	Description	Mallee MVG current extent (ha)
IA	Strict Nature Reserve (e.g. Ngarkat CP, Mallee Cliffs NP)	631,118
IB	Wilderness Area (e.g. Danggali WPA, Big Desert WP, Sunset WZ)	816,940
II	National Park (e.g. Murray-Sunset NP, Wyperfeld NP, Little Desert NP, Scotia PNR)	1,272,280
III	Natural Monument/Feature (e.g. various unnamed Heritage Agreements)	416,027
IV	Habitat/Species Management Area (e.g. various Bushland Reserves and Conservation Covenants)	8,912
V	Protected Landscape/Seascape (e.g. Heritage River Reserves)	48,616
VI	Protected Area with Sustainable Use (e.g. Chowilla RR & GR)	85,928
<b>Total</b>		<b>3,279,821</b>

Sources: CAPAD and NVIS databases (DAWE 2020a; b). IUCN protected area categories are fully described by IUCN (2020).



**Table 5.2.** Key Biodiversity Areas (KBAs) identified by Birdlife Australia within the Murray Darling Depression bioregion and their extent of mallee habitats.

Key Biodiversity Area	Jurisdiction	Area (ha)	Mallee MVGs - current (ha)	% KBA with mallee
Peebinga	SA	3,370	3,357	99.6
Wandown	Vic	4,844	4,016	82.9
Billiat	SA	59,411	59,241	99.7
Little Desert	Vic	135,593	92,214	68.0
Central NSW Mallee	NSW	249,314	131,023	52.6
Murray-Sunset, Hattah & Annuello	Vic	700,421	619,586	88.5
Southern NSW Mallee	NSW	823,157	646,766	78.6
Wyperfeld, Big Desert & Ngarkat	SA, Vic	974,268	670,480	68.8
Riverland Mallee	NSW, SA	1,221,833	923,554	75.6
<b>Total KBAs</b>	<b>NSW, SA, Vic</b>	<b>4,171,889</b>	<b>3,150,237</b>	<b>75.5</b>

Source: Birdlife Australia (2020a) dataset for KBAs intersected with the NVIS Major Vegetation Group data for the current extent of mallee (MVGs 14 + 32).

Note: Three other KBAs occur within the MDD bioregion that may retain a minor extent of mallee: Lakes Alexandrina and Albert; Coorong; and Natimuk Douglas. These KBAs mostly comprise wetlands in the southern extent of the bioregion. However, they could provide some habitat and refuge for certain Mallee Bird species.

## 5.2 Existing protection under state laws.

The Victorian Mallee Bird Community is listed as a threatened ecological community under the Victorian *Flora and Fauna Guarantee Act 1988*. Ecological communities listed under Victorian legislation are only protected on public land tenures. The Victorian Mallee Bird Community protects twenty mallee-dependent bird species within north-western Victoria. Seventeen bird species from this community are members of the Mallee Bird Community. No other mallee bird communities are recognised as threatened in other States. The key differences with the Victorian Mallee Bird Community are that the national community:

- extends over the full extent of the MDD bioregion, so includes mallee habitats in south-western NSW and south-eastern SA as well as Victoria;
- does not include all the bird taxa recognised as mallee-dependent by the Victorian listing. The Brown-headed Honeyeater (*Melithreptus brevirostris*), Redthroat (*Pyrrholaemus brunneus*) and Slender-billed Thornbill (*Acanthiza iredalei*) are not part of the national community;
- includes two species identified as mallee-associated (Crested Bellbird and Yellow-plumed Honeyeater) that are not formally part of the Victorian-listed bird community; and
- includes one species (Scarlet-chested Parrot) not mentioned in the Victorian listing.

## 5.3 Existing EPBC Matters of National Environmental Significance

As at July 2021, thirteen members of the Mallee Bird Community are individually recognised as threatened taxa by at least one jurisdiction and six taxa are nationally listed as threatened species (Table 2.1).

Habitat for the Black-eared Miner at Gluepot Reserve, Taylorville Station and Calperum Station, excluding the area of Calperum Station south and east of Main Wentworth Road has been placed on the EPBC Act Register of Critical Habitat. This is the only species of the Mallee Bird Community that has had its critical habitat formally registered.

As at July 2021, four woodland types that occur in the MDD Bioregion are listed as nationally threatened ecological communities:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions (Endangered);
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Endangered);
- Plains Mallee Box Woodland of the Murray Darling Depression and Riverina Bioregions (Critically endangered); and

- Weeping Myall Woodlands (Endangered).

The Buloke, Grey Box and Weeping Myall woodlands are all distinguished from mallee habitats by being non-mallee woodlands, that is they don't have mallee trees as a dominant feature of the tree canopy. Each of these communities is dominated to co-dominated by a specific non-mallee tree species that is characteristic for that ecological community. Patches of some of these communities may intergrade with or be interspersed among patches of mallee vegetation. Under those circumstances, some local occurrences of these listed woodlands may be included as part of the habitat for the Mallee Birds.

The Plains Mallee Box Woodland is a mallee tree-dominated community that occurs in the Murray Mallee of SA, NSW and Victoria and represents a mostly grassy type of Chenopod Mallee that has been heavily cleared and is now rare in the landscape. Remnant stands of the Plains Mallee Box Woodlands may provide habitat for some Mallee Bird species.

There are no National or World Heritage listings in the MDD bioregion relevant to the ecological community. Five Ramsar wetland sites occur within the MDD region: Hattah-Kulkyne Lakes; Lake Albacutya; Riverland; Banrock Station Wetland Complex; and The Coorong, Lakes Alexandrina and Albert Wetlands. These sites may provide resources, especially water, to some populations of the ecological community.

#### **5.4 Existing management plans relevant to the ecological community**

At the time this Conservation Advice was developed, there was no existing management plan specifically for this ecological community. However, there are national conservation advices and recovery plans for the nationally threatened bird species, and similar documents that accompany some State species listings. Other plans and guidelines for managing bushland and threatened species habitats may be relevant. These include:

Baker-Gabb D (2003). Recovery Plan for the Black-eared Miner *Manorina melanotis* 2002 - 2006: Conservation of old-growth dependent mallee fauna. Department for Environment and Heritage, Adelaide.

Baker-Gabb D and Hurley VG (2011). National Recovery Plan for the Regent Parrot (eastern subspecies) *Polytelis anthoepplus monarchoides*. Department of Sustainability and Environment, Melbourne.

Benshemesh J. (2007). National Recovery Plan for Malleefowl. Department for Environment and Heritage, South Australia.

Boulton RL and Lau J (2015). Threatened Mallee Birds Conservation Action Plan, Report June 2015. Report to the Threatened Mallee Birds Implementation Team, Birdlife Australia.

Department of Environment, Land, Water and Planning (2016). National Recovery Plan for the Mallee Emu-Wren *Stipiturus mallee*, Red-lored Whistler *Pachycephala rufogularis* and Western Whipbird *Psophodes nigrogularis leucogaster*. Australian Government, Canberra.

Howling GM, Boulton RL and Lau J (2019). Threatened Mallee Birds Conservation Action Plan, second edition. Report to the Threatened Mallee Birds CAP Steering Committee. Birdlife Australia, Melbourne.

Mallee CMA (2012). *Mallee Ecology Manual 2012*. Mallee Catchment Management Authority, Mildura Victoria.

Parks Victoria 2019. Conservation Action Plan for Parks and Reserves Managed by Parks Victoria. Mallee. Parks Victoria, Melbourne.

South Australian Department for Environment and Heritage 2009. *Fire Management Plan Billiatt District* Department for Environment and Heritage, Adelaide.

South Australian Department for Environment and Heritage 2009. *Fire Management Plan Ngarkat District* Department for Environment and Heritage, Adelaide.

## 6 CONSERVATION OF THE ECOLOGICAL COMMUNITY

### 6.1 Conservation Objective

The conservation objective provides the goal and rationale for the priority actions identified here. The objective is:

To prevent further loss and degradation of the **Mallee Bird Community** and help recover its biodiversity, viability, function and extent, by protecting it from significant impacts as a Matter of National Environmental Significance under national environmental law and by guiding implementation of management and recovery, consistent with the recommended priority conservation and research actions set out in this advice.

### 6.2 Principles and standards

In undertaking priority actions to achieve the conservation objective, the overarching principle is that it is preferable to maintain existing habitat areas for the Mallee Birds that are relatively intact and of medium to high quality. There are good, practical reasons to do so. It is typically more successful and cost-effective to retain an intact occurrence and habitats than to allow degradation and then attempt to restore it or another area. The more disturbed and modified the ecological community is, the greater the recovery effort that is required. Also, intact habitat remnants are likely to retain a fuller suite of birds, viability and ecological functions. Certain species and habitat features (e.g. large trees, a diverse understorey) may not be easy to recover in practice, if lost from a site.

This principle is highlighted in the *National Standards for the Practice of Ecological Restoration in Australia* (Standards Reference Group SERA, 2016):

*“Ecological restoration is not a substitute for sustainably managing and protecting ecosystems in the first instance.*

*The promise of restoration cannot be invoked as a justification for destroying or damaging existing ecosystems because functional natural ecosystems are not transportable or easily rebuilt once damaged and the success of ecological restoration cannot be assured. Many projects that aspire to restoration fall short of reinstating reference ecosystem attributes for a range of reasons including scale and degree of damage and technical, ecological and resource limitations.”*

*Standards Reference Group SERA (2016) – Appendix 2.*

The principle discourages ‘offsets’ where intact remnants are removed with an undertaking to set aside and/or restore other, lesser quality, sites. The destruction of intact sites represents a net loss of the functional ecological community because there is no guarantee all the species and ecological functions of the intact site can be replicated elsewhere.

Where restoration is to be undertaken, it should be planned and implemented with reference to the *National Standards for the Practice of Ecological Restoration in Australia*. These Standards guide how ecological restoration actions should be undertaken and are available online from the Standards Reference Group SERA (2016)<sup>7</sup>. They outline the principles that convey the main ecological, biological, technical, social and ethical underpinnings of ecological restoration practice. Further guidance regarding best-practice recovery of the Mallee Birds may also become available.

As restoration ecology is continually developing, it is also important to reflect on the experience of others who have worked on recovering the ecological community and its habitats, or similar communities, or reintroducing / recovering its component species, as well as adapting restoration projects as site-level experience accumulates. The knowledge and practices of Traditional Owners/Custodians should also be acknowledged and considered.

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<sup>7</sup> Society for Ecological Restoration: [www.seraustralia.com/standards/contents.html](http://www.seraustralia.com/standards/contents.html)

To achieve cost-effective investments in conservation management it is important to consider the likely interaction of the various management actions being undertaken at any one site, as these may be synergistic or antagonistic. There are also likely to be interactions between sites. Additionally, when allocating management resources, it is important to consider what is the minimum investment required for success and the follow-up required to secure long-term recovery (for example, the responses of some mallee birds to fire are known to be long-term).

### **6.3 Priority actions**

Priority actions are recommended for the abatement of threats and supporting recovery of the ecological community. These recommended actions are designed to provide guidance for:

- planning, management and restoration of the ecological community by landholders, NRM and community groups, Traditional custodians and other land managers;
- determining conditions of approval for relevant actions (and controlled actions) under national environment law; and
- prioritising activities in applications for Australian Government or other funding programs.

Detailed advice on actions may be available in other documents, such as management plans for individual mallee bird species, control of pest animals, fire or certain parks or regions. The most relevant are listed in section 4.3 and the References.

This conservation advice identifies priority conservation actions under the following key approaches:

- **PROTECT** the ecological community to prevent further losses;
- **RESTORE** the ecological community by active abatement of threats, appropriate management, restoration of habitats and other conservation initiatives;
- **COMMUNICATE, ENGAGE WITH AND SUPPORT** people to increase understanding of the value and function of the ecological community and encourage their efforts in its protection and recovery; and
- **RESEARCH AND MONITORING** to improve our understanding of the ecological community and the best methods to aid its management and recovery.

These approaches overlap in practice; and form part of an iterative approach to management that includes research, planning, management, monitoring and review.

The actions below do not necessarily encompass all actions in detail that may benefit the Mallee Birds community. They highlight general but key actions required to at least maintain survival of the ecological community at the time of preparing this Conservation Advice. Actions inconsistent with these actions and that are likely to significantly adversely affect the ecological community should be avoided.

#### *6.3.1 PROTECT the ecological community*

This key approach includes priorities intended to protect the ecological community by preventing further losses to extent and integrity, i.e. minimise decline of component bird species, prevent further clearance and degradation of habitats.

- The ecological community and its habitats should be properly taken into account during the early stages of zoning and development planning decisions, including strategic planning documents at state, regional and local levels.
- Liaise with local councils and State authorities to ensure that cumulative impacts on the ecological community are reduced as part of broader strategic planning or large projects (e.g. road works, developments).

### 6.3.1.1 CONSERVE REMAINING OCCURRENCES

Avoid further clearance and damage to habitats for this ecological community.

- Protect and conserve mallee remnants that provide habitats for the ecological community and avoid further clearance of mallee. The highest levels of protection from clearing, inappropriate burning or other detrimental habitat impacts should be given to:
  - Remnants that provide features such as hollows, fissures and bark ribbons that provide important resources for many mallee bird species (Gibbons & Lindenmayer 2002; Haslem et al. 2012); and
  - Mallee habitats that support at least three of the characteristic bird species ([Table 2.1](#)), irrespective of the current growth stage of the trees.
- Retain native vegetation remnants that are particularly important for connectivity (with other native vegetation or to water sources), wildlife corridors or migration routes.
- Protect occurrences of the ecological community, including important mallee bird populations, areas identified as wildlife refuges, or of regional importance, in formal conservation reserves (preferably those affording long-term protection). This includes investigating formal conservation arrangements, management agreements and covenants to protect bird populations and critical/important habitats on private land.
- Where regeneration is occurring, provide measures that will support the regeneration to maturity. This applies to regeneration of mallee habitats and reintroduction of bird populations.

### 6.3.1.2 MANAGE ACTIONS TO MINIMISE IMPACTS

Apply the mitigation hierarchy to sequentially avoid, then mitigate, then offset potential impacts on the ecological community from development or other actions. The priority is to avoid further loss of bird populations or critical/important habitats. Offsetting is a last resort and may be difficult to apply to a bird community.

- Plan projects to avoid the need to offset, by avoiding significant impacts to the ecological community. For example, route powerlines, roads and other infrastructure around known bird populations or high-quality areas of native habitats, wherever possible.
- Avoid or manage activities that could cause significant permanent or seasonal hydrological change. For example, levees, causeways, drains and other structures that detrimentally alter the natural water flows in or near occurrences of the ecological community.
- In circumstances where impacts cannot be totally avoided, then they should be minimised by:
  - minimising the spatial footprint of the action and planning its location to affect low-quality, rather than high-quality patches of mallee vegetation;
  - retaining and avoiding damage to high quality mallee vegetation, which should be managed to retain their benchmark state; and
  - protecting specific and important habitat features, such as old growth mallee trees, including stags with hollows as these take many decades to develop and cannot be quickly replaced, as well as logs, food plants, areas of diverse native understorey and well-developed organic litter layers.
- Where impacts are unavoidable, offsets should be used as a last resort because many mallee bird species are now threatened, and old growth mallee habitats are rare. The outcomes of offsetting activities are generally highly uncertain and may involve considerable risk of failure. Any proposals considering offsets for this ecological community should:
  - minimise the need to offset the ecological community by designing development around occurrences of the ecological community;

- avoid impacting high quality occurrences and habitats, especially old growth stands with mature trees and diverse native understoreys; these would now be difficult to offset;
- demonstrate they can be managed in perpetuity as areas dedicated for conservation purposes, with monitoring and management to ensure they deliver biodiversity benefits for the ecological community over the long-term.
- Minimise the risk of indirect impacts to the ecological community from actions outside but near to occurrences of the ecological community. An example relevant to the Mallee Birds is spraying for locusts in the region with insecticides. Although most spraying is applied over paddocks where locusts are most likely to emerge (Boulton and Lau 2015), in the event of possible drift affecting the ecological community, if considered appropriate it can be somewhat mitigated by applying the biocontrol agent *Metarhizium* (or appropriate alternative) for that site.
- Avoid activities that could significantly alter the fire regime of patches of the ecological community. Ensure that fire management activities (including creation of any new fire access tracks) do not have detrimental impacts on fire-sensitive species and the integrity of the ecological community. For further information on fire management see below.

#### 6.3.1.3 PREVENT THE INTRODUCTION AND SPREAD OF EXOTIC SPECIES

- Support strong border biosecurity and avoid importing or accidentally introducing invasive species and pathogens that may have a serious adverse impact on this ecological community.
- When conducting activities in or around the ecological community, practice good biosecurity hygiene to avoid spreading weeds or pathogens.
- Minimise unnecessary soil disturbance that may facilitate weed establishment.
- Prevent dumping of garden waste into bushland, especially in or near patches of the ecological community.
- If new weed incursions do occur, detect and control them early, as small infestations are more likely to be eradicated.
- Prevent further introduction of feral animals and, where possible, contain pets in nearby residential areas.
- Several mallee birds, especially ground foraging and nesting species, are vulnerable to predation by feral Cats (*Felis catus*) and Red Foxes (*Vulpes vulpes*). Addressing this requires effective feral animal management and management of habitat features, such as fostering areas of dense cover that help birds avoid predators.
- Manage total grazing pressure in medium to high quality mallee remnants, especially from introduced herbivores and overabundant native grazing animals.
- Where prescribed burning is planned in a remnant, ensure that a full pest risk assessment has been undertaken prior to the burn and that follow up weed, pest animal and native herbivore management is budgeted for and implemented in the first and subsequent growing seasons with appropriate monitoring to guide when and where to eliminate pests.
- Assist commercial and domestic apiaries to minimise feral bee colonisation of trees and remove existing feral bee colonies from areas of habitat.

#### 6.3.2 RESTORE and MANAGE the ecological community

This key approach includes priorities to restore and maintain occurrences of the ecological community by active abatement of threats, appropriate management, restoration and other conservation initiatives. Restoration actions should be based on the best available knowledge and scientific research to maximise positive biodiversity outcomes.

- Restoration actions should be based on the best available knowledge, including from traditional cultures and scientific research to maximise positive biodiversity outcomes.
- Engage and liaise with landholders, NRM and community groups, Traditional Owners/Custodians and governments to support and undertake and promote programs that ameliorate threats such as altered fire regimes management of total grazing pressure and human disturbances.
- Identify and prioritise specific threats and undertake appropriate on-ground site management strategies where required.

#### 6.3.2.1 MANAGE FIRE

Based on best available information, implement fire management regimes for the ecological community that are appropriate for the mallee vegetation types and fire-sensitive flora and fauna present at each site, as well as the landscapes surrounding the ecological community, taking into account Indigenous cultural management and results from research:

- Implement appropriate fire management of the ecological community and the broader landscape, considering Indigenous knowledge and results from research. Promote Cultural burning techniques that don't have detrimental impacts on birds and create diversity in the landscape. Avoid mid to late postfire mallee stands.
- Manage mallee systems as single continuous blocks, irrespective of tenure and jurisdictional boundaries. This helps ensure that conservation decisions account for the large scale, long-term nature of fire impacts and diversity of habitats suitable for supporting a variety of fauna species.
- Where hazard reduction burns or prescribed fires are undertaken in areas important to the ecological community:
  - Ensure that the potential for the fire to escape is appropriately risk assessed and management responses are in place to protect the ecological community;
  - Minimise the planned fire footprint;
  - Focus strategically on the asset(s) to be protected, rather than broad area burns;
  - Management responses are in place to protect the ecological community and other threatened species;
  - Wherever possible, exclude areas in mid to late post fire states that take a long time to recover; and
  - Minimise the risk of large-scale fires that damage entire vegetation remnants and leave no havens for the bird fauna.
- Use a landscape-scale approach and available local knowledge on fire histories, including with traditional knowledge and practices to identify sites that would benefit from either burning or not burning and protecting sites. Fire management strategies at each location should take into account occurrence size, habitat features (e.g. protect hollow-bearing trees and large logs), vegetation structure and the surrounding landscape (including property protection) to minimise damage, maintain refuges for fauna and sources of recolonization (during and after fire) and increase habitat suitability for the bird community.
- Fires (including planned burns) must be managed to: maintain the ecological community by avoiding disruption of the life cycles of the component species; supporting rather than degrading the habitat; avoiding invasion of exotic species, and avoiding compounding / cascading impacts of other threats such as drought, grazing or predation by feral predators. Isolated bird and other animal, as well as threatened plant, populations are particularly vulnerable to local extinction to large, intense fires combined with other threats. Therefore:
  - Ensure that an invasive species risk assessment and management program is planned and budgeted for ahead of any proposed burning.

- Use available ecological information to avoid detrimental fire impacts on key and susceptible species in the ecological community; for instance, do not burn in a way that is detrimental to long-term habitat features such as mature trees.
- Consider weather conditions and do not burn in or adjacent to the ecological community when soil moisture is low, or dry conditions are predicted for the coming season as flora and fauna are already stressed, recovery will be too slow and erosion may occur or weeds and pest animals become established while the vegetation cover is reduced.
- Monitor the outcomes of fire and the consequences from other threats, and manage within an appropriate time (for example, immediately put in place erosion control measures; limit access by feral predators and grazers; control weeds as they first appear with follow up treatments as necessary). Ensure the results are taken into account when planning and implementing future fire regimes.

#### 6.3.2.2 *MANAGE WEEDS, PESTS AND DISEASES*

- Implement effective integrated control and management techniques for weeds, pests and diseases that may affect the ecological community or its habitats and manage sites to prevent the introduction of new, or further spread of, invasive species.
- Identify potential new weed incursions early and manage for local eradication, where possible. Prioritise weed control in patches for which management is most urgent.
- Control introduced pest animals through coordinated landscape-scale control programs. For example, work with relevant authorities to suppress feral animal numbers in line with regional pest management strategies.
  - Management of feral predators is particularly important to help recover and protect populations of mallee birds.
- All control programs should be risk-assessed and managed to avoid impacting non-target species or having unintended consequences (e.g. not controlling pest animals with methods that harm native species).
- Ensure chemicals, or other mechanisms used to manage weeds, pests and pathogens do not have significant adverse, off-target impacts on the ecological community.

#### 6.3.2.3 *MANAGE GRAZING PRESSURE*

- Remove or reduce artificial water access. Artificial watering points in the mallee may negatively affect the bird community and can affect grazing pressure up to 10km away. They impact on native vegetation and habitats by maintaining high numbers and densities of introduced pests and native herbivores. Consider decommissioning at least some artificial water points to reduce numbers of pest animals and allow regeneration of native habitats.
  - Care should be taken to avoid adverse outcomes, particularly where water may be used for firefighting, or where grazing pressure might keep fuel levels low. Further, at a landscape scale, lack of water may force some species into altered landscapes where that may face new threats (i.e. bird control around orchids near river systems). Use of sealed water reservoirs is recommended as a more reliable way of supplying water for firefighting.
- Fence off habitat adjacent to cleared grazing land.
- Inform graziers of impacts of grazing in mallee, and when grazing is/isn't suitable (i.e. might be suitable for fuel control during good years). In perpetuity contracts, stewardship schemes and incentives aimed at reducing or removing grazing from critical/important habitat areas are recommended.
- Manage feral herbivore numbers on public land and work with private land holders to do the same.



- Manage total grazing levels following fires. In patches with rabbits, goats, elevated kangaroo numbers and/or other grazing there is potential for significant impact to post-fire recruitment of vegetative cover unless grazing is managed.

#### 6.3.2.4 UNDERTAKE RESTORATION AND RECOVERY

- Undertake restoration, including bush regeneration and revegetation, of degraded mallee habitats to restore them in a manner that supports birds. Restoration works to reconnect isolated patches to other areas of native vegetation is also valuable.
  - Support natural regeneration (e.g. using fenced areas, weed and pest control, and fire) before planning and implementing replanting programs. Replant areas where natural regeneration has not been successful.
  - Maintain important long-term habitat features for birds, e.g. logs, hollows, bark ribbons, mistletoe plants.
  - Use local native species in restoration/revegetation projects for the ecological community and restore understorey vegetation to a structure and diversity appropriate to the site.
  - Consider the landscape context and other relevant species and communities when planning restoration works. For example, ensure adjacent ecological communities and threatened and migratory species are not adversely impacted by tree planting or other restoration activities.
- Implement effective adaptive management regimes using information from available research and management guidelines, for example, see the *National Standards for the Practice of Ecological Restoration in Australia* (SERA 2017), relevant research or advice from local authorities.
- Undertake translocation and reintroduction of important mallee bird species, where feasible, to re-establish populations that may have become locally extinct.
  - Refer to the actions and recommendations from available recovery plans and conservation advices/action plans for threatened mallee birds.
  - Where the local habitat may not have fully recovered after an impact (e.g. due to long post-fire recovery) consider if other nearby sites have suitable and safe habitats for bird reintroductions.

#### 6.3.3 COMMUNICATE, engage with and support

This key approach includes priorities to promote the ecological community to build awareness and encourage people and groups to contribute to its recovery. This includes communicating, engaging with and supporting the public and key stakeholders to increase their understanding of the value of the ecological community and to encourage and assist their efforts in its protection and recovery. Key groups to communicate with include landholders, land managers, land use planners, researchers, community members, Indigenous communities, schools and volunteers.

##### 6.3.3.1 RAISE AWARENESS

- Educate people and groups about the birds, their values and threats (such as fire impacts, cat and fox predation, human disturbance and habitat loss). This may be done through the distribution of relevant publications, erecting interpretive signs at strategic locations, school programs and fostering interest in birdwatching and contributing to citizen science by volunteering to help with surveys.
- Encourage the activities of, and seek support from, local birdwatching groups, as well as national groups, such as Birdlife Australia.
  - Encourage participation in the monitoring and management of Important/Key Biodiversity Areas in the mallee region, especially by local Indigenous peoples (elders and youth).

- Communicate with landholders/managers, relevant agencies and the public to emphasise the value of the ecological community, the key threats, its significance, and appropriate management and to highlight the importance of its protection and restoration. Encourage landholders to talk with local NRM organisations and field naturalist and birdwatching groups.
- Encourage landholders to protect valuable habitat through long-term private land conservation mechanisms.
- Undertake effective community engagement and education to highlight the importance of minimising disturbance (e.g. not collecting logs and dead trees as firewood) and of minimising pollution and littering (e.g. via signage).
- Inform landholders about incentives, such as conservation agreements, stewardship projects, funding and NRM programs etc. that may apply to help look after habitats on private lands.

#### 6.3.3.2 *GATHER AND PROVIDE INFORMATION*

- Develop education programs, information products and signage to help the public recognise the presence and importance of the ecological community, and their responsibilities under state and local regulations and the EPBC Act.
- Improve understanding of Traditional Ecological Knowledge relevant to the ecological community and identify and support culturally appropriate mechanisms to implement this knowledge, with the support and participation of local Indigenous peoples, to protect and restore the ecological community.
- Install signage to discourage damaging activities such as the removal of dead timber, dumping garden waste and other rubbish, creating informal paths and tracks, and the use of off-road vehicles in patches of the ecological community.
- Install significant markers along roads to designate areas of important habitat to protect and prevent inappropriate roadside maintenance from occurring.

#### 6.3.3.3 *COORDINATE EFFORTS*

- Support opportunities for Traditional Owners/Custodians or other members of the Indigenous community (including elders and young people) to manage the ecological community, including cultural burning, where it will benefit habitat areas for the ecological community.
- Encourage local participation in restoration and 'Landcare' efforts through local conservation groups, creating 'friends of' groups, field days and planting projects, etc.
- Liaise and advocate with local fire management authorities and agencies to get their support in fire management of the ecological community (e.g. to incorporate areas of the ecological community as conservation assets in fire response plans). Request these agencies to use suitable maps and install field markers to avoid damage to sensitive areas for the ecological community, such as old growth mallee. Ensure land managers are given information about how to manage fire risks to conserve any threatened species and ecological communities.
- Promote awareness, protection and recovery requirements for the ecological community with relevant agencies and industries. For example, with:
  - state and local government planning authorities, to ensure that planning takes the protection of remnants into account, with due regard to principles for long-term conservation;
  - landowners, land managers and developers, to minimise threats associated with land conversion and development;
  - local councils and state authorities, to ensure infrastructure or development works involving substrate or vegetation disturbance do not adversely impact the ecological community. This includes avoiding the introduction or spread of weeds;

- regional authorities, NRM organisations and local councils to collaborate on threat management and planning with neighbouring authorities.
- Plan and prepare for future captive breeding in the event of catastrophic loss of critical mallee bird populations, with assistance from Zoos Victoria and Zoos SA (e.g. Olds 2014).

#### 6.3.4 RESEARCH and monitoring

This key approach includes identifying priorities for research into the ecological community, and monitoring, to improve understanding of the ecological community and the best methods to aid its recovery through restoration and protection. Relevant and well-targeted research and other information gathering activities are important in informing the protection and management of the ecological community.

Monitoring of management and restoration activities is essential to establish trends in recovery and to make assessments against the overarching objective for the ecological community.

##### 6.3.4.1 MAPPING

- Collate existing information about bird records and observations, as well as vegetation mapping information and associated data for this ecological community and identify gaps in knowledge.
- Undertake a study to identify the optimal habitat, landscape and other environmental characteristics that support the highest diversity of birds within the ecological community.
- Comprehensively record the occurrences and habitat condition of the ecological community across its range.
  - Support further field observations based on systematic bird surveys plus other vegetation and habitat information, e.g. from on-site surveys, aerial photographs and satellite images to more accurately document current status and trends.
  - Monitor the fire stage of mallee habitat remnants to better track variation in habitat suitability for the ecological community.
- Identify and map the fire history status of important habitats for ecological community and surrounding fire-dependent and/or fire sensitive vegetation.

##### 6.3.4.2 OPTIONS FOR MANAGEMENT

- Research into integrated methods to effectively manage pests that affect the ecological community.
- Research into the recovery and habitat requirements for mallee bird species to improve understanding of how to make species translocations and reintroductions more effective, if and when such methods are required.
  - This includes the degree of genetic isolation of geographically separate subpopulations to inform thresholds and the development of translocation programs.
- Research into potential impacts of climate change on the current distribution and future habitat suitability of mallee bird species.
  - Assess the vulnerability of the ecological community to climate change and investigate ways to improve resilience through other threat abatement and management actions.
- Improve understanding the role of the mechanisms that mediate persistence under alternative fire regimes in this ecological community, building on the Mallee Fire and Biodiversity project (Watson et al. 2012), and other research projects.
- Conduct research leading to the development of effective landscape-scale restoration techniques for the ecological community, incorporating Indigenous knowledge. Investigate the interaction between disturbance types, such as fire and invasion by weeds and feral

animals, to determine how an integrated approach to threat management can be implemented.

#### 6.3.4.3 MONITORING

It is important that any monitoring is planned before management commences and considers what data are required to address management outcomes and research questions. Monitoring must be resourced for management activities, especially for those using a novel approach, and applied during and following management actions.

- Monitor for new incursions or spread of weeds and pest animals.
- Promote long-term monitoring of species by Traditional custodians, citizen scientists and volunteers to bird databases collated by Birdlife Australia, Atlas of Living Australia and others.
  - Evaluate available datasets for signs of decline of individual and collective bird species.
  - Use the information on trends in bird abundance coupled with observations on the status of habitat features to inform recommendations for future management.
- Monitor the impacts of fires, especially in severe fire seasons, at sites recovering from fire. Community involvement in recovery is particularly beneficial where it contributes to long-term monitoring.
- Monitor herbivore numbers across the landscape to inform actions.

## 7 LISTING ASSESSMENT AND RECOVERY PLAN RECOMMENDATION

The Threatened Species Scientific Committee finalised this assessment on 4 June 2021.

### 7.1 Reason for assessment

This assessment follows prioritisation of a nomination from the public.

### 7.2 Eligibility for listing

This assessment uses the criteria set out in the [EPBC Regulations](#) and TSSC [Guidelines for Nominating and Assessing Threatened Ecological Communities](#), as in force at the time of the assessment. Information on listing eligibility under the IUCN Red List for Ecosystems criteria (Bland et al 2017) is included for information only.

Based on available information, it is recommended that the Mallee Bird Community is eligible for listing as **Endangered**. This was the highest conservation category met at the time of assessment.

7.2.1. Criterion 1. Decline in geographic distribution			
Category	Critically endangered	Endangered	Vulnerable
Its decline in geographic distribution is <b>either</b> :	very severe	severe	substantial
<b>a)</b> Decline relative to the longer-term (beyond 50 years ago e.g. since 1750); <b>or</b> ,	≥90%	≥70%	≥50%
<b>b)</b> Decline relative to the shorter-term (past 50 years).	≥80%	≥50%	≥30%
<p>A past decrease sufficient to meet the criterion is considered to be a measurable change whereby:</p> <ul style="list-style-type: none"> <li>the ecological community has contracted to less than some threshold proportion of its former range; or</li> <li>the total area occupied by the community is less than the threshold proportion of its former area; or</li> <li>less than the threshold proportion of the former area of the community is in patches of a size sufficiently large or well connected with other patches for them to be likely to persist beyond the <i>near future</i>.</li> </ul>			

### Insufficient data to determine eligibility under Criterion 1.

#### Evidence:

This criterion considers changes in the geographic extent of the ecological community. The evidence that applies to Criterion One includes available data on:

- decline in the extent of mallee habitats available to the bird assemblage; and
- changes to the estimated geographic extent of the Mallee Bird assemblage.

#### *Has the extent of habitat (mallee woodlands) declined substantially across the MDD?*

NVIS Major Vegetation Groups 14 and 32 comprise the range of mallee habitats for the ecological community. The overall decline in extent of mallee vegetation within the MDD bioregions is about 42% ([Table 7.1](#)).

The overall estimate masks variable patterns of decline in extent across the bioregion. There are substantial to severe declines in extent in the southern MDD but less decline for the northern subregions of the MDD ([Table 7.1](#)). This does not mean the northern MDD has not been impacted by land use, just that the nature of impact is more subtle and not characterised by extensive outright losses of native vegetation.

- To conclude: an overall decline in extent of approximately 42% is below the 50% threshold to meet a substantial long-term (since 1750) decline in mallee habitats.

**Table 7.1.** Extent and decline of mallee woodlands and shrublands in the MDD grouped by subregions based on location, climate and land use impacts.

IBRA Subregion	Pre-1750 (ha)	Current (ha)	Decline (%)
<i>Northern subregions – climate class E6 (semi-arid)</i>			
MDD01 South Olary Plain	2,974,705	2,699,802	9.24
MDD06 Darling Depression	750,038	743,600	0.86
MDD07 Braemar	43,379	43,054	0.75
<i>Subtotal</i>	<i>3,768,122</i>	<i>3,486,456</i>	<i>7.47</i>
<i>Southern subregions – climate class E1/E2 (Mediterranean)</i>			
MDD02 Murray Mallee	3,840,134	755,332	80.33
MDD03 Murray Lakes and Coorong	9,773	4,756	51.34
MDD04 Lowan Mallee	1,856,445	1,283,283	30.87
MDD05 Wimmera	245,740	71,076	71.08
<i>Subtotal</i>	<i>5,952,092</i>	<i>2,114,447</i>	<i>64.48</i>
<b>Total MDD Mallee</b>	<b>9,720,214</b>	<b>5,600,903</b>	<b>42.38</b>

Source: DAWE (2020). NVIS Major Vegetation Group data v5.1 intersected with geographic layers for IBRA subregions v7. Mallee vegetation is based on data aggregated for NVIS Major Vegetation Groups 14 and 32.

*Has there been a substantial decline in the geographic distribution of the bird assemblage across the Eastern Mallee?*

The distribution of the bird ecological community may be estimated using extensive biological records collated by the Atlas of Living Australia (ALA). Based on these observations, the presence of Mallee Bird species within individual ten by ten-kilometre grids overlain across the MDD bioregion can be determined. The sum of 100km<sup>2</sup> grids occupied by a minimum number of mallee bird species provides an estimate of Area of Occupancy (AOO) for the bird assemblage.

Estimates of AOO based on minimum occupancy by any three to five, or more, member bird species showed no clear trend of change between 2000-2009 and 2010-2019 (Table 7.2). These decades were compared to show recent short-term changes in distribution and because they had high and comparable numbers of observations.

- To conclude: there has been no substantial change in estimated AOO for the bird assemblage relative to a short-term period (2000 to 2019).
- However, data is not available to estimate decline in the geographic distribution of the bird assemblage over the longer term (e.g. since 1750).

**Table 7.2.** Estimated Area of Occupancy (AOO, km<sup>2</sup>) for the Mallee Bird Community (MBC), based on minimum presence of any three to five-member bird species in ten by ten-kilometre grids across the MDD bioregion. The number of collated bird observations on which estimates were based are also shown.

Period	No records	≥ 3 MBC species	≥ 5 MBC species
2000-09	33,001	51,300	33,500
2010-19	45,695	56,700	38,400

Source: Atlas of Living Australia (2020), records of mallee bird species collated for two time periods: 2000-2009 and 2010-2019. The numbers of bird observations used for this analysis were based on records for the 20 species listed in Table 2.1. Numbers were rounded to the nearest hundred.

*Conclusion*

Following assessment of the data the Committee has determined that there is an approximate 42% decline in the available habitat for the ecological community, but there is insufficient information on long-term decline in the geographic distribution of the birds in order to determine the eligibility of the ecological community for listing in any category under Criterion 1.

<b>7.2.2. Criterion 2 - Limited geographic distribution coupled with demonstrable threat</b>			
Its geographic distribution is:	<b>Very restricted</b>	<b>Restricted</b>	<b>Limited</b>
2.1. Extent of occurrence (EOO)	< 100 km <sup>2</sup> = <10,000 ha	<1,000 km <sup>2</sup> = <100,000 ha	<10,000 km <sup>2</sup> = <1,000,000 ha
2.2. Area of occupancy (AOO)	< 10 km <sup>2</sup> = <1,000 ha	<100 km <sup>2</sup> = <10,000 ha	<1,000 km <sup>2</sup> = <100,000 ha
2.3. Patch size	< 0.1 km <sup>2</sup> = <10 ha	< 1 km <sup>2</sup> = <100 ha	-
<b>AND</b> the nature of its distribution makes it likely that the action of a threatening process could cause it to be lost in:			
the Immediate future [within 10 years, or 3 generations of any long-lived or key species, whichever is the longer, up to a maximum of 60 years.]	Critically endangered	Endangered	Vulnerable
the Near future [within 20 years, or 5 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.]	Endangered	Endangered	Vulnerable
The Medium-term future [within 50 years, or 10 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.]	Vulnerable	Vulnerable	Vulnerable

**Not eligible under Criterion 2.**

Criterion 2 aims to identify ecological communities that are geographically restricted to some extent or where the nature of the distribution makes them more susceptible to threats. It is recognised that an ecological community with a distribution that is small and/or fragmented, either naturally or that has become so through landscape modification and other threats, has an inherently higher risk of extinction if it continues to be subject to ongoing threats that may cause it to be lost in the future.

The indicative measures that apply to this criterion are based on former and extant mallee habitats which the bird assemblage requires to persist in the MDD bioregion. The measures are:

- extent of occurrence, an estimate of the total geographic range over which the ecological community occurs or is likely to occur;
- area of occupancy, an estimate of the area actually occupied by the ecological community, which generally equates with its present extent;
- patch size and distribution, an indicator of the vulnerability of small and/or isolated patches to particular threats; and
- an assessment of timeframes over which threats could result in further loss of the ecological community.

**Evidence:**

*Does the Extent of Occurrence (EOO) indicate at least a limited geographic distribution?*

Given many of the member species of the Mallee Bird Community are wide-ranging across the MDD bioregion, potential habitats may provide a reasonable estimate of EOO for the ecological community. Two relevant measures are:

- The total area of the MDD bioregion, about 20 million ha; and
- The extent of mallee habitats originally available to the birds in the MDD bioregion, estimated as about 9.7 million ha ([Table 7.1](#)).

These measures do not indicate a limited geographic distribution based on EOO.

*Does the Area of Occupancy (AOO) indicate at least a limited geographic distribution?*

Estimates of AOO for the Mallee Birds are:

- The total current extent of mallee habitats currently available to the birds, about 5.7 million ha ([Table 7.1](#)); and
- Based on the area of 10x10 km grids occupied by a minimum number of five bird species from the assemblage during 2000 to 2019 ([Table 7.2](#)): about 33,000 to 38,000 km<sup>2</sup>.

These measures do not indicate a limited geographic distribution based on AOO.

*Does the patch size distribution indicate at least a limited geographic distribution?*

Some species, such as the Mallee Emu-wren, are geographically very limited with low dispersibility, while other mallee birds range widely ([Table 2.2](#)), so can traverse areas of modified land use or non-mallee native vegetation that separate mallee remnants (e.g. the nomadic Scarlet-chested Parrot).

It is possible to apply patch size considerations to the mallee habitats on which the Mallee Bird assemblage most depends. This can be done at a broad scale (MVG) over the entire bioregion to capture the variety of habitats that different members of the bird assemblage may rely upon. Two approaches for this are to look at the number of patches or the areal extent within each mallee patch size class. These two approaches show opposite trends, partly as a consequence of the geometry of patch distribution.

- The majority of individual mallee patches are under one hectare in size and over 95% of patches are less than ten hectares in size ([Table 7.3A](#)). This is largely influenced by clearing in the MDD South where formerly continuous occurrences of mallee are now broken into numerous small remnants, many of which are isolated in a matrix of modified land uses. The average patch size for mallee in the MDD South has declined from about 471 ha pre-1750 to only about 13 ha currently.
- However, more than 90% of the remaining extent of mallee occurs as large patches over 1,000 ha in size ([Table 7.3B](#)). This includes some very large areas that are over half a million hectares and protected as conservation reserves, such as Big Desert-Ngarkat and Murray-Sunset national parks. Most mallee, therefore, occurs as remnants extensive enough to support larger and diverse bird populations. Small remnants that are under one hundred hectares in size, while very numerous, account for less than five percent of the total remaining extent of mallee.

Fragmentation in terms of areal extent rather than numbers of patches is more meaningful to the Mallee Bird Community because it reflects viability of habitat for bird populations. Good quality habitat is more likely to persist in patches that are over 1000 hectares in size. Nevertheless, smaller patches may still contribute to viability of bird populations if they occur in close proximity to each other or to a very large patch, effectively contributing as extensions of larger patches or connections between such patches. The overall patterns of mallee patch sizes and fragmentation, in this case, does not indicate a restricted geographic distribution nor is there a clear case that the nature of the distribution for the ecological community makes it substantially more susceptible to threats.



**Table 7.3.** Current patch size data for mallee vegetation in the MDD Bioregion.

A) Number of patches within each size range class.

Category		Size range (ha)	No. of patches	% of patches	Cumulative % of patches	
Restricted	Very Restricted	0-1	138,202	81.7%	96.4%	99.5%
		>1-10	24,815	14.7%		
		>10-100	5,267	3.1%		
		>100-1000	762	0.4%		
		>1000	140	0.1%		
		<b>Total</b>	<b>169,186</b>	<b>100%</b>		
		Av patch size	33.3 ha			

B) Total extent of patches within each size range class.

Category		Size range (ha)	Ha. of patches	% of extent	Cumulative % of extent	
Restricted	Very Restricted	0-1	27,389	0.5%	1.9%	4.4%
		>1-10	80,450	1.4%		
		>10-100	140,613	2.5%		
		>100-1000	212,268	3.8%		
		>1000	5,168,040	91.8%		
		<b>Total</b>	<b>5,628,760</b>	<b>100%</b>		

Source: DAWE (2020). NVIS Major Vegetation Group data v5.1 intersected with IBRA geographic layers for the area of interest. Mallee vegetation is based on data aggregated for NVIS Major Vegetation Groups 14 and 32.

*Are there demonstrable threats to the ecological community and what timeframes apply?*

The key threats to the Mallee Bird Community are outlined in [Section 4](#). The ecological community faces several threats that are potentially serious and ongoing. Clearing is largely a past threat apart from mostly small-scale actions. However, the impacts of fragmentation arising from past clearing are an ongoing legacy that continues to impact on parts of the ecological community. Fragmentation results in patches being more prone to catastrophic fires, pest animal and weed impacts, and other disturbances from surrounding modified land uses.

Almost half the original mallee vegetation remains extant, with over 90% occurring as extensive patches over 1,000 hectares. Clearing some smaller remnants will not lead to an appreciable permanent loss of mallee birds, though could further reduce connectivity for the bird assemblage that remains in these areas. Therefore, it's not the nature of the distribution that is likely to cause extinction in the relevant timeframes. Extinction of the mallee bird community is mostly likely if the extensive mallee reserves are impacted through one, or a succession of, catastrophic fire seasons, possibly mediated through climate change and occurring in combination with other serious ongoing threats, such as invasive species, that collectively have already caused significant degradation.

*Conclusion.*

Following assessment of the data the Committee has determined that the ecological community is not eligible for listing in any category under Criterion 2.

7.2.3. Criterion 3 - Loss or decline of functionally important species			
Category	Critically endangered	Endangered	Vulnerable
For a population of a native species likely to play a major role in the community, there is a:	very severe decline	severe decline	substantial decline
3.1 Estimated decline over the last 10 years or three generations, whichever is longer of:	at least 80%	at least 50%	at least 20%
to the extent that restoration of the community is not likely to be possible in:	the immediate future	the near future	the medium-term future
3.2: <i>restoration</i> of the ecological community as a whole is <i>unlikely</i> in	10 years, or 3 generations of any long-lived or key species, whichever is the longer, up to a maximum of 60 years.	20 years, or 5 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.	50 years, or 10 generations of any long-lived or key species, whichever is the longer, up to a maximum of 100 years.

### Eligibility for listing under Criterion 3: Endangered

#### Evidence:

This criterion considers whether there has been a decline of species that are functionally important to the persistence of an ecological community. The Mallee Birds is an assemblage of 20 bird species identified as being specialist or dependent on mallee habitats within the MDD bioregion. The questions are: Can functionally important species be identified within this assemblage? If so, have those species declined at least substantially within a given timeframe? Are these populations likely to recover within a given timeframe?

*Can functionally important species be identified for the Mallee Bird Community?*

There are a number of ways to consider functional importance. One is to consider the known biology of the component species and their interactions, as a way to infer functional importance. For instance, can we determine from the known biology if losing any of the Mallee Bird species will, in itself, necessary lead to decline in the remaining species? In the absence of detailed food web, competitive and similar studies, the range of interactions are too poorly known to properly assess an individual species' functional importance.

A second approach is to consider function in terms of the diversity of functional traits within a species assemblage. For instance, Suarez-Castro et al (2020) define:

“... functional diversity as the variation and dispersion in the distribution of functional traits in a species assemblage. A subgroup of functional traits that is important to consider separately when using functional diversity to understand ecosystem function are “effect traits”. Effect traits determine the effect of species on ecosystem functions such as nutrient cycling, seed dispersal and primary productivity, and thus effect trait diversity plays a key role linking biodiversity and ecosystem functioning .... For example, effect traits such as tongue length and bill morphology “affect” ecosystem function by influencing pollination effectiveness and the handling of fruits .... [An]other important subgroup of traits to consider when studying functional diversity and its link to ecosystem function are “response traits”; traits that determine species vulnerability to environmental change. Body size and dispersal capacity are

examples of response traits as they are involved in the way that species respond to changes in habitat patch size, patch isolation and matrix permeability .... Importantly, individual functional traits can be both effect and response traits depending on the context.”

Some traits of Mallee Bird species are shown in [Table 7.4](#). Effect traits may be represented by the food and nesting preferences of individual species. For instance, nectar feeders are likely to function as pollinators while seed and fruit feeders function as plant propagule dispersers. Ground nesters and burrowers help with nutrient cycling activities by digging and mixing leaf and litter material from the canopy and ground layers directly into the soil. Response traits are covered by body size, distance/dispersibility and longevity traits shown in [Table 7.4](#). Longevity is a key trait that refers to the persistence and restorability of functions provided by a given species: persistence in the sense that longer-lived species contribute their functional roles over their longer lifespans; but with the trade-off that restorability may be delayed if longer-lived species need more time to mature and recover from population declines.

There is some redundancy in traits across bird assemblage species because member species from the same families share similar traits. Many of the birds are honeyeaters, parrots, wrens and robins and this commonality extends to the broader avifauna diversity recorded from the MDD bioregion ([Table 7.5](#)). Three assemblage species are unique at the family level, not just to the community but also for the MDD avifauna. Of these three species, one – the Malleefowl - has markedly distinctive traits in its large size, long lifespan and age to first reproduction, and its habit of building a very large mound for its nest. It occurs throughout the MDD.

Benshemesh (2007) provides a summary of the life history and ecology of Malleefowl. They prefer patches of mallee that have been long unburnt (>40 years). Extensive fires may lead to the loss of populations from burnt patches and disrupt Malleefowl breeding activity for up to 17 years. Long unburnt mallee coincides with critical habitat features, such as tree hollows, dense *Triodia* tussocks, accumulated litter and bark ribbons, which are important for other members of the Mallee Bird Community. The reduced litter load over areas associated with Malleefowl activities in litter gathering and mound building, especially where several mounds are present, can reduce the likelihood and intensity of fires at a local scale (Smith et al 2016). This, in turn, can lead to heterogeneous patterns of fire where some areas of long unburnt mallee are retained in the landscape as fire refuges. The interaction of Malleefowl and fire behaviours is another indication of the functional importance of Malleefowl and how this species may influence the persistence of Mallee Bird populations at a local scale.

In conclusion about presence of functionally important species: the Malleefowl stands out as the most functionally unique species of the assemblage, important to the condition of mallee habitats.

*Has there been a decline in any functionally important species for the Mallee Bird Community?*

National monitoring data from about 140 sites between 1989 to 2017 suggests Malleefowl are undergoing a continuing national decline of about 2% per annum, with trends varying regionally (Benshemesh et al. 2021).

Annual data on Malleefowl abundance in the MDD region, measured as reporting rate, are presented for 2000 to 2019 at [Figure 7.1](#). The data show differences between areas where extensive occurrences of mallee remain (Key Biodiversity Areas) and areas where mallee vegetation is absent or fragmented and less extensive. Malleefowl were consistently much more abundant in areas where extensive mallee remains, with the exception of strong droughts in 2005-06 and 2018-19, when Malleefowl reporting rates were similar in both areas. During the decade from 2010 to 2019, the mean decline in reporting rates between Key Biodiversity Areas and areas outside KBAs was about 70%. There was no long-term trend of decline in Key Biodiversity Areas, with sharp increases in reporting rates after 2010, coinciding with the breaking of the Millennium drought ([Figure 7.1](#)). However, in the areas with less extensive mallee, Malleefowl were absent from surveys during 2007 to 2013. Even though the species reappeared each year after 2014 to 2019, it was still at low abundance.

In conclusion about decline in functionally important species:

- There are large areas of former and fragmented Malleefowl habitats where the species has declined in reporting rates relative to areas of extensive and intact mallee. These declines are in the order of at least 70% for the decade 2010 to 2019. Such a decline, along with potential contraction of suitable habitats, is sufficient to be considered severe.
- National monitoring shows the Malleefowl has been in decline since 1989.
- Annual fluctuations in the abundance of Malleefowl over the past twenty years appear to coincide with periods of drought and high rainfall.

Malleefowl prefer mid to late-stage mallee, that require several decades of regrowth. In addition, much of the decline outside of the more intact mallee KBAs relates to areas where native vegetation has become permanently lost and modified due to land use. For these reasons, habitats for the Malleefowl are unlikely to be restored within the near future to a condition suitable for maintaining strong Malleefowl populations.

### *Conclusion*

The available information on bird functional traits indicates the Malleefowl has a set of functional attributes likely to be important to the ecological community, i.e. the assemblage of 20 mallee specialist and dependent bird species<sup>8</sup>. Malleefowl have also declined severely in abundance across much of their former range and are most abundant in the extensive mallee reserves that remain. Recent trends in reporting rates mirror rainfall patterns and show that Malleefowl can disappear from parts of the landscape during times of environmental stress. The important functional roles of the Malleefowl are unlikely to be restored in the near future given the broad patterns of habitat loss and decline of this species. The Committee considers the Mallee Bird Community is **eligible** for listing as **Endangered** under this criterion.

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<sup>8</sup> The functional traits of malleefowl are also evident in species outside the Mallee Bird Community that occupy similar niches. For instance, native burrowing marsupials and ants are ground-dwelling soil engineers that influence nutrient cycling and soil microbial activity. The broader functionality and persistence of the mallee ecosystem also rests on these other species assemblages and ecological communities. However, these fall outside of this listing assessment.

**Table 7.4.** Traits of the component bird species of the Mallee Bird Community.

Common name	Food preferences <sup>1</sup>	Av. Body size (g) <sup>1</sup>	Nest location <sup>1</sup>	Maximum distance (km) <sup>2</sup>	Maximum recapture (yrs) <sup>2</sup>	Survival <sup>3</sup>	Age at first reproduction (yrs) <sup>3</sup>	Maximum longevity (yrs) <sup>3</sup>
<b>Mallee specialists</b>								
Black-eared Miner	Nectar-Pollen / Invertebrates	51.7	Supported	8	9.1	0.72	1.9	9 *
Chestnut Quail-thrush	Seeds / Invertebrates	74.5	Ground, Supported	-	8.1	0.75	1.6	8*
Mallee Emu-wren	Seeds / Invertebrates	5.5	Supported	1	0.6	0.55	0.9	7
Malleefowl	Seeds / Foliage / Invertebrates	1,920	Ground, mound builder	37	6.1	0.82	3.5*	29*
Red-lored Whistler	Invertebrates	36.7	Supported	-	0.2	0.82	1.2	10
Scarlet-chested Parrot	Seeds / Foliage	38.0	Hollow	-	-	0.64	1.0*	25*
Striated Grasswren	Seeds / Invertebrates	18.6	Supported	-	0.2	0.67	1.2	10
Mallee Western Whipbird	Invertebrates	46.0	Supported	-	-	0.72	0.7	11
<b>Mallee dependents</b>								
Crested Bellbird	Seeds / Invertebrates	63.4	Supported	8	5.0	0.73	1.5	11
Grey-fronted Honeyeater	Fruit / Nectar-Pollen / Invertebrates	16.6	Supported, Hanging	6	4.0	0.67	1.2	11
Jacky Winter	Invertebrates	14.5	Supported	12	5.3	0.66	1.2	5*
Purple-gaped Honeyeater	Fruit / Nectar-Pollen / Seeds / Invertebrates	19.8	Supported	2	13.7	0.72	1.7	14*
Regent Parrot	Fruit / Seeds	175.0	Hollow	370	9.2	0.65	1.0*	28*
Shy Heathwren	Invertebrates	14.7	Supported	-	-	0.64	1.2	9*
Southern Scrub-robin	Seeds / Invertebrates	33.5	Ground, Supported	2	9.8	0.74	1.5	10*
Splendid Fairy-wren	Invertebrates	9.2	Supported	6	11.0	0.65*	2.0*	11*
Spotted Pardalote	Invertebrates	8.5	Burrow	633	6.5	0.54	0.9	7*
White-eared Honeyeater	Fruit / Nectar-Pollen / Invertebrates	21.6	Supported	25	12.9	0.69	1.3	13*
White-fronted Honeyeater	Nectar-Pollen / Invertebrates	17.2	Supported	165	4.1	0.62	1.2	4*
Yellow-plumed Honeyeater	Nectar-Pollen / Invertebrates	17.2	Supported	94	9.1	0.68	1.2	9*

Sources: <sup>1</sup> Garnett et al. (2015).

<sup>2</sup> Australian Bird and Bat Banding Scheme database, accessed 7 Sept 2020. Note the ABBBS is a national dataset and it is assumed the data are indicative regionally, for the MDD.

<sup>3</sup> Bird et al. (2020). Data based on modelling except \* indicates data based on published observations.

*Legend to nest location*

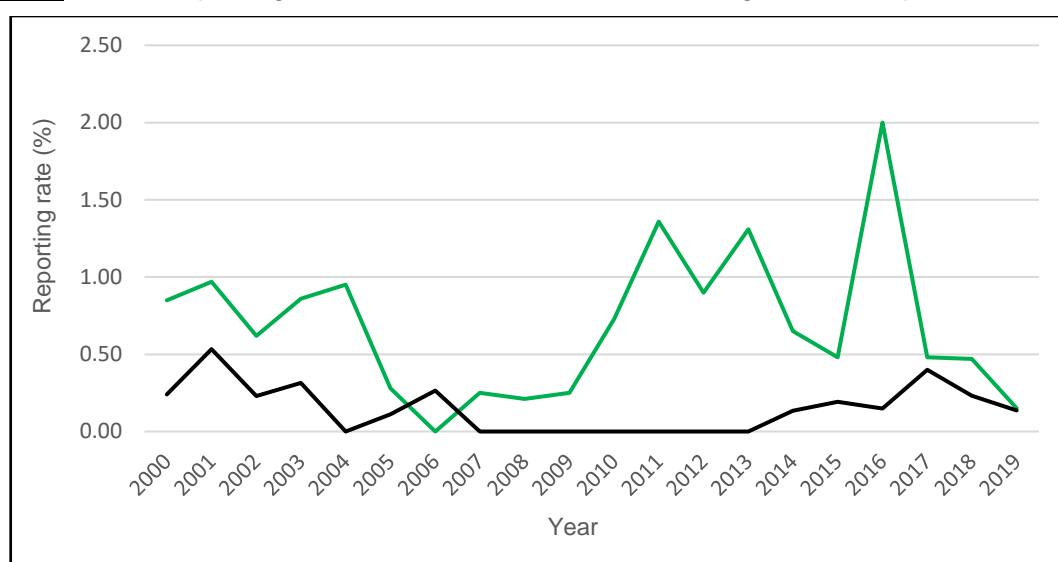
Nest location	Description
Burrow	Nest under the ground, either in a self-excavated burrow, a burrow constructed by another species, or a rock crevice.
Ground	Nest on or within 0.5 m of the ground.
Hanging	Nest constructed in a manner that leaves it suspended in mid-air.
Hollow	Nest in a tree hollow above the ground, with or without additional nesting materials.
Supported	Nest supported from beneath by standing vegetation.

**Table 7.5.** Representation of key bird families in the Mallee Bird Community (MBC) and the avifauna recorded for the MDD bioregion.

Family	Common name	No. species - MBC	No. species - MDD
Meliphagidae	Honeyeaters, Miners	6	32
Acanthizidae	Thornbills	1	17
Psittacidae	Parrots, Lorikeets	2	15
Maluridae	Wrens	3	7
Petroicidae	Robins	2	7
Pachycephalidae	Whistlers	1	5
Pardalotidae	Pardalotes	1	2
Psophodidae	Whipbirds	1	2
Cinclosomatidae	Quail-thrushes	1	1
Megapodidae	Malleefowl	1	1
Oreocidae	Bellbirds	1	1

Source: Birddata, Birdlife Australia accessed January 2021. Refer to legend for Table x in Appendix A.

**Figure 7.1.** Annual reporting rates for Malleefowl in the MDD region, for the period 2000-2019.



Source: Birddata, Birdlife Australia, accessed May 2021. Reporting rates were based on malleefowl observations from all standardised 2ha 20 minute and 500 metre area searches undertaken in the area of interest.

Records were collated from within a polygon bounded by:

Menindee to the north and the top end of the Grampians to the south;

Mount Barker to the west and Swan Hill to the east; and

configured to include the Central NSW Mallee KBA in NSW and exclude the Coorong and lakes KBA in SA.

This polygon covers the main extent of mallee and the MDD bioregion.

**Green line:** Reporting rate for Malleefowl observations within mallee Key Biodiversity Areas (KBAs). This is representative of the remaining extensive areas of mallee vegetation.

**Black line:** Reporting rate for all Malleefowl observations that occur outside of KBAs within the polygon. This is representative of fragmented and less extensive mallee remnants.

7.2.4. Criterion 4 - Reduction in community integrity			
Category	Critically endangered	Endangered	Vulnerable
The reduction in its integrity across most of its geographic distribution is:	very severe	severe	Substantial
as indicated by degradation of the community or its habitat, or disruption of important community processes, that is:			

Reference should also be made to the indicative restoration timeframes as outlined under Criterion 3, above.

### Eligibility for listing under Criterion 4: Endangered

#### Evidence:

This criterion considers whether there has been a loss of integrity for the Mallee Bird Community across most of its geographic range. Several factors may influence integrity and it is noted that this criterion includes evidence that is qualitative as well as quantitative, where such data are available. The factors considered relevant and influential on the Mallee Bird Community, and for which some data are available are: habitat fragmentation, fire regimes, interactions with pest animals, and total grazing pressure.

- Mallee habitats, and native vegetation generally, have become fragmented to a variable degree across the MDD bioregion due to past and ongoing land uses, and this will impact on the local abundance and composition of the bird fauna.
- Fire is a key influence on mallee ecosystems. Fires may create new habitats or render them unsuitable depending on the successional stage preferred by individual mallee bird species.
- Pest animals such as feral cats and foxes, prey on a range of animals, including birds. Traits shown by different bird species influences their vulnerability as potential prey.
- Total grazing pressure due to the presence of domestic stock, feral herbivores such as goats and rabbits, and native herbivores such as kangaroos. This influences the structure and quality of the vegetation understorey as potential habitats for bird species.

These threats do not operate independently but may interact in complex ways, for instance the interactions between fragmentation and fire reviewed by Driscoll et al. (2021) and discussed further below.

#### *Loss of integrity due to fragmentation of habitats*

##### Have mallee habitats become fragmented?

Three approaches to fragmentation of habitat are presented here. Firstly, the patterns of extent, decline and patch sizes for mallee vegetation, based on NVIS polygons across the MDD bioregion are shown in [Figure 1.2](#), and [Table 7.3](#). These show a pattern of loss and fragmentation within the MDD bioregion although northern subregions are more intact while the southern subregions are much more cleared of native vegetation. The native vegetation that now persists in parts of that area comprises only older paddock trees and narrow roadside corridors (Mallee CMA, 2012).

Secondly, fragmentation can be considered in a manner more relevant to birds by considering extent of mallee vegetation within ten by ten-kilometre (100km<sup>2</sup>) grids overlaid across the area of interest. This gives an indication of amounts of mallee habitat locally available to birds within each grid. Most 10x10 km grids across the MDD bioregion contained mallee vegetation to some extent but mallee was absent in 28% of grids (noting that other types of native vegetation may

have been present). Of those grids that contain mallee, almost half had low (<10%) to moderate (<40%) mallee cover ([Figure 7.2A](#)). Extensive occurrences of mallee (>60% cover) remain in less than 20% of the grid cells. Therefore, about 75% of grid cells either have no mallee, low cover or only moderate cover of mallee, suggesting low habitat integrity for most of the geographic range

Fragmentation is tied to the degree of landscape modification from various land uses. The patterns of landscape modification are similar for all vegetation across the MDD bioregion and for areas where mallee is present. About 42% of grid cells with mallee have had over 50% of their area modified, while 18% of grid cells with mallee have undergone >90% modification ([Figure 7.2B](#)). This represents a considerable proportion (60%) of the current extent of mallee that has been not only reduced but now abut areas of intensive land use. It indicates the extent to which former bird habitats are likely to have become increasingly unsuitable for the Mallee Bird community across much of the MDD bioregion.

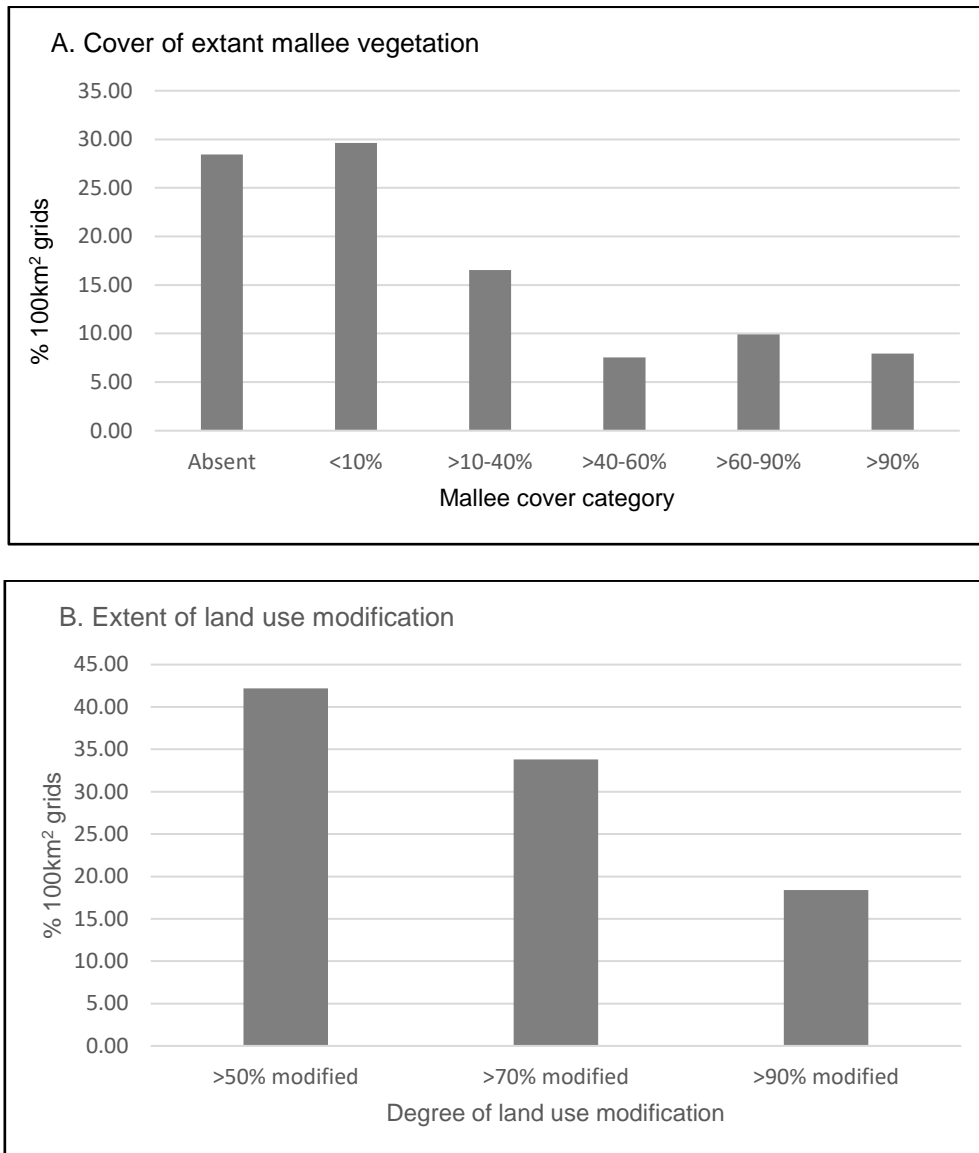
Thirdly, temporal changes to woody vegetation through analyses of woody vegetation under the National Carbon Accounting System (NCAS) from 1991 to 2015 (DoEE 2017). This woody vegetation dataset classifies vegetation across Australia as either woody (forest) ( $\geq 20\%$  cover); sparse woody (5-19% cover) or non woody (<5% cover) over various years. The analysis focused on areas within the MDD that were classified as woody at any period examined.

- Designations of 'stable' were applied to woody and sparse-woody areas if 25x25m pixels did not vary in classification during 1991-2015.
- A designation of 'variable woody' was applied to pixels that were 'sparse woody' at least once during 1991 to 2015, but never 'non-woody'. These may reflect subtle classification changes or reductions in canopy cover due to clearing or drought.
- A designation of 'modified woody' was applied to pixels that were 'non-woody' at least once during 1991 to 2015. These indicate changes in canopy cover from  $\geq 20\%$  to <5%, due to clearing, fires or drought. In the case of extensive conservation reserves, fire and drought are the most likely causes.
- Stable non-woody areas were disregarded for this analysis.

The NCAS analysis highlighted extensive areas of stable woody and modified woody vegetation, both of which coincide with mallee remnants in the MDD bioregion ([Figure 7.3](#)). Stable woody vegetation was most evident in the northern areas of the bioregion. Modified woody vegetation, however, was most evident in the southern areas of the bioregion. In particular, it highlighted much of the iconic mallee conservation areas: Murray-Sunset, Ngarkat-Big Desert, Little Desert and almost all of Billiat, have undergone extensive changes in the state of their woody vegetation during the period 1991 to 2015. The transition to/from non-woody vegetation suggests fire as a likely cause, with the Millennium drought as an additional factor. This is supported by the maps on fire extent and frequency across the MDD bioregion presented in Clarke et al (2021) that show similar patterns of landscape change, and that [Figure 7.3](#) clearly shows the fires of 2014 known to have burnt almost the entire Billiat and Bronzewing conservation areas and large parts of Ngarkat within the timeframes of the NCAS analysis.



**Figure 7.2.** Fragmentation of current mallee MVGs and degree of landscape modification within the MDD bioregion, based on occurrences within 10x10 km grid cells.



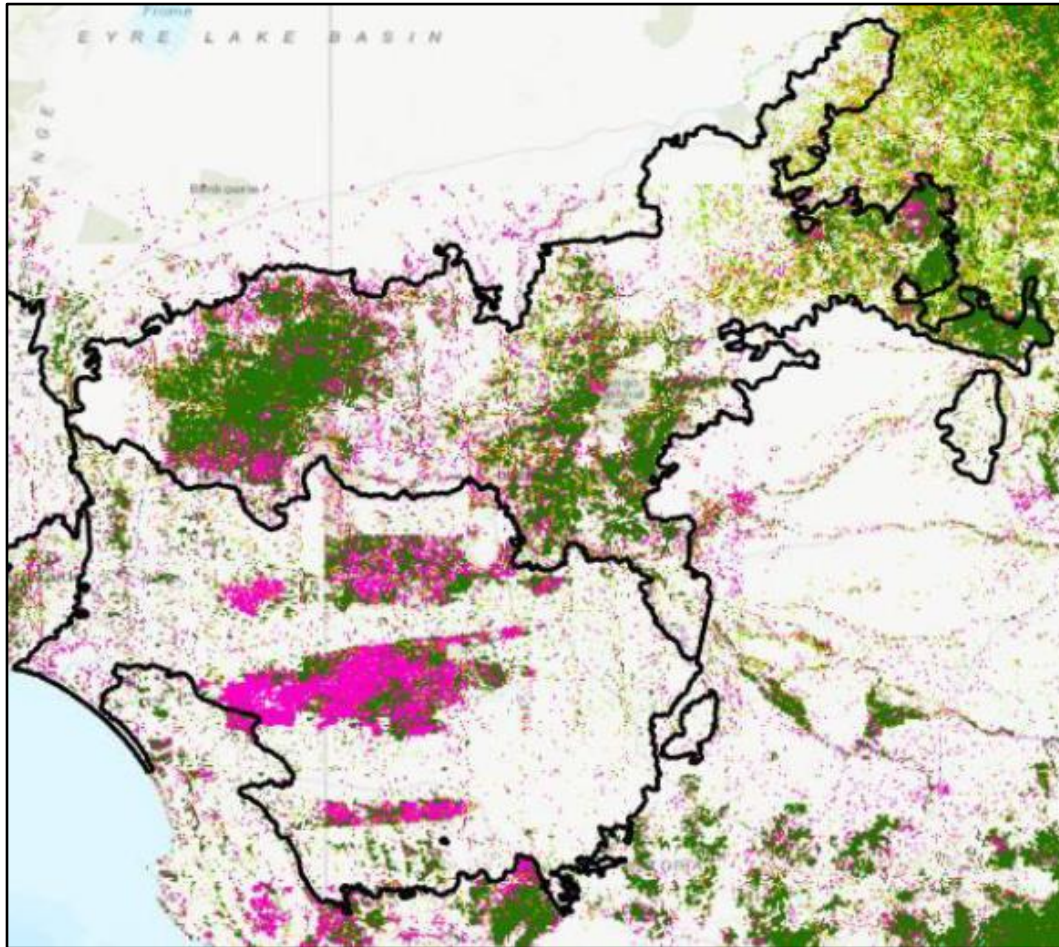
Source: DAWE (2020b). NVIS v5.1 data aggregated for Mallee MVGs 14 and 32 or Modified land use MVGs (25 and 29). Data based on occurrences of mallee overlain within 10x10 km grids across the MDD. The maximum area that can be occupied per grid cell is 100km<sup>2</sup>.

Legend: Top (A) - Bars indicate the percentage of total grid cells per category of vegetation cover for current mallee extent.

Bottom (B) – Bars represent the percentage of grid cells where mallee vegetation is present and the natural vegetation has been modified by more than 50, 70 or 90 percent of the 100 km<sup>2</sup> area. Data within all these bars is nested, e.g. the 50% bar includes all the 70 and 90% modified grid cells.

About half the woody vegetation of the MDD bioregion has remained stable since 1991 ([Table 7.6](#)). However, the extent of modified woody vegetation across the MDD is considerable: about 2 million ha or 28% of the total extent of woody vegetation. It shows that the presence of mallee remnants, as indicated by NVIS Major Vegetation Groups, does not necessarily imply that suitable habitat for the Mallee Bird community is consistently available through time. Patches that have transitioned to a non-woody state no longer match the mid to late mallee successional stages preferred by some members of the ecological community, notably the more threatened species.

**Figure 7.3.** Classification of native woody vegetation in the MDD and surrounding bioregions according to the National Carbon Accounting System (NCAS) for the period 1991 to 2015.



Source: DoEE (2017). Analysis undertaken by DAWE (2021).

**Legend:**

Light green = stable sparse-woody (consistently has 5-19% cover)

Dark green = stable woody (consistently has  $\geq 20\%$  cover)

Orange = variable woody ( $\geq 20\%$  cover but was classified as sparse-woody ( $< 20\%$ ) at least once during 1991-2015)

Pink = modified woody ( $\geq 20\%$  cover but was classified as non-woody ( $< 5\%$ ) at least once during 1991-2015)

**Table 7.6.** Extent of stable, variable and modified woody vegetation in the MDD Bioregion.

Classification	Area (ha)	% Total
Stable sparse-woody	585,400	8.17
Stable woody	3,756,800	52.44
Variable woody	789,300	11.02
Modified woody	2,032,400	28.37
Total	7,163,900	100.00

Source: DoEE (2017). Analysis undertaken by DAWE (2021). Data refers to all woody vegetation in the bioregion, including mallee and non-mallee woodland and forest types.

In conclusion, mallee habitats for the Mallee Bird Community within the MDD bioregion have become fragmented, not only in their broad extent and landscape pattern, but also through transition to habitats in unsuitable states over time. A considerable proportion of mallee now occurs in areas where the natural landscape has become modified by land use and is subject to further pressures.

### Does fragmentation impact on Mallee birds?

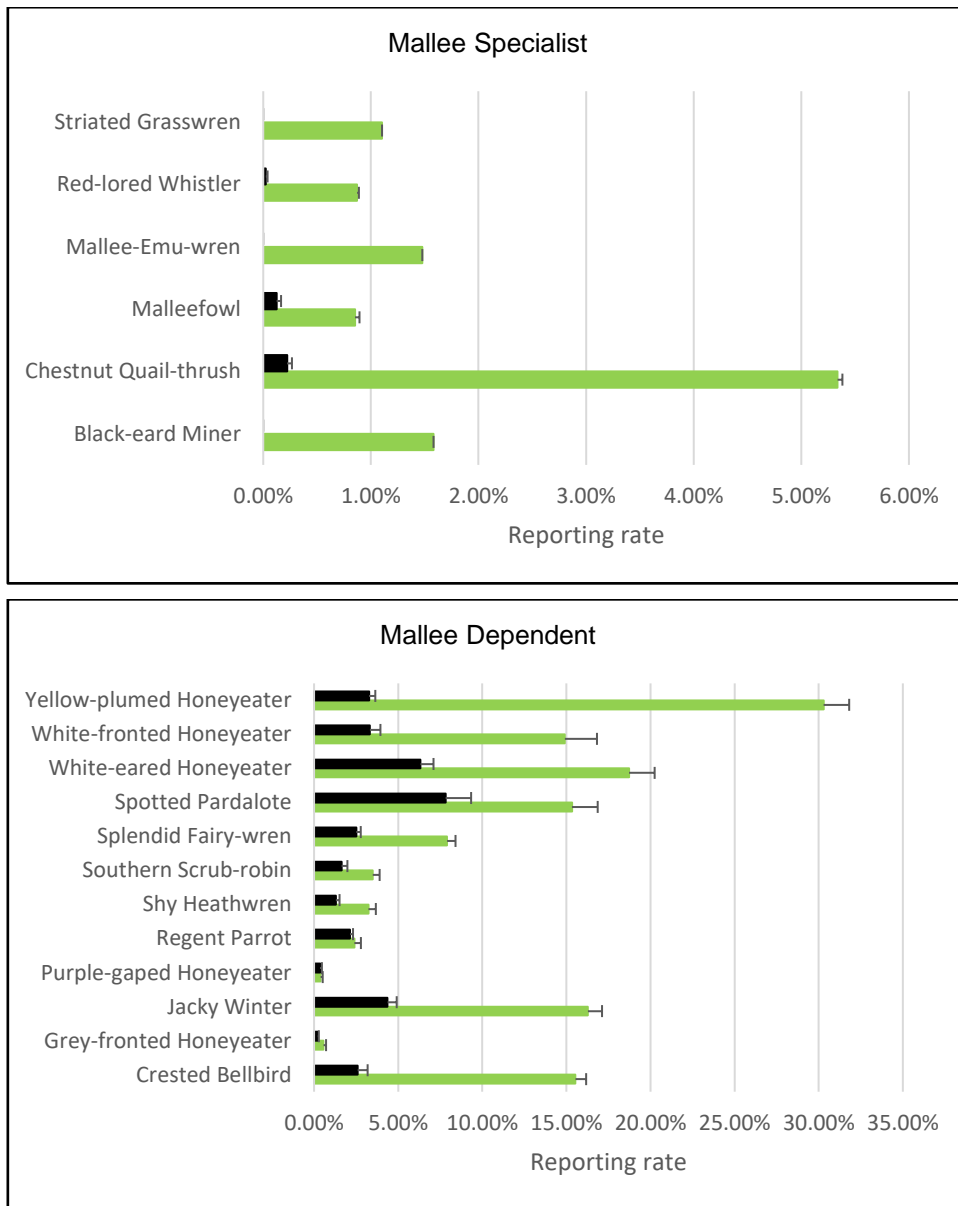
Habitat fragmentation is known to impact on biodiversity (Saunders et al. 1991; Mallee CMA 2012) and these mechanisms explain the significant impact of habitat fragmentation on the Mallee Bird ecological community. Isolated patches lose connectivity and increased separation of patches limits key processes such as resource availability, movement of species among remnants and capacity for recovery and recolonisation of species, e.g. after fire. Small patches surrounded by modified land uses, such as crops and pastures suffer edge effects where proximity to non-native landscapes and disturbances leads to heightened encroachment by weeds and pest animals. This is especially severe in narrow linear fragments where there is typically a short distance between a remnant's edge and the core.

Fragmentation can affect individual species that are part of the Mallee Bird Community. Smaller remnants may be more susceptible to catastrophic impacts from wildfires, because a higher proportion of the remnant may be impacted, though ignition risk may be lower in remnants that are smaller and more isolated. Populations of some bird species within such remnants may be similarly at risk of local or temporary extinction, if they are susceptible to decline and unable to recolonise from external populations if they have low mobility or are too far away and unable to disperse over large areas of modified landscapes. Such extinction events have been observed in Mallee Emu-wren, Red-lored Whistler and Mallee Western Whipbird from mallee blocks surrounded by cleared land (e.g. Possingham & Possingham 1997; Clarke 2004). The Mallee Emu-wren is a short-range habitat-specialist species that has a host range of only a few hectares, a maximum dispersal of up to ten km and prefers *Triodia* mallee vegetation that has not been burnt for at least fifteen years (DEH 2009a,b; Brown et al. 2009). Seven reserve-scale populations of the Mallee Emu-wren were known in 2000 but only five populations survived by 2009, with populations in the Bronzewing and Wathe Flora and Fauna Reserves becoming extinct (Brown et al. 2009). Since then, Billiatt Conservation Park was entirely burnt in the 2013-14 fire season, leading to the loss of further critical habitats and populations of this species (Brown 2014).

Fragmentation impacts the abundance of Mallee Birds across such landscapes. The reporting rates for Mallee Birds are much higher within extensive intact mallee areas (Key Biodiversity Areas) than in surrounding areas, where natural remnants are fragmented and surrounded by modified land uses (Figure 7.4). This pattern applied to both mallee specialist and dependent bird species. Many of the Mallee Bird species continue to persist in the broader landscape, albeit at much lower reporting rates. The main exceptions were mallee specialists such as the Black-eared Miner, Mallee Emu-wren and Striated Grasswren which were not recorded in fragmented mallee during the period analysed. Two mallee dependent species, the Regent Parrot and Purple-gaped Honeyeater, showed equivalent and low reporting rates between the intact and fragmented mallee areas (Figure 7.4).

In conclusion, fragmentation and loss of mallee habitats does impact on the abundance of Mallee Birds and, in the case of some mallee specialist bird species, also impacts on their continued presence. While many Mallee Birds continue to persist across the fragmented landscape, they do so at much lower abundance, making them prone to catastrophic impacts that could lead to local or temporary extinctions.

**Figure 7.4.** Reporting rates (%) for Mallee Bird species. Data represent mean + standard errors of annual reporting rates over for the decade 2010 to 2019. Bars compare reporting rates in relatively intact mallee versus fragmented landscapes within the MDD, as explained in the legend.



Source: Birddata, Birdlife Australia, accessed May 2021. Reporting rates were based on bird observations from all standardised 2ha 20 minute and 500 metre area searches undertaken in the area of interest during 2010 to 2019.

Records were collated from within a polygon bounded by:

Menindee to the north; top end of the Grampians to the south; Mount Barker to the west; Swan Hill to the east; and configured to include the Central NSW Mallee KBA in NSW and exclude the Coorong and lakes KBA in SA. This polygon covers the main extent of mallee and the MDD bioregion.

There were insufficient records to analyse two mallee specialist species: Scarlet-chested Parrot and Mallee Western Whippbird.

**Green bars:** Reporting rates for bird observations within mallee Key Biodiversity Areas (KBAs). This is representative of the remaining extensive areas of mallee vegetation. The number of surveys collated within KBAs is 7,360.

**Black bars:** Reporting rate for bird observations that occur outside of KBAs within the polygon. This is representative of fragmented and less extensive mallee remnants. The number of surveys collated from the area outside of KBAs is 8,890.

### *Loss of integrity due to fire regimes*

Fire is a key driver of mallee systems across Australia (Bradstock and Cohn, 2002; Yates et al. 2017; Keith et al. 2020). Lightning is the main source of ignition for fires in mallee systems and can result in fires that burn over extensive areas, if uncontrolled. Reserve-scale fires that impact entire mallee remnants are a key threat to mallee birds, especially if the reserves are smaller in size and/or contain threatened bird species. Other large fire events may not affect entire remnants but can homogenise the fire age-class and vegetation structure across a wide area (Brown et al. 2009), sometimes in ways that render habitats unsuitable for certain mallee bird species.

#### What is known about fire impacts on mallee habitats and mallee birds

There is extensive literature on the fire regimes of mallee systems; only a summary of key points relevant to this criterion is presented here.

The Mallee Fire and Biodiversity project has identified a chronosequence of how various habitat attributes change over post-fire intervals up to 110 years in the Murray Mallee, with many attributes showing non-linear responses (Clarke et al. 2010; Haslem et al. 2011; Watson et al. 2012). For instance, *Triodia* cover, an important resource for mallee bird species such as wrens, increases over the first 30 years after fire then declines gradually. In *Triodia* Mallee, litter and ground fuel cover increase for the first 20 or so years after fire, then plateau before a late decline after 80 years, as does the cover of the ground and mid-layer flora. Canopy cover sharply rises over the first 30 years then reaches a plateau. The only attributes that continually increase with time since fire are bark and hollow development that are attributes associated with older mallee vegetation. Hollows in mallee trees only begin to develop after about 35 years and become large after 80 years. These long-term patterns are partly determined by how the flora responds to fire which, in turn, influences the resources available to fauna and what animal assemblages (not just birds) appear over time.

The composition of the mallee bird assemblage is known to change with time since fire, as identified by Woinarski (1999):

- Recently burnt areas (<1-year post-fire): the birds are mainly widespread opportunists (e.g. Nankeen Kestrel, Australian Magpie).
- 1–10 years post-fire: Chestnut Quail-thrush, Tawny-crowned Honeyeater, Hooded Robin, Red-capped Robin, White-fronted Honeyeater and Shy Heathwren become abundant.
- 10–30 years post-fire: taller and denser vegetation favours more mallee endemic birds and the density of Red-lored Whistler, Crested Bellbird, Purple-gaped Honeyeater and Southern Scrub-robin peaks.
- >30 years post-fire: vegetation with tall mallees and relatively open understorey favours Malleefowl, Black-eared Miner, White-browed Babbler, Yellow Thornbill and hollow-nesting birds such as Striated Pardalote and Regent Parrot start to appear. Species dependent on larger hollows, such as Major Mitchell's Cockatoo, are expected to appear with increasing time since fire as these develop in mature trees.

Other known responses of important mallee birds to fire include (Brown et al. 2009; DEH 2009a,b; Mallee CMA 2012):

- Chestnut Quail-thrush and Shy Heathwren - highest densities in sites burnt <10 years ago.
- Mallee Emu-wren - prefers *Triodia* mallee that has not been burnt for at least 15 years.
- Malleefowl – reaches maximum breeding capacity in sites at least 40 years post-fire and highest densities at sites burnt 60-80 years ago.
- Mallee Western Whipbird – associated with vegetation generally 10-30 years post-fire.
- White-eared Honeyeater – associated with mid-successional vegetation, 15 to 40 years post-fire.
- Yellow-plumed Honeyeater - associated with older vegetation, 40 to 100 years post-fire.

The responses of several birds to time since fire were determined using the 100-year chronosequence from the Murray Mallee. About six types of responses in bird occurrence were

identified (Watson et al 2012; Clarke et al (2021): Null (no change in abundance with time since fire); Irruptive (immediate increase then rapid decline); Decline (sustained decline since fire); Bell (peak abundance at mid stage, 30-50 years); Incline (sustained increase since fire); and Plateau (initially low, then increase followed by little to no change in mid to late stage after fire). A general pattern, where a fire response was apparent, was for lowest abundance in the immediate post-fire stage, and maximum abundance in the mid to late stages post-fire, after about 20-30 years (i.e. a Plateau response type). Other factors than time since fire also need to be taken into account to better understand bird responses, such as droughts that affect post-fire recovery of vegetation, and variation due to vegetation types.

A general pattern of immediate decline in abundance post-fire and preference for mid to long unburnt mallee by many mallee bird species has implications for fire management. Fires, in themselves, are a natural feature of mallee systems but threats to integrity arise when the risk of fire and the consequences of its impacts are altered by human activities and, potentially, climate change. Fire management regimes that promote an abundance of recently burnt mallee at the expense of long-unburnt mallee areas, are likely to damage more bird species than they aim to protect (Taylor et al. 2012; 2013). This may happen under policies that burn a fixed minimum proportion, e.g. 5%, of vegetation in a landscape regardless of their state, or where entire remnants are burnt creating homogenous stands. There have been reserve-scale wildfires that have affected populations of mallee bird species, for instance during the 2013-14 fire season Billiat was entirely burnt. Populations of the Mallee Emu-wren disappeared, and the mallee habitats reset to large areas of single post-fire stage vegetation.

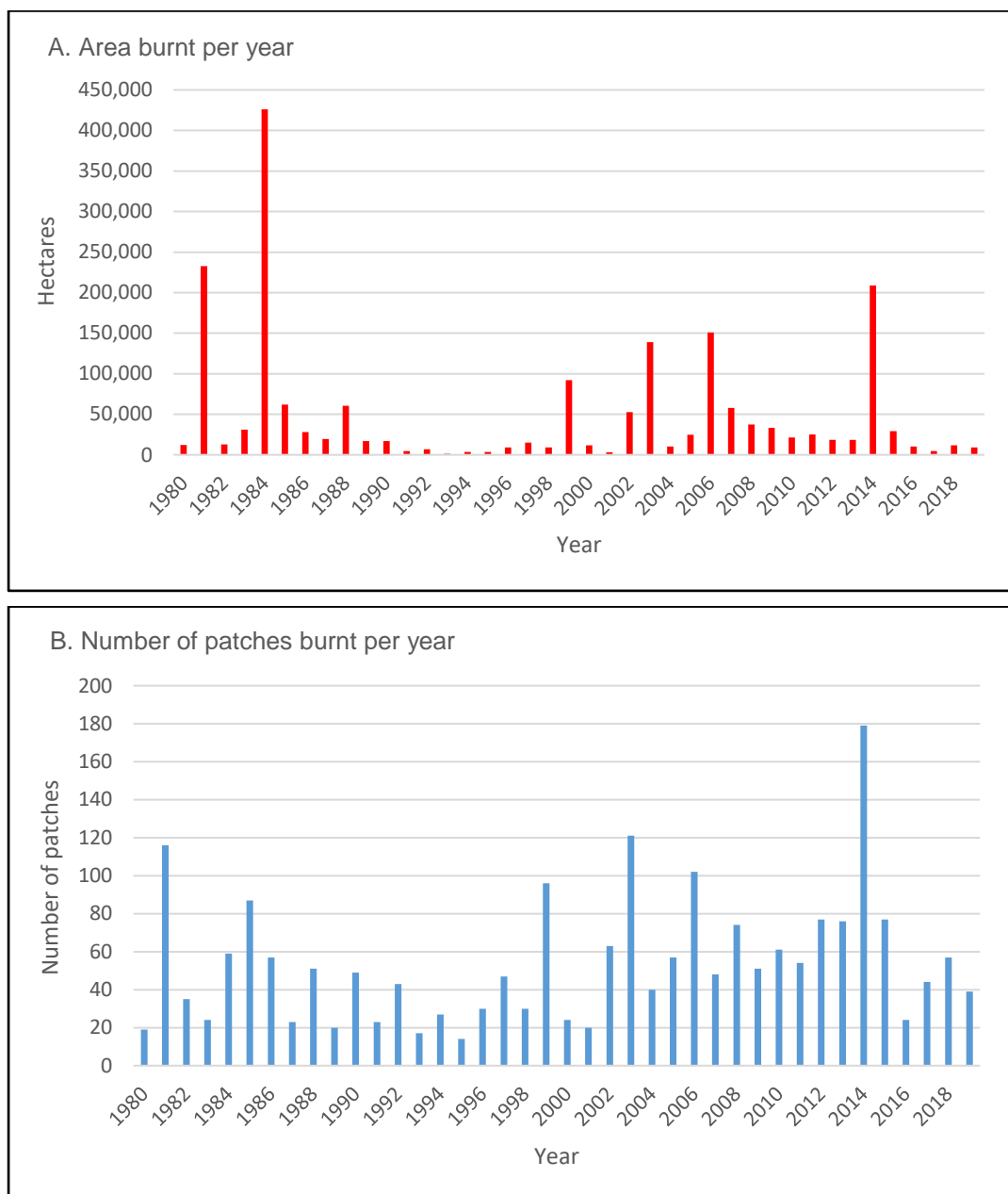
Tree hollows are among the key features of old growth mallee that are crucial to birds but take decades to develop. Mallee Bird species that most rely on hollows include members of the parrot and cockatoo families. Long unburnt areas also retain deeper layers of leaf litter, more bark ribbons and large fallen logs. These provide important resources for the Malleefowl, Black-eared Miner, Regent Parrot, Red-lored Whistler, Crested Bellbird and other birds, as well as mallee reptiles (Parks Victoria 2019).

Fire weather has become more severe since the 1990s, with fire seasons starting earlier and extending over a longer season (Clarke et al. 2019). Climate change models project, with high confidence, harsher fire weather for at least the Murray Basin in the future (CSIRO and BOM 2015). This is due to projected increases in temperature and the number of hot to very hot days, plus a general decline in rainfall. However, there is likely to be considerable seasonal variability in rainfall patterns that makes it difficult to project how much harsher the fire weather will actually become. There are expected to be increased risk of droughts and extreme storm weather, bringing more lightning strikes in some years.

Recent patterns of fire impacts on mallee in the MDD bioregion.

Analysis of fire history data since 1980 overlain against NVIS mallee polygons for the MDD bioregion shows how mallee vegetation and potential mallee bird habitats have been impacted by fires over the past forty years. The available data looks at temporal as well as spatial patterns of fire impacts.

**Figure 7.5.** Fire impacts in mallee vegetation of the MDD bioregion. Graphs show the area of mallee vegetation burnt per year and the number of mallee patches burnt per year.



Source: NVIS v5.1 (DAWE 2020b). data aggregated for Mallee MVGs 14 and 32 and fire history information supplied to the Department by State agencies. Data refer to mallee vegetation polygons 10 ha or more in size.

Annual fire patterns show irregular major fire impacts by area and number of mallee patches burnt (Figure 7.5A). In the forty years from 1980 to 2019, one fire season (1984) resulted in very extensive areas of mallee being burnt, over 400,000 hectares and five seasons had more than 100,000 ha of mallee burnt. For most seasons, less than 50,000 ha (or under 1% of estimated total current mallee extent) was burnt. Patterns for the annual number of mallee patches (as NVIS polygons for MVGs 14 and 32) burnt were different to patterns for total area burnt (Figure

7.5B). A large area burnt was not necessarily due to more patches being burnt: a large fire in one extensive remnant may burn a larger total area than numerous fires in smaller remnants. Fire seasons in which more than 100 patches were burnt occurred only four times in 40 years, with three occasions more recently, after 2000.

Patterns of cumulative fire impacts may better indicate the degree to which fire impacts on mallee habitats for the bird community over a longer term. Over the past 40 years, nearly 1.9 million hectares of mallee vegetation in large patches was burnt. However, this represents only about a third of the total remaining extent that was burnt (Table 7.7A). A much smaller proportion of current extent (six to sixteen percent) has been impacted by fires more recently (10-20 years). In terms of the number of large patches burnt, the cumulative data indicates about 35 to 45% of larger patches were impacted by fire to some extent, over recent timeframes (Table 7.7B). It is worth noting that after 20 to 40 years, some significant habitat features, such as *Triodia* understorey (where present), may have re-established sufficiently to once again provide the mid-successional habitat requirements for some mallee bird species.

**Table 7.7.** Cumulative impacts of fires on mallee vegetation since 1980 in the MDD bioregion. Data relate to large extant patches of 1000 ha or more.

A. Extent of large patches burnt

Timeframe	Cumulative area burnt (ha)	% of current extent
Last 40 years (1980-2019)	1,889,199	36.6
Last 20 years (2000-2019)	845,839	16.4
Last 10 years (2010-2019)	337,267	6.5

B. Number of large patches burnt

Timeframe	Cumulative no. patches burnt	% of large patches	Cumulative no. patches burnt >90%	% of all large patches
Last 40 years (1980-2019)	63	45.0	11	7.9
Last 20 years (2000-2019)	55	39.3	3	2.1
Last 10 years (2010-2019)	49	35.0	1	0.7

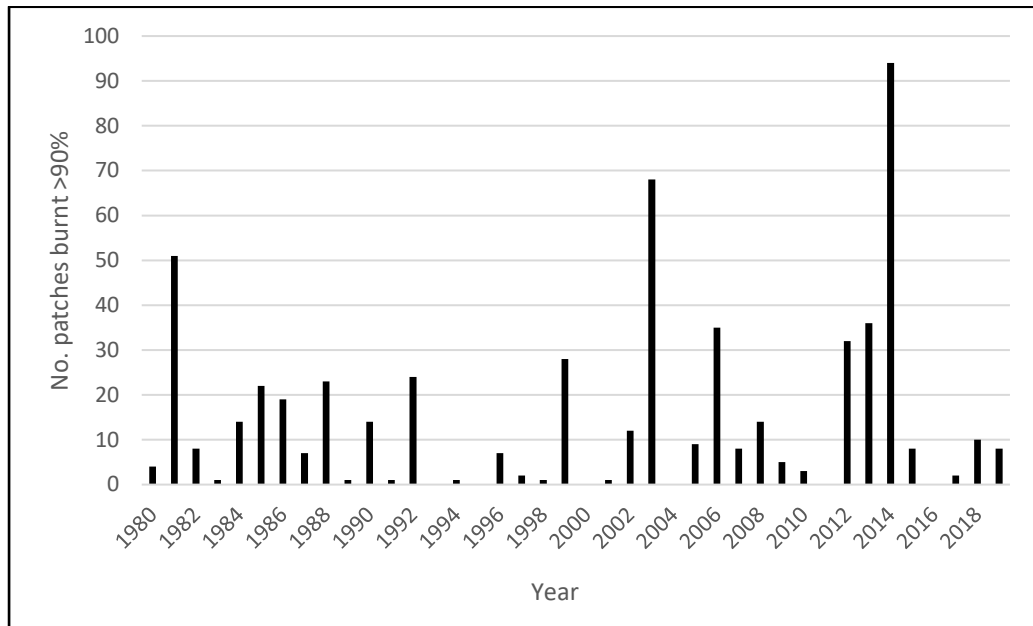
Source: DAWE (2020b) NVIS v5.1 data aggregated for Mallee MVGs 14 and 32 and overlain with fire history information supplied to the Department by State agencies. Large extant patches refer to mallee vegetation polygons that are over 1,000 hectares in size.

Cumulative area refers to the area of mallee polygons burnt by fires to some extent and summed over the periods shown. The total current extent of mallee vegetation in the MDD bioregion that occur in patches >1,000 ha is 5,168,000 ha (Table 7.3). Similar calculations apply for the number of patches counted, where the total number of patches >1000 ha is 140. There is an assumption that, for larger patches, successive fires only minimally overlap previous areas burnt. This assumption may lead to an overestimate of cumulative area and percentages burnt.

It is relevant to mallee birds to consider how many mallee remnants are entirely affected by fires. It provides an indication of potential local extinction events for the bird populations that rely on these patches as their primary habitat. About 8% of larger patches have encountered devastating cumulative impacts of 90% or more of their extent due to fires in the past 40 years, and about 2% over the last 20 years. It may be expected that smaller mallee remnants are more likely to be catastrophically impacted by fires given their small size. This is an issue for the more heavily fragmented southern extent of the MDD bioregion. The numbers of smaller remnants catastrophically impacted is variable but can be high, with zero to over ninety such fragments affected annually during 1980 to 2019 (Figure 7.6). In terms of cumulative impacts, a lower proportion of smaller remnants are affected by fire over time (9-28% depending on timeframe), mainly due to the large number of small mallee remnants (over 6,000) present in the MDD. (Table 7.8). The proportion of smaller remnants that have been catastrophically impacted (>90% burnt) over the past 10, 20 and 40 years is in the order of 3-10%. While this may seem low, smaller remnants play an important role as connecting habitats and their loss may affect the capability of certain Mallee Bird species to move between, occupy and colonise habitats.



**Figure 7.6.** Annual number of smaller mallee patches (10-1000 hectares) where at least 90% of each remnant was burnt in the MDD bioregion.



Source: NVIS v5.1 (DAWE 2020b). data aggregated for Mallee MVGs 14 and 32 and fire history information supplied to the Department by State agencies. Data refer to mallee vegetation polygons 10 to 1,000 ha in size that had at least 90% of their total extent impacted by fires in a given year.

**Table 7.8.** Cumulative impacts of fires on smaller remnants mallee vegetation since 1980 in the MDD bioregion. Data relate to patches 10 to 1000 ha in area.

Timeframe	Cumulative no. patches burnt	% of smaller patches	Cumulative no. patches burnt > 90%	% of smaller patches
Last 40 years (1980-2019)	1,675	27.8	573	9.5
Last 20 years (2000-2019)	1,006	16.7	345	5.7
Last 10 years (2010-2019)	539	8.9	193	3.2

Source: DAWE (2020b) NVIS v5.1 data aggregated for Mallee MVGs 14 and 32 and overlain with fire history information supplied to the Department by State agencies. Smaller extant patches refer to mallee vegetation polygons that are over 1,000 hectares in size.

Cumulative number refers to the number of mallee polygons within the size range burnt by fires to some extent and summed over the periods shown. The total current number of patches that are between 10 to 1,000 ha in size is 6,029 (Table 7.3).

The general pattern of fires in the mallee of the MDD over the past 20 to 40 years is that smaller patches appear to be burnt less frequently but more extensively, if not entirely, while larger patches are burnt more frequently but less extensively and presumably over different parts of their area. Cumulative impacts over the past 20 to 40 years affect a reasonable proportion of the area and number of mallee remnants. The effect of fires is to transform areas of mallee into early-successional stages that are unsuitable habitat for many Mallee Bird species. This has implications for the persistence of the ecological community in large parts of the MDD landscape. While it is possible for mallee habitats to recover as suitable habitat, given time, there are likely to be other fire events during that period that will continue to happen.

Maps on fire extent and frequency in the MDD bioregion (Clarke et al 2021) confirm that large areas of mallee have been burnt since 1970, especially in the extensive conservation reserves / Key Biodiversity Areas south of the Murray River. These are also the areas where fires have been more frequent, especially in Ngarkat Conservation Park. These maps also conform with the changes in woody vegetation shown in Figure 7.3.

A further factor to consider is the effect of projected climate change on, not only future fire weather, but potential bird responses to fire and climate change. There is a gradient of increasing aridity from south to north within the MDD bioregion, and projections currently predict that semi-arid climates will shift southwards (CSIRO and Bureau of Meteorology 2021). What this means is that, by 2050, the arable southern MDD will be hotter and drier like the northern MDD, while the northern MDD will become more arid like the deserts toward the interior (Clarke et al 2021). Some Mallee birds may respond to the dryness and heat by shifting their range further south. However, the southern areas of the MDD and adjoining Naracoorte Coastal Plain and Victorian Midland bioregions have undergone high levels of loss and fragmentation of native vegetation. Consequently, there is very little suitable mallee habitat remaining for the birds to move toward. The capability of Mallee Birds to respond to climate change through dispersal southward is severely constrained.

In conclusion, cumulative fire impacts over the past 20 to 40 years shows that a reasonable proportion of mallee habitats may be rendered unsuitable for Mallee Birds by returning sites to early seral stages that are not preferred by several mallee birds that require mid to late stage fire succession mallee. Fire return intervals for the Murray Mallee are at least 35 years (Watson et al. 2012), which is sufficient time to allow recovery of some habitat features such as understorey development. However, while some parts of the landscape are recovering from past fires, other areas will continue to be burnt and rendered potentially unsuitable habitat by new fires, as indicated by the variable nature of fires across the MDD over the past 40 years.

#### *Loss of integrity due to pest animals.*

Several pest animals impact on biodiversity throughout the MDD bioregion, including predators, herbivores and competitive pest birds, as described in [Table 4.1 Summary of Threats](#). All these pest species have some impact upon mallee habitats and potentially the mallee bird assemblage, notably species identified as threatened mallee birds (DEH 2009b; DENR 2011; Mallee CMA 2012; Parks Victoria 2019).

Foxes and feral cats are widespread throughout Australia and are estimated to kill a substantial number of native animals (Woinarski et al. 2017a). In a typical year of average rainfall within the MDD bioregion, cats are estimated to kill 46.9 birds per km<sup>2</sup> per year. While foxes kill 35.3 birds per km<sup>2</sup> per year. The estimate for cats includes predation by both feral and pet cats. Several factors make cats one of the major pest animals affecting Mallee Bird species: they are very efficient hunters, they can climb into tree canopies where birds shelter and nest, and their impacts are relatively greater in more open, arid to semi-arid environments, such as mallee systems. Mallee Birds therefore may be more vulnerable to cat predation than other temperate woodland bird communities.

Modelling of cat predation records against bird traits suggests the birds most likely to be killed by cats are species that nest and forage on the ground, have an intermediate body mass (60–300 g); and occupy mostly open habitats such as shrublands and woodlands (Woinarski et al. 2017b). It is a given that mallee habitats generally comprise open woodlands and shrublands, though certain understoreys below the mallee canopy may locally vary in density. Most Mallee Bird species tend to be of a size ([Table 7.4](#)) that is favoured by cats. In addition, foxes limit the abundance of the largest bird in the community, the Malleefowl, causing mortalities at all stages of the bird's life cycle (Benshemesh 2007).

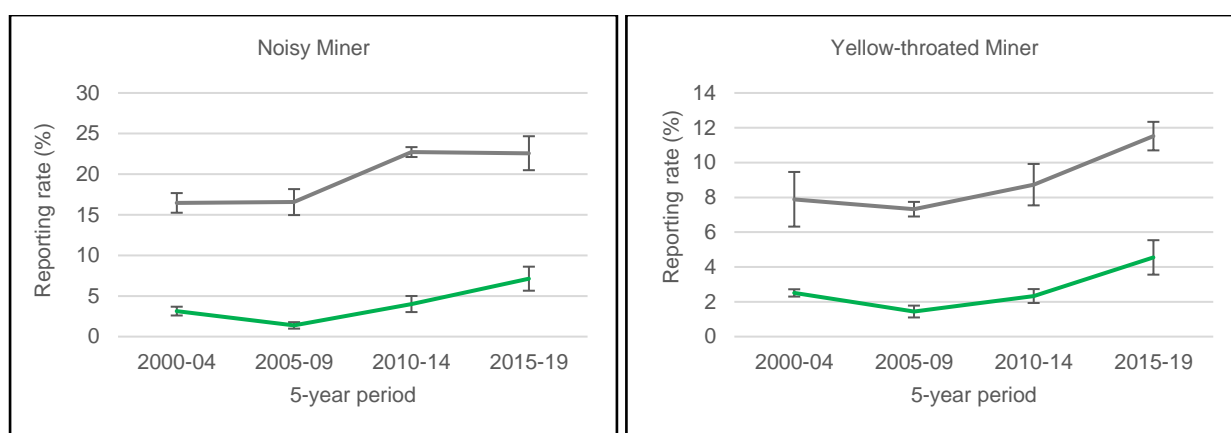
Native miner species are known to impact on woodland bird communities by aggressively and competitively excluding smaller native birds (Clarke and Grey 2010; Kutt et al. 2016). The Noisy Miner occurs at the western edge of its natural range in the MDD bioregion and is not considered to be a significant issue for mallee habitats. However, the Yellow-throated Miner extends from the eastern rangelands, including the MDD bioregion, inland into the arid zone (Morcombe 2003) and is known to interact with mallee birds. The reporting rates for both miner species show they are more prevalent outside of intact mallee areas, and appear to have increased slightly during 2000 to 2019 ([Figure 7.7A](#)). These increases are apparent both within mallee Key Biodiversity Areas and outside mallee KBAs. Comparisons within NRM regions

showed that Noisy Miners only increased in abundance within the Victorian Mallee, with a sharp rise after 2005 ([Figure 7.7B](#)). This is in the easternmost part of the MDD, where much of the natural landscape is now highly fragmented and abuts bioregions where Noisy Miners are more active in non-mallee woodlands. There were no major or consistent trends in the abundance of Yellow-throated Miners among NRM regions during the period, though there was a gradient of high to low miner abundance from the northernmost (NSW Western) to southernmost (Victorian Wimmera) NRM regions ([Figure 7.7B](#)).

The key conclusion is that the Miner species are mainly an issue in the modified and highly fragmented landscapes outside of intact and extensive mallee landscapes and that they appear to be increasing slightly in abundance across MDD landscapes. Apart from the hybridisation issue between Yellow-throated and Black-eared Miners, which is limited to those species, the main concern is the potential impact of miner colonies on the recovery of mallee bird populations in the modified areas of the MDD bioregion, where miners are more prevalent.

**Figure 7.7.** Reporting rates (RR,%) of two native miner species within the MDD region over 5-year intervals between 2000 to 2019.

**7.7A)** Comparison of miner reporting rates within, and outside of, mallee Key Biodiversity Areas.

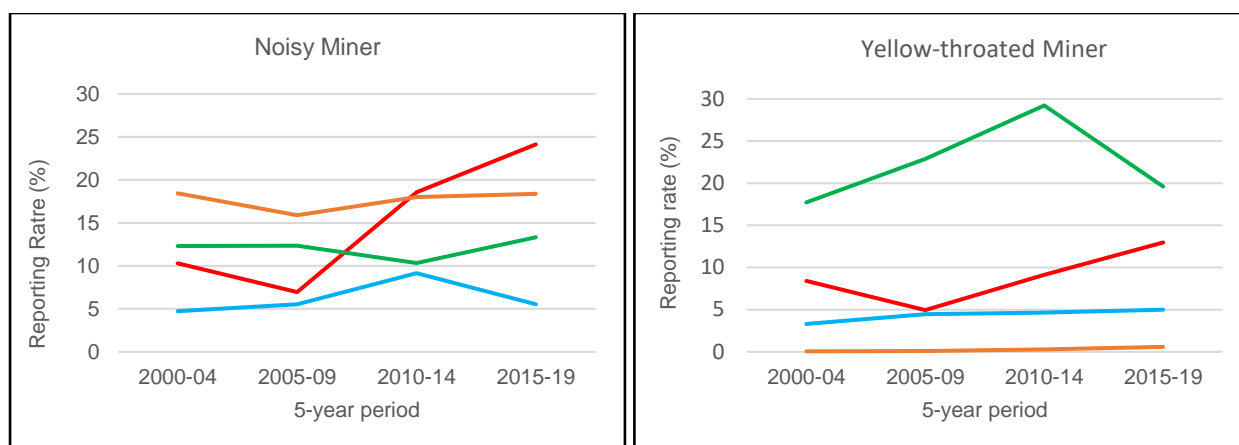


Source: Birddata, Birdlife Australia, accessed May 2021. Reporting rates were based on bird observations from all standardised 2ha 20 minute and 500 metre area searches undertaken in the area of interest during 2000 to 2019. Refer to *Source/Legend* for [Figure 6.8](#) for further detail.

**Legend:** Green = observations within mallee Key Biodiversity Areas (KBAs). This is representative of the remaining extensive intact areas of mallee vegetation.

Grey = observations outside of KBAs within the polygon. This is representative of fragmented and less extensive mallee, and non-mallee remnants.

## 7.7B) Miner reporting rates by NRM region within the MDD area of interest.



Source: Birddata, Birdlife Australia, accessed January 2021. Reporting rates were based on bird observations from all standardised 2ha 20 minute and 500 metre area searches undertaken within each NRM region during 2000 to 2019.

Legend to NRM agencies:

Blue = SA Murray Darling Basin (now Murraylands and Riverland Landscape Board, SA).

Red = Mallee Catchment Management Authority (Victoria)

Orange = Wimmera Catchment Management Authority (Victoria)

Green = Western Local Land Services (NSW, south of Menindee)

### Loss of integrity due to grazing pressure.

This section considers total grazing pressure - the combined grazing impacts from domestic stock, feral herbivores such as rabbits and goats and native herbivores such as kangaroos that are present in the MDD bioregion. The impacts of total grazing pressure on remnant natural vegetation across the MDD bioregion region are considerable: livestock grazing in rangelands, alone, affects the structure, function and composition of vegetation with particularly detrimental impacts on plant biomass (Eldridge et al 2016), and noting that total grazing impacts are not confined to livestock and affect lands of all land tenures, including conservation reserves (Prowse et al. 2019). A landscape-scale analysis across southern SA showed that the proportion of heavily/severely grazed vegetation over the decade prior to 2016 increased in the southern SA Murray Darling Basin region (Prowse et al 2019). By 2016, about 46 to 54% of vegetation in these regions was heavily to severely grazed (Prowse et al. 2019). This pattern was more pronounced for protected tenures in the SA Murray Darling Basin region and reflects the ongoing impact of introduced and unmanaged native herbivores, notably kangaroos, in reserves. Kangaroos have the capacity to boom in numbers under good conditions if left unmanaged. Plant families that represent important habitat components (e.g. Myrtaceae and Poaceae) also showed trends of generally increasing grazing pressures in the regions noted above. These findings are important because protected conservation lands and areas where critical plant habitat resources remain are where many threatened mallee birds are most likely to persist.

Similar issues are likely to apply to the Victorian and NSW extents of the Mallee Birds distribution, which were outside the scope of Prowse et al.'s (2019) study. The Victorian mallee region is essentially similar in fragmentation and land use as the southern SA Murray Darling Basin but the northern region is relatively less fragmented with pastoral and rangeland being more prominent land uses. The impacts of rangeland land uses are likely to have similar deleterious impacts on native mallee vegetation to those noted by Prowse et al. (2019).

A preliminary risk assessment for the southern agricultural zone of SA, within the MDD bioregion, rated the actions of introduced herbivores as having a major impact on populations of seven threatened mallee bird species: the Mallee Western Whipbird, Red-lored Whistler, Malleefowl, Crested Bellbird, Striated Grasswren, Southern Scrub-robin and Chestnut Quail-thrush (DENR 2011). This risk assessment likely also applies to adjacent agricultural zones in north-western Victoria. Malleefowl, for instance, are highly sensitive to sheep grazing and their

breeding densities have declined by at least 85% in areas grazed by sheep (Benshemesh 2007).

The impacts of herbivores may be more severe when they interact with fire. Grazing exerts pressure on the regeneration of plant species after fire by browsing on seedlings or tender regrowth and can limit the regeneration of key resource species for Mallee Birds, such as *Triodia* species (spinifex) (Clarke et al. 2021). Herbivores may be attracted by the fresh browse and more open areas after fire, leading to congregation at higher densities and more intense grazing impacts in smaller burnt areas. The impacts to regeneration may also be exacerbated when fires occur during drought and post-fire recruitment is already limited by low rainfall.

### *Conclusion*

The four factors considered here all interact. Driscoll et al.'s (2021) review of fire and fragmentation identified three main ways by which these two drivers and threats may interact:

- Fire influences fragmentation by destroying habitats or creating and connecting new areas;
- Fragmentation influences fire by suppressing it, limiting its spread or affecting flammability and ignition sources.
- The two factors do not influence each other but still affect species responses.

Of these, most of the case studies reviewed fell into the first category of fire influencing fragmentation.

The patterns of fire and fragmentation presented here for mallee in the MDD show both the first and second kinds of fire-fragmentation interactions. With regard to fire influencing fragmentation: the NCAS data on transitions to non-woody vegetation plus data on cumulative fire impacts across the MDD over recent decades points to a sequential transition of state within larger remnants. What appear to be intact larger remnants may well be a mosaic of increasingly unsuitable habitats for components of the Mallee Birds assemblage. In effect, cumulative fires are turning the large mallee conservation areas into a patchwork of separate fragments, as far as the Mallee Birds are concerned. The major differences between the fragmentations in conservation areas versus those in the surrounding matrix of altered land uses are: cause (land clearing in the latter, fire for the former); and permanence leading to recovery potential (land clearing for agriculture constitutes a permanent change while burnt areas in conservation areas are able to recover given time and opportunity, in the form of appropriate fire intervals).

With regard to fragmentation influencing fire, this is evident from the pattern of fires in smaller mallee remnants across the landscape. More smaller mallee remnants are burnt and a higher proportion are burnt entirely by single fire events. While these may not add up to a large total extent of mallee by area, their small size belies their importance as connections between remnants in the mallee landscape; i.e. they influence dispersal and mobility of bird species between suitable habitats.

The threats of pest animals and total grazing also interact with each other, with fire and fragmentation though these may not have been quantified for the MDD. For instance, it is reasonable to presume that fires could enhance predation of birds by cats since cat impacts are greater in more open vegetation (Woinarski et al. 2017a) and fires lead to more open understorey. This could lead to greater activity by feral cats in areas that are in, or adjacent to, burnt sites. Intense fires would also kill some of the cat population, as happens for native birds, but this may be temporary if cat populations recolonise from nearby areas. Grazing pressure may modify the fuel load and understorey cover of patches, leading to potentially less extensive and severe fires. These all point to the complexity of potential interactions on top of known impacts by these factors.

Loss of ecological integrity for the Mallee Bird Community and its mallee habitats cannot be properly considered in isolation of losses due to other criteria. The loss of ecological integrity should be considered additional to other known losses. For instance,

- mallee vegetation has already declined by 42% within the MDD bioregion, representing permanent loss of prime Mallee Bird habitats over a large part of the region (Criterion 1);

- 91% of the remaining extent occurs as larger patches over 1000 ha in size, leaving 9% as smaller remnants potentially vulnerable to catastrophic losses.
- About 37% of the extent of these larger remnants were impacted by fires during the past 40 years, with about 8% of patches being entirely burnt.
- About 461,000 ha occur as smaller remnants scattered over a broad area, mostly in the southern MDD, with about 28% of patches being impacted by fires during the past 40 years and about 10% being entirely burnt.
- About 39% of woody vegetation across the MDD, some of it in existing extensive mallee conservation areas, has deteriorated in canopy cover to a sparse or non-woody state. This is indicative of a serious transition towards less suitable mallee habitat for the Mallee Birds.
- The unsuitability of fragmented areas for Mallee Birds is demonstrated by the consistently lower reporting rates of most component bird species outside of Key Biodiversity Areas, i.e. in former habitat outside of the current extensive mallee conservation areas. Some species have declined even within KBAs. The unsuitability of recently burnt sites for Mallee Birds is evident from the known requirements for many of the species for mid to late stage mallee seral stages.
- Regardless of fire and fragmentation cats and foxes together kill about 82 birds per km<sup>2</sup> per year in the MDD. If the current extent of mallee in patches >1000 ha is taken to be 52,000 km<sup>2</sup>, then this equates to the loss of 4.26 million native birds of all species. Note this is prime Mallee Bird habitat and at least some of the more common component species will likely be predated.

All this information needs to be considered holistically to evaluate the degree of reduction in community integrity across most of the range of the Mallee Bird Community. These impacts have happened in the past, recently over the last 20-40 years, and are ongoing with management intervention needed to restore community integrity. The Committee considers the Mallee Bird Community has undergone a severe reduction in its ecological integrity. The ecological community is therefore eligible for listing as **Endangered**.

### 7.2.5. Criterion 5 - Rate of continuing detrimental change

Category	Critically endangered	Endangered	Vulnerable
Its rate of continuing detrimental change is: as indicated by a) degradation of the community or its habitat, or disruption of important community processes, that is: or b) intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:	very severe	severe	substantial
5.1 An observed, estimated, inferred or suspected <i>detrimental change</i> over the <i>immediate</i> <sup>#</sup> past or projected for the <i>immediate</i> future of at least:	80%	50%	30%

<sup>#</sup>The immediate timeframe refers to 10 years, or 3 generations of any long-lived or key species believed to play a major role in sustaining the community, whichever is the longer, up to a maximum of 60 years.

#### Eligibility for listing under Criterion 5: Endangered

##### Evidence:

This criterion considers recent past or projected trends in the abundance of Mallee Bird species and their habitats. Information about past declines, of mallee habitats and geographic distribution of the bird community, over the long term is presented against Criterion 1. Systematic information about recent past losses in mallee habitats is not available, other than fire history data, which is more appropriately considered under Criterion 4. However, a rate of change in bird abundances can be determined from reporting rates of bird species, as detailed in databases and reports compiled, for instance, by Birdlife Australia.

The Eastern Mallee Woodland Trends report (Birdlife Australia 2015a) identified generally negative trends in reporting rates for mallee bird species during 1999-2013 ([Table 7.9](#)).

**Table 7.9.** Broad trends in bird reporting rates from systematic bird surveys 1999-2013.

Common name	1999-2013	2001-06	2006-13
Black-eared Miner	Negative	Negative	
Chestnut Quail-thrush	Negative	Negative	Positive
Crested Bellbird	Negative	Negative	Positive
Grey-fronted Honeyeater	No trends noted		
Jacky Winter	Negative	Negative	Positive
Mallee Emu-wren	No trends noted		
Malleefowl	No trends noted		
Purple-gaped Honeyeater	No trends noted		
Red-lored Whistler	No trends noted		
Regent Parrot	No trends noted		
Scarlet-chested Parrot	No trends noted		
Shy Heathwren	Negative	Negative	
Southern Scrub-robin	Negative	Negative	
Splendid Fairy-wren	Negative	Negative	
Spotted Pardalote	Negative	Negative	Negative
Striated Grasswren	No trends noted		
Mallee Western Whipbird	No trends noted		
White-eared Honeyeater	Negative	Negative	
White-fronted Honeyeater	No trends noted		
Yellow-plumed Honeyeater	Negative	Negative	

Source: Birdlife Australia (2015a)

This decline mostly related to the period, 2001-2006, which coincided with the onset of the Millennium drought, although some species continued the decline trend for the full period until 2013, which is several years after the drought ended. However, the report did not include all species in the Mallee Bird assemblage and only indicated general trends without reference to the thresholds required for this criterion.

The rate of detrimental change over the immediate past is demonstrated more conclusively by a comprehensive analysis of Birddata, using bird observations from all standardised 2ha 20 minute and 500 metre area searches undertaken in the area of interest during 2000 to 2019. Trends in bird reporting rates for component Mallee Bird species were analysed over the 20-year period between 2000 to 2019 and comparisons made between reporting rates in relatively more intact, extensive mallee landscapes identified as Key Biodiversity Areas (KBAs) and fragmented, less extensive areas of mallee outside of KBAs. Despite variability in reporting rates among different species and over time, some trends were apparent ([Figure 7.8](#)).

- Average reporting rates were generally lower in areas outside of intact KBAs for many Mallee Bird species. This applies to all six Mallee specialist species and several Mallee dependent species.
- Trends over time in reporting rates were not always the same within KBAs as for areas outside of KBAs. Most Mallee specialist birds showed consistent declines in areas outside of KBAs, where reporting rates were very low to begin with. Two specialist species, the Chestnut Quail-thrush and Striated Grasswren also showed consistent declines within intact mallee KBAs.
- Consistent declines over the period were less evident for Mallee dependent birds. Two species, the Shy Heathwren and Southern Scrub-robin, declined within intact KBAs. However, the variability of the data indicates the declines may not be significant.
- Mallee dependent birds did not decline consistently over the 20 period in areas outside of KBAs despite many species maintaining lower reporting rates.
- One concern is that, during the period, many Mallee specialist birds appear to have disappeared from the broader landscapes where mallee is less intact. Mallee dependent bird species have not disappeared from this landscape, but several species have declined from being relatively common birds (reporting rates of 15-20% or more) to a less common status (reporting rates of under 5-10%).
- Comparisons of relative change in reporting rates during 2010 to 2019 between intact and less intact mallee areas showed that reporting rates had reduced, on average, by more than 80% for seven bird species; by more than 50% for thirteen bird species and by more than 30% for sixteen bird species ([Figure 7.4](#)). These trends can be ascribed to land use changes (e.g. clearing) that were operating well before 2010; nevertheless, the legacy of these changes continues and remains relevant to the present day.

The period 2000 to 2019 included years of drought (Millennium drought from around 2006-09), a high-rainfall La Nina event that broke the drought in 2010-11 and another intense drought in 2018-19. Connell et al. (2021) examined the impact of climate extremes on bird abundances and their response to time since fire in the Murray Mallee during 2006-15. They observed many bird species responded positively to the La Nina rainfall event though some species, notably threatened mallee birds such as the Red-lored Whistler, continued to decline again after the La Nina rainfall period. Such ongoing declines in some Mallee Bird species are evident from [Figure 7.8](#). Climatic extremes may influence what resources are available for mallee birds at sites of different fire age, hence their variable responses to time since fire. Many bird species, however, continued to show preference for mid to late stage post-fire mallee vegetation across all climatic periods.

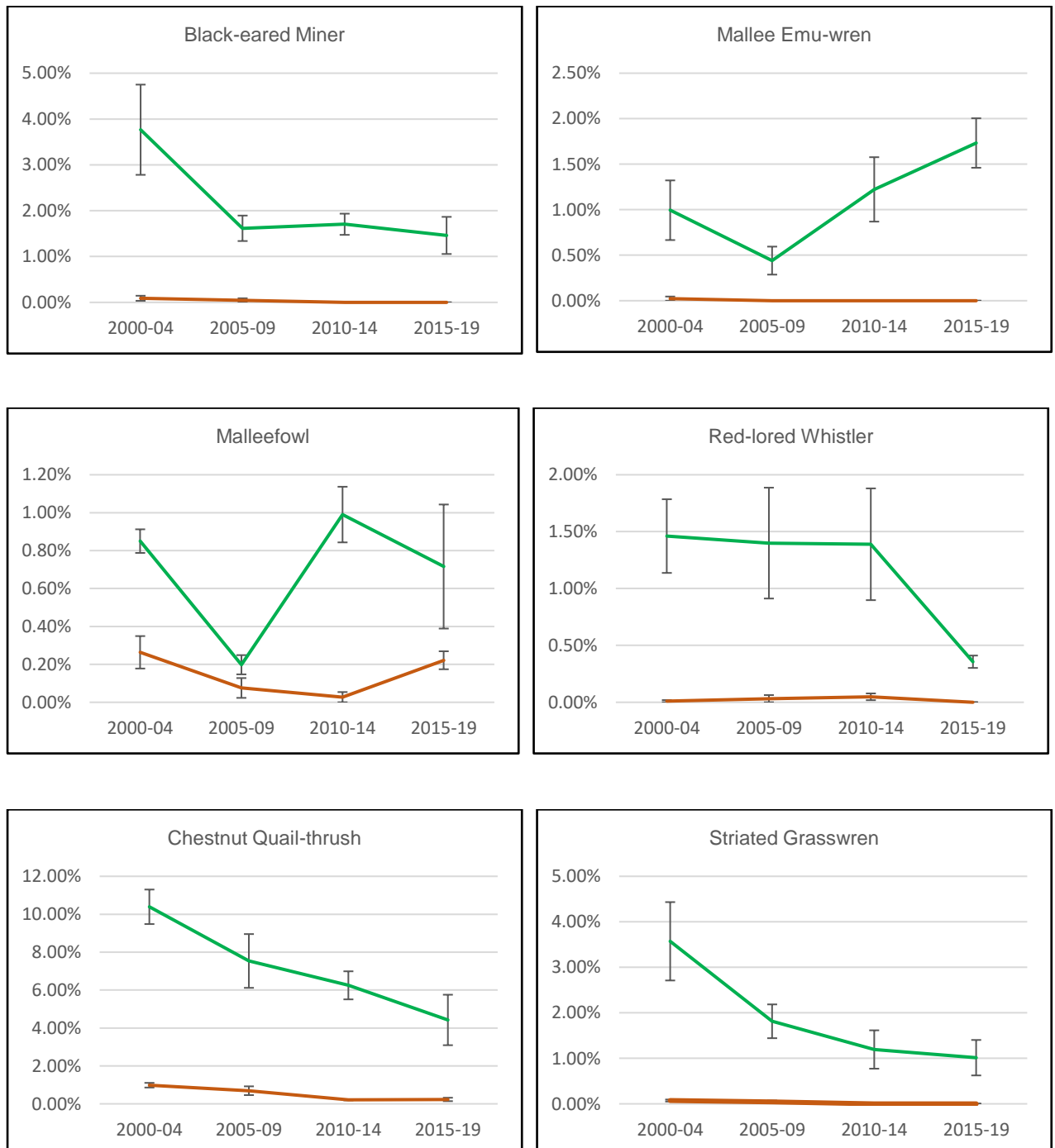
In conclusion, data on reporting rates for Mallee Birds indicates that 7 out of 20 species have shown a very severe (>80%) decline and most species (13 out of 20 bird species) have shown at least a severe (>50%) reduction in abundance spatially, over major parts of their range outside of the KBAs. Furthermore, 16 out of 20 species showed at least a



severe/substantial (30%) decline within KBAs. Also, of major concern is that some Mallee specialists such as the Red-lored Whistler and Chestnut Quail-thrush have shown trends of reduced abundance over the immediate past, i.e. the decade from 2010-2019. The Committee therefore considers that the Mallee Birds is **eligible** for listing as **Endangered** against this criterion.

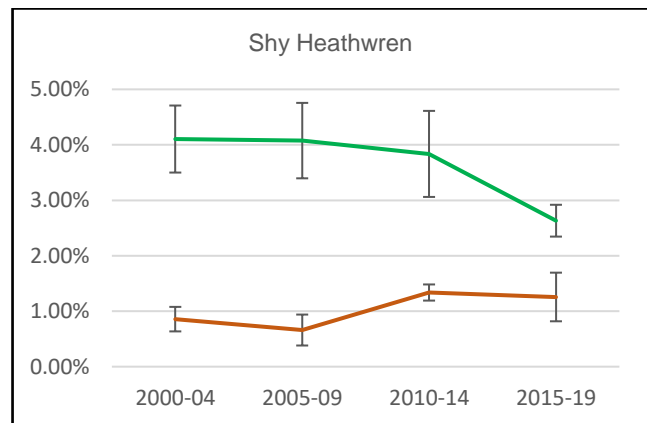
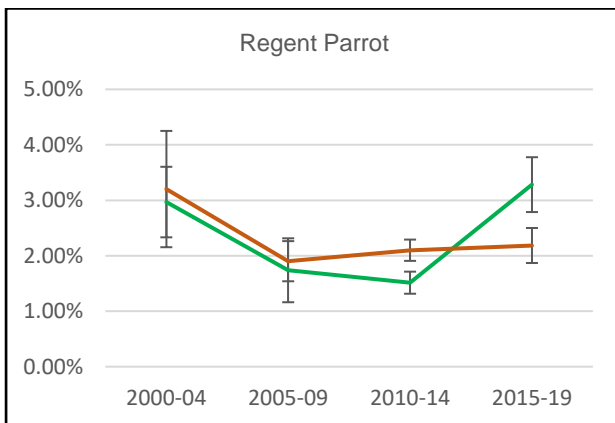
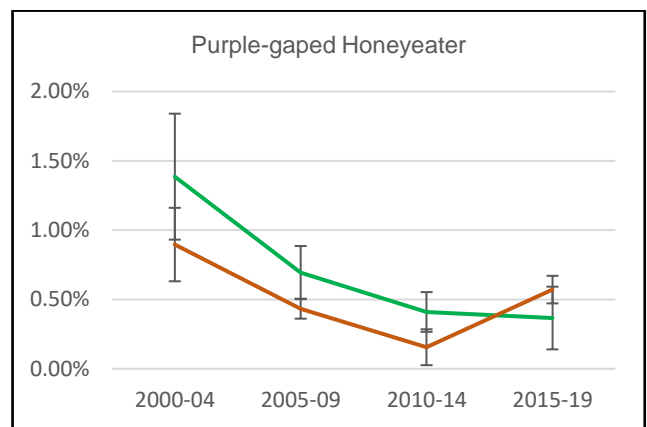
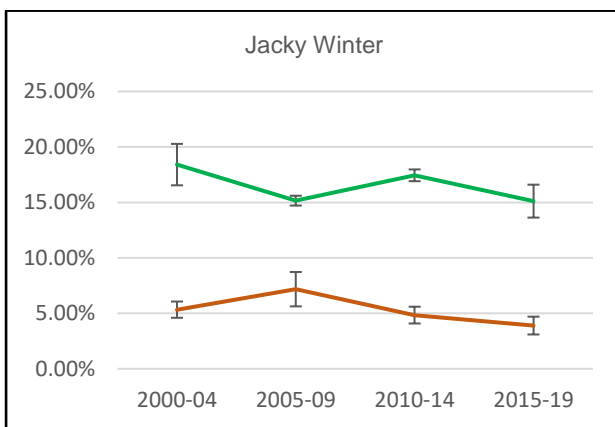
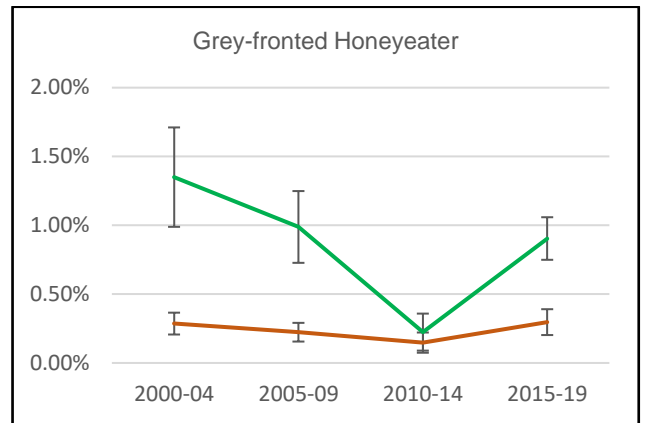
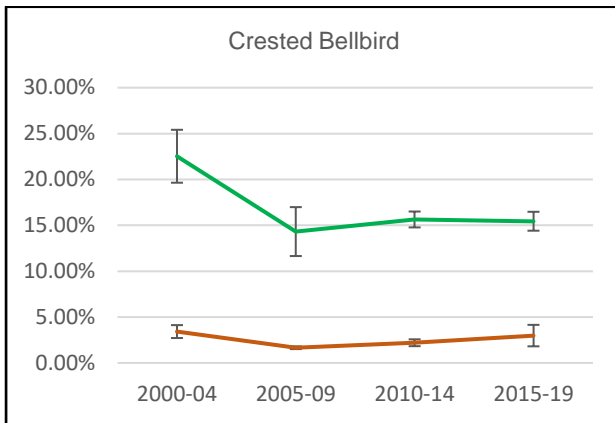
**Figure 7.8.** Trends in reporting rates (%) for component species of the Mallee Bird Community. Data show mean and standard errors of annual reporting rates for each five-year interval. Lines compare observations in relatively intact mallee landscapes (green) and landscapes where mallee is fragmented and less intact (orange). Refer to Legend for more detail.

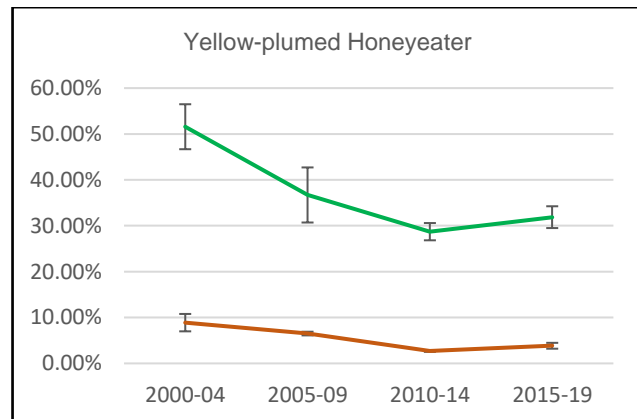
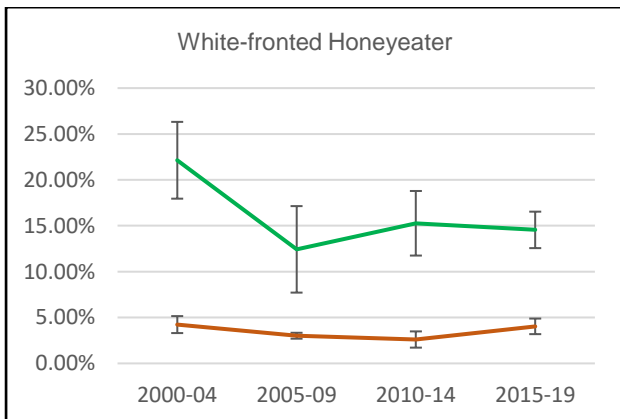
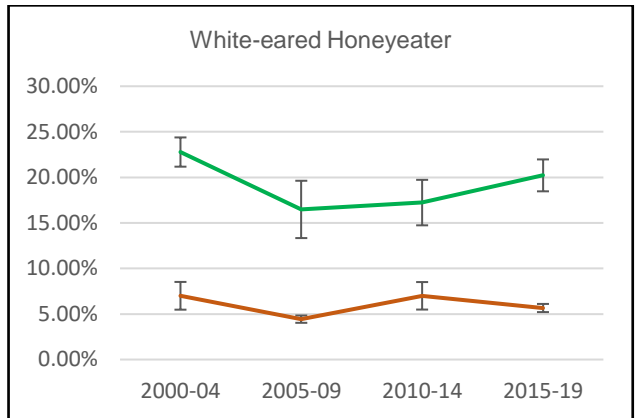
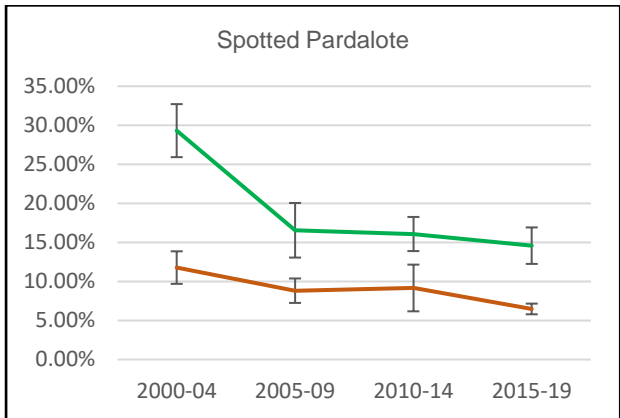
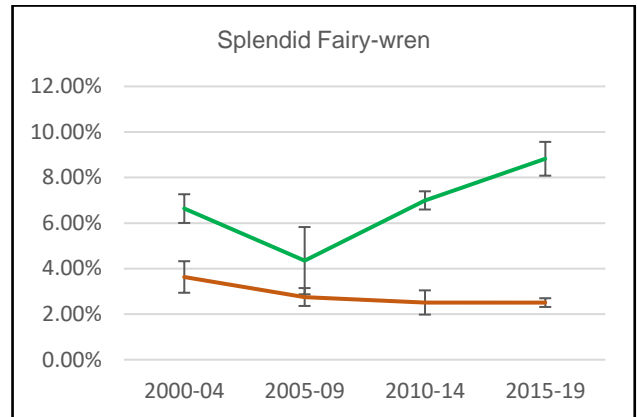
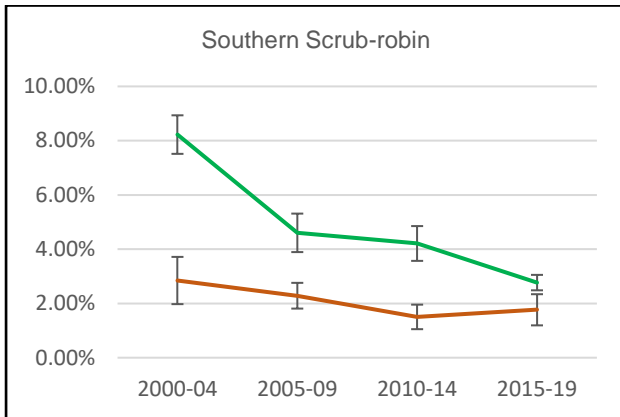
*Mallee specialist bird species*



The Scarlet-chested Parrot and Mallee Western Whipbird are not shown because there were too few observations of these bird species over the 20-year period.

*Mallee dependent bird species*





Source: Birddata, Birdlife Australia, accessed May 2021. Reporting rates were based on bird observations from all standardised 2ha 20 minute and 500 metre area searches undertaken in the area of interest during 2000 to 2019.

Records were collated from within a polygon bounded by: Menindee to the north; top end of the Grampians to the south; Mount Barker to the west; Swan Hill to the east; and configured to include the Central NSW Mallee KBA in NSW and exclude the Coorong and lakes KBA in SA. This polygon covers the main extent of mallee and the MDD bioregion.

**Green line:** Reporting rates for bird observations within mallee Key Biodiversity Areas (KBAs). This is representative of the remaining extensive intact areas of mallee vegetation. The number of surveys collated within KBAs is 18,600.

**Orange line:** Reporting rate for bird observations outside of KBAs within the polygon. This is representative of fragmented and less extensive mallee remnants. The number of surveys collated from this area is 20,100.

7.2.6. Criterion 6 - Quantitative analysis showing probability of extinction			
Category	Critically endangered	Endangered	Vulnerable
A quantitative analysis shows that its probability of extinction, or extreme degradation over all of its geographic distribution, is:	at least 50% in the immediate future.	at least 20% in the near future.	at least 10% in the medium-term future.

### Insufficient data to determine eligibility under Criterion 6.

Quantitative analysis of the probability of extinction or extreme degradation over all its geographic distribution has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the ecological community for listing in any category under this criterion.

### 7.3 Public consultation

Notice of the proposed listing and a consultation document was made available for public comment for a minimum of 30 business days between 15 July and 28 August 2020. Any comments received that were relevant to the assessment of the ecological community were considered by the Committee as part of the assessment process.

### 7.4 Listing and Recovery Plan Recommendations

The Threatened Species Scientific Committee recommends:

(i) that the list referred to in section 178 of the EPBC Act be amended by **including** the Mallee Bird Community of the Murray Darling Depression Bioregion in the list in the **Endangered** category.

AND

(ii) that there not be a recovery plan for this ecological community at this time.

The main threats to the ecological community and the priority actions required to address them are largely understood. The primary conservation need of this threatened ecological community is the ongoing management and protection of the species assemblage and its remaining habitats. The Conservation Advice provides sufficient information to guide this activity along with other management documents for the conservation and recovery of individual bird species.

Therefore, listing under national environment law, provision of the information contained within this Conservation Advice and implementation of the priority conservation actions are sufficient to guide protection and recovery of this ecological community.

## APPENDIX A – SPECIES LISTS

Scientific names are nationally accepted names as per the Australian Faunal Directory (AFD 2021) at the time of writing. Additional information on bird species are available through the Atlas of Living Australia.

**Table A1.** Terrestrial bird species observed from the Murray Darling Depression bioregion. Reporting rates indicative of relative abundance are compared for intact mallee Key Biodiversity Areas with areas outside of Key Biodiversity Areas in the MDD bioregion. Data show average reporting rates for the period 2010-2019.

**Mallee Birds – Specialist** - members of the Mallee Bird Community.

Common Name	Scientific Name	In KBAs	Outside KBAs
Black-eared Miner	<i>Manorina melanotis</i>	1.58	0.00
Chestnut Quail-thrush	<i>Cinclosoma castanotum</i>	5.34	0.22
Mallee Emu-wren	<i>Stipiturus mallee</i>	1.48	0.00
Malleefowl	<i>Leipoa ocellata</i>	0.85	0.12
Red-lored Whistler	<i>Pachycephala rufogularis</i>	0.87	0.02
Scarlet-chested Parrot	<i>Neophema splendida</i>	0.20	0.01
Striated Grasswren	<i>Amytornis striatus</i>	1.10	0.00
Mallee Western Whipbird	<i>Psophodes leucogaster</i> syn. <i>P. nigrogularis</i>	0.01	0.00

**Mallee Birds – Dependent** - members of the Mallee Bird Community.

Common Name	Scientific Name	In KBAs	Outside KBAs
Crested Bellbird	<i>Oreica gutturalis</i>	15.54	2.59
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>	0.56	0.20
Jacky Winter	<i>Microeca fascinans</i>	16.28	4.37
Purple-gaped Honeyeater	<i>Lichenostomus cratitius</i>	0.39	0.31
Regent Parrot	<i>Polytelis anthopeplus</i>	2.40	2.14
Shy Heathwren	<i>Hylacola cauta</i> syn. <i>Calamanthus cautus</i>	3.23	1.30
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	3.49	1.63
Splendid Fairy-wren	<i>Malurus splendens</i>	7.91	2.51
Spotted Pardalote	<i>Pardalotus punctatus</i>	15.33	7.82
White-eared Honeyeater	<i>Nesoptilotis leucotis</i>	18.72	6.33
White-fronted Honeyeater	<i>Pumella albifrons</i>	14.91	3.32
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>	30.29	3.27

**Mallee Birds – Associated** - not formally part of the Mallee Bird Community but may be indicative of its likely presence.

Common Name	Scientific Name	In KBAs	Outside KBAs
Australian Ringneck	<i>Barnardius zonarius</i>	14.09	12.06
Blue Bonnet	<i>Northiella haematogaster</i>	2.17	8.17
Brown Treecreeper	<i>Climacteris picumnus</i>	7.39	18.98
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	9.94	7.14
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	24.16	8.18
Gilbert's Whistler	<i>Pachycephala inornata</i>	3.55	1.49
Inland Thornbill	<i>Acanthiza apicalis</i>	7.85	1.98
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	2.68	1.32
Mulga Parrot	<i>Psephotus varius</i>	8.09	3.75
Red-capped Robin	<i>Petroica goodenovii</i>	12.58	6.51
Slender-billed Thornbill	<i>Acanthiza iredalei</i>	0.65	0.05
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	30.49	22.93
Spotted Nightjar	<i>Eurostopodus argus</i>	0.43	0.13
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>	8.17	3.81
Weebill	<i>Smicromnis brevirostris</i>	42.00	23.64
White-browed Treecreeper	<i>Climacteris affinis</i>	1.44	0.83

## Other Terrestrial Birds

Common Name	Scientific Name	In KBAs	Outside KBAs
Apostlebird	<i>Struthidea cinerea</i>	2.55	3.91
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	1.94	1.81
Australian Reed-Warbler	<i>Acrocephalus australis</i>	0.48	7.46
Azure Kingfisher	<i>Ceyx azureus</i>	0.02	0.02
Banded Lapwing	<i>Vanellus tricolor</i>	0.18	0.34
Banded Whiteface	<i>Aphelocephala nigricincta</i>	0.01	0.00
Bar-shouldered Dove	<i>Geopelia humeralis</i>	0.66	0.23
Bassian Thrush	<i>Zoothera lunulata</i>	0.00	0.01
Black Honeyeater	<i>Sugomel niger</i>	0.62	0.71
Black-chinned Honeyeater	<i>Melithreptus gularis</i>	0.20	0.80
Black-eared Cuckoo	<i>Chalcites osculans</i>	1.00	0.55
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	5.40	11.15
Black-faced Woodswallow	<i>Artamus cinereus</i>	0.29	1.10
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	0.34	3.10
Blue-winged Parrot	<i>Neophema chrysostoma</i>	0.26	0.69
Brown Honeyeater	<i>Lichmera indistincta</i>	0.00	0.02
Brown Quail	<i>Synoicus ypsilophora</i>	0.05	0.43
Brown Songlark	<i>Cincloramphus cruralis</i>	0.31	1.51
Brown Thornbill	<i>Acanthiza pusilla</i>	0.27	2.19
Brush Bronzewing	<i>Phaps elegans</i>	0.05	0.28
Budgerigar	<i>Melopsittacus undulatus</i>	0.46	0.41
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	1.09	3.33
Bush Stone-curlew	<i>Burhinus grallarius</i>	0.03	0.08
Chestnut-crowned Babbler	<i>Pomatostomus ruficeps</i>	3.12	3.20
Chestnut-rumped Heathwren	<i>Hylacola pyrrhopygia</i>	0.04	0.28
Chirruping Wedgebill	<i>Psophodes cristatus</i>	0.00	0.10
Cockatiel	<i>Nymphicus hollandicus</i>	0.17	1.92
Common Bronzewing	<i>Phaps chalcoptera</i>	7.22	11.36
Crescent Honeyeater	<i>Phylidonyris pyrrhopterus</i>	0.00	0.04
Crested Shrike-tit	<i>Falcunculus frontatus</i>	0.02	0.39
Crimson Chat	<i>Epthianura tricolor</i>	0.28	0.65
Crimson Rosella	<i>Platycercus elegans</i>	4.19	21.49
Diamond Dove	<i>Geopelia cuneata</i>	0.14	0.12
Dollarbird	<i>Eurystomus orientalis</i>	0.00	0.02
Double-barred Finch	<i>Taeniopygia bichenovii</i>	0.02	0.06
Dusky Woodswallow	<i>Artamus cyanopterus</i>	1.23	4.81
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	0.02	0.28
Eastern Yellow Robin	<i>Eopsaltria australis</i>	0.46	1.39
Elegant Parrot	<i>Neophema elegans</i>	0.09	0.09
Emu	<i>Dromaius novaehollandiae</i>	5.05	3.02
Fairy Martin	<i>Petrochelidon ariel</i>	0.16	3.38
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	0.40	1.17
Flame Robin	<i>Petroica phoenicea</i>	0.04	0.04
Forest Raven	<i>Corvus tasmanicus</i>	0.00	0.45
Fork-tailed Swift	<i>Apus pacificus</i>	0.05	0.06
Fuscous Honeyeater	<i>Ptilotula fusca</i>	0.00	0.04
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	0.00	0.08
Golden Whistler	<i>Pachycephala pectoralis</i>	2.01	2.98
Golden-headed Cisticola	<i>Cisticola exilis</i>	0.01	0.11
Grey Currawong	<i>Strepera versicolor</i>	8.31	5.25
Grey Fantail	<i>Rhipidura fuliginosa</i>	3.72	10.55
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	19.62	23.85
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	0.37	1.02
Ground Cuckoo-shrike	<i>Coracina maxima</i>	0.02	0.05
Hooded Robin	<i>Melanodryas cucullata</i>	4.54	4.59
Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>	3.27	3.74

Common Name	Scientific Name	In KBAs	Outside KBAs
Horsfield's Bushlark	<i>Mirafrja javanica</i>	0.00	0.15
Little Button-quail	<i>Turnix velox</i>	0.09	0.20
Little Friarbird	<i>Philemon citreogularis</i>	0.65	2.99
Little Grassbird	<i>Poodytes gramineus</i>	0.19	5.26
Little Lorikeet	<i>Parvipsitta pusilla</i>	0.02	0.13
Little Wattlebird	<i>Anthochaera chrysoptera</i>	0.27	2.54
Little Woodswallow	<i>Artamus minor</i>	0.00	0.01
Long-billed Corella	<i>Cacatua tenuirostris</i>	0.66	8.11
Masked Lapwing	<i>Vanellus miles</i>	2.90	12.65
Masked Woodswallow	<i>Artamus personatus</i>	6.21	2.41
Mistletoebird	<i>Dicaeum hirundinaceum</i>	1.26	3.59
Musk Lorikeet	<i>Glossopsitta concinna</i>	0.49	8.91
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	2.86	15.29
Noisy Friarbird	<i>Philemon corniculatus</i>	0.24	0.25
Olive-backed Oriole	<i>Oriolus sagittatus</i>	0.05	0.13
Orange Chat	<i>Epthianura aurifrons</i>	0.09	0.51
Painted Button-quail	<i>Turnix varius</i>	0.09	0.27
Painted Honeyeater	<i>Grantiella picta</i>	0.00	0.06
Pallid Cuckoo	<i>Heteroscenes pallidus</i>	1.10	1.18
Peaceful Dove	<i>Geopelia placida</i>	2.26	9.50
Pied Honeyeater	<i>Certhionyx variegatus</i>	0.18	0.13
Plum-headed Finch	<i>Aidemosyne modesta</i>	0.00	0.01
Purple-crowned Lorikeet	<i>Parvipsitta porphyrocephala</i>	0.34	4.70
Rainbow Bee-eater	<i>Merops ornatus</i>	6.02	4.96
Red Wattlebird	<i>Anthochaera carunculata</i>	10.61	24.49
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>	0.24	0.44
Red-browed Finch	<i>Neochmia temporalis</i>	0.00	0.07
Red-chested Button-quail	<i>Turnix pyrrhotorax</i>	0.00	0.02
Red-rumped Parrot	<i>Psephotus haematonotus</i>	4.98	27.64
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>	0.00	0.34
Redthroat	<i>Pyrrholaemus brunneus</i>	0.16	0.62
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	0.00	0.01
Restless Flycatcher	<i>Myiagra inquieta</i>	1.83	5.09
Rufous Fieldwren	<i>Calamanthus campestris</i>	0.27	0.79
Rufous Songlark	<i>Cincloramphus mathewsi</i>	0.58	4.44
Rufous Whistler	<i>Pachycephala rufiventris</i>	11.04	11.15
Sacred Kingfisher	<i>Todiramphus sanctus</i>	1.12	3.83
Scarlet Robin	<i>Petroica boodang</i>	0.25	1.28
Shining Bronze-Cuckoo	<i>Chalcites lucidus</i>	0.05	0.36
Silvereye	<i>Zosterops lateralis</i>	1.37	6.14
Singing Honeyeater	<i>Gavicalis virescens</i>	4.29	19.29
Southern Whiteface	<i>Aphelocephala leucopsis</i>	4.73	5.51
Speckled Warbler	<i>Pyrrholaemus sagittatus</i>	0.21	0.25
Spotted Bowerbird	<i>Chlamydera maculata</i>	0.33	0.30
Striated Pardalote	<i>Pardalotus striatus</i>	24.15	27.31
Striated Thornbill	<i>Acanthiza lineata</i>	0.10	0.66
Stubble Quail	<i>Coturnix pectoralis</i>	0.07	0.32
Superb Fairy-wren	<i>Malurus cyaneus</i>	4.01	19.25
Superb Parrot	<i>Polytelis swainsonii</i>	0.00	0.02
Swift Parrot	<i>Lathamus discolor</i>	0.03	0.05
Tawny Frogmouth	<i>Podargus strigoides</i>	0.42	0.66
Tawny Grassbird	<i>Cincloramphus timoriensis</i>	0.00	0.01
Tawny-crowned Honeyeater	<i>Gliciphila melanops</i>	1.89	1.28
Tree Martin	<i>Petrochelidon nigricans</i>	3.20	11.78
Varied Sittella	<i>Daphoenositta chrysoptera</i>	1.85	1.77
Variegated Fairy-wren	<i>Malurus lamberti</i>	4.82	8.12
Welcome Swallow	<i>Hirundo neoxena</i>	3.64	29.50

Common Name	Scientific Name	In KBAs	Outside KBAs
Western Gerygone	<i>Gerygone fusca</i>	0.80	0.86
White-backed Swallow	<i>Cheramoeca leucosterna</i>	0.31	0.95
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>	0.02	0.08
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>	0.12	1.96
White-browed Babbler	<i>Pomatostomus superciliosus</i>	9.04	11.34
White-browed Scrubwren	<i>Sericornis frontalis</i>	0.02	0.68
White-browed Woodswallow	<i>Artamus superciliosus</i>	7.25	5.24
White-fronted Chat	<i>Epthianura albifrons</i>	1.60	4.17
White-naped Honeyeater	<i>Melithreptus lunatus</i>	0.08	0.85
White-plumed Honeyeater	<i>Ptilotula penicillata</i>	4.80	32.79
White-throated Treecreeper	<i>Cormobates leucophaea</i>	0.21	3.33
White-winged Chough	<i>Corcorax melanorhampus</i>	5.71	10.41
White-winged Fairy-wren	<i>Malurus leucopterus</i>	0.98	5.35
White-winged Triller	<i>Lalage tricolor</i>	1.67	2.26
Yellow Thornbill	<i>Acanthiza nana</i>	2.24	6.70
Yellow-faced Honeyeater	<i>Caligavis chrysops</i>	0.40	2.79
Yellow-tailed Black-Cockatoo	<i>Zanda funerea</i>	0.24	1.14
Yellow-throated Miner	<i>Manorina flavigula</i>	3.44	10.13
Yellow-tufted Honeyeater	<i>Lichenostomus melanops</i>	0.00	0.01
Zebra Finch	<i>Taeniopygia guttata</i>	0.06	1.16

**Table A2.** Non-terrestrial bird species observed from the Murray Darling Depression bioregion. Reporting rates indicative of relative abundance are compared for intact mallee Key Biodiversity Areas with areas outside of Key Biodiversity Areas in the MDD bioregion. Data show average reporting rates for the period 2010-2019.

These bird species are excluded from survey diagnostics.

#### Aquatic & Marine birds

Common Name	Scientific Name	In KBAs	Outside KBAs
Australasian Darter	<i>Anhinga novaehollandiae</i>	2.63	9.74
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	2.70	8.26
Australasian Pipit	<i>Anthus novaeseelandiae</i>	1.05	3.73
Australasian Shoveler	<i>Spatula rhynchotis</i>	1.04	2.65
Australian Gull-billed Tern	<i>Gelochelidon macrotarsa</i>	0.04	0.18
Australian Little Bittern	<i>Ixobrychus dubius</i>	0.00	0.02
Australian Painted Snipe	<i>Rostratula australis</i>	0.00	0.03
Australian Pelican	<i>Pelecanus conspicillatus</i>	3.77	13.36
Australian Pied Oystercatcher	<i>Haematopus longirostris</i>	0.02	0.00
Australian Pratincole	<i>Stiltia isabella</i>	0.00	0.03
Australian Shelduck	<i>Tadorna tadornoides</i>	1.81	8.04
Australian Spotted Crake	<i>Porzana fluminea</i>	0.04	1.20
Australian White Ibis	<i>Threskiornis moluccus</i>	1.13	7.34
Australian Wood Duck	<i>Chenonetta jubata</i>	2.85	16.29
Baillon's Crake	<i>Zapornia pusilla</i>	0.00	0.49
Banded Stilt	<i>Cladorhynchus leucocephalus</i>	0.11	0.21
Black Swan	<i>Cygnus atratus</i>	1.57	8.84
Black-fronted Dotterel	<i>Euseyornis melanops</i>	1.58	5.93
Black-tailed Godwit	<i>Limosa limosa</i>	0.00	0.01
Black-tailed Native-hen	<i>Tribonyx ventralis</i>	1.40	6.12
Blue-billed Duck	<i>Oxyura australis</i>	0.14	0.59
Brolga	<i>Antigone rubicunda</i>	0.04	0.08
Buff-banded Rail	<i>Hypotaenidia philippensis</i>	0.00	0.17
Caspian Tern	<i>Hydroprogne caspia</i>	0.35	3.19
Cattle Egret	<i>Bubulcus ibis</i>	0.00	0.02
Chestnut Teal	<i>Anas castanea</i>	0.44	1.63
Common Greenshank	<i>Tringa nebularia</i>	0.04	0.07



Common Name	Scientific Name	In KBAs	Outside KBAs
Common Sandpiper	<i>Actitis hypoleucos</i>	0.01	0.03
Crested Tern	<i>Thalasseus bergii</i>	0.00	0.04
Curlew Sandpiper	<i>Calidris ferruginea</i>	0.02	0.08
Double-banded Plover	<i>Charadrius bicinctus</i>	0.03	0.01
Dusky Moorhen	<i>Gallinula tenebrosa</i>	0.59	9.30
Eurasian Coot	<i>Fulica atra</i>	3.30	11.56
Freckled Duck	<i>Stictonetta naevosa</i>	0.13	0.42
Glossy Ibis	<i>Plegadis falcinellus</i>	0.00	0.39
Great Cormorant	<i>Phalacrocorax carbo</i>	1.99	7.73
Great Crested Grebe	<i>Podiceps cristatus</i>	1.08	0.66
Great Egret	<i>Ardea alba</i>	1.41	5.90
Grey Teal	<i>Anas gracilis</i>	5.43	15.13
Hardhead	<i>Aythya australis</i>	1.09	4.37
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	2.00	4.19
Intermediate Egret	<i>Ardea intermedia</i>	0.16	0.74
Latham's Snipe	<i>Gallinago hardwickii</i>	0.00	0.08
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	1.77	8.64
Little Egret	<i>Egretta garzetta</i>	0.23	0.22
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	2.24	9.14
Magpie Goose	<i>Anseranas semipalmata</i>	0.00	0.06
Marsh Sandpiper	<i>Tringa stagnatilis</i>	0.08	0.16
Musk Duck	<i>Biziura lobata</i>	0.53	1.66
Nankeen Night-Heron	<i>Nycticorax caledonicus</i>	0.13	1.26
Northern Mallard	<i>Anas platyrhynchos</i>	0.00	0.11
Pacific Black Duck	<i>Anas superciliosa</i>	3.01	18.75
Pectoral Sandpiper	<i>Calidris melanotos</i>	0.00	0.01
Pied Cormorant	<i>Phalacrocorax varius</i>	1.15	3.92
Pied Stilt	<i>Himantopus leucocephalus</i>	1.60	4.67
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	1.39	3.47
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>	0.00	0.15
Purple Swamphen	<i>Porphyrio porphyrio</i>	0.14	9.96
Red-capped Plover	<i>Charadrius ruficapillus</i>	0.34	1.18
Red-kneed Dotterel	<i>Erythronyx cinctus</i>	0.95	3.43
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	0.74	2.05
Red-necked Stint	<i>Calidris ruficollis</i>	0.10	0.23
Royal Spoonbill	<i>Platalea regia</i>	0.22	0.99
Ruddy Turnstone	<i>Arenaria interpres</i>	0.00	0.01
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	0.15	0.78
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	0.83	8.34
Spotless Crake	<i>Zapornia tabuensis</i>	0.00	0.37
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	0.38	3.66
Wandering Whistling-Duck	<i>Dendrocygna arcuata</i>	0.00	0.02
Whiskered Tern	<i>Chlidonias hybrida</i>	0.31	1.86
White-faced Heron	<i>Egretta novaehollandiae</i>	2.75	11.07
White-necked Heron	<i>Ardea pacifica</i>	0.77	3.81
White-winged Black Tern	<i>Chlidonias leucopterus</i>	0.00	0.03
Wood Sandpiper	<i>Tringa glareola</i>	0.00	0.08
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	1.37	4.32

### Birds of Prey

Common Name	Scientific Name	In KBAs	Outside KBAs
Australian Hobby	<i>Falco longipennis</i>	0.36	1.60
Black Falcon	<i>Falco subniger</i>	0.11	0.27
Black Kite	<i>Milvus migrans</i>	0.61	5.74
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	0.00	0.01
Black-shouldered Kite	<i>Elanus axillaris</i>	0.31	3.52
Brown Falcon	<i>Falco berigora</i>	2.00	4.26
Brown Goshawk	<i>Accipiter fasciatus</i>	0.83	1.39
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>	0.85	1.29
Eastern Barn Owl	<i>Tyto javanica</i>	0.24	0.62
Little Eagle	<i>Hieraaetus morphnoides</i>	0.39	1.62
Nankeen Kestrel	<i>Falco cenchroides</i>	2.39	8.70
Osprey	<i>Pandion haliaetus</i>	0.01	0.00
Peregrine Falcon	<i>Falco peregrinus</i>	0.17	1.06
Southern Boobook	<i>Ninox boobook</i>	1.18	2.32
Spotted Harrier	<i>Circus assimilis</i>	0.17	0.84
Square-tailed Kite	<i>Lophoictinia isura</i>	0.00	0.01
Swamp Harrier	<i>Circus approximans</i>	0.13	1.27
Wedge-tailed Eagle	<i>Aquila audax</i>	1.65	3.93
Whistling Kite	<i>Haliastur sphenurus</i>	4.51	17.72
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	0.32	0.32

### Common Birds (after Simmonds et al. 2019)

Common Name	Scientific Name	In KBAs	Outside KBAs
Australian Magpie	<i>Gymnorhina tibicen</i>	17.77	54.00
Australian Raven	<i>Corvus coronoides</i>	16.49	23.98
Crested Pigeon	<i>Ocyphaps lophotes</i>	6.41	35.89
Eastern Rosella	<i>Platycercus eximius</i>	1.57	13.67
Galah	<i>Eolophus roseicapilla</i>	14.60	42.70
Grey Butcherbird	<i>Cracticus torquatus</i>	25.05	10.13
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	3.24	13.93
Little Corella	<i>Cacatua sanguinea</i>	2.52	7.89
Little Crow	<i>Corvus bennetti</i>	0.98	0.73
Little Raven	<i>Corvus mellori</i>	1.80	12.91
Magpie-lark	<i>Grallina cyanoleuca</i>	6.07	28.91
Noisy Miner	<i>Manorina melanocephala</i>	5.57	22.65
Pied Butcherbird	<i>Cracticus nigrogularis</i>	3.61	11.94
Pied Currawong	<i>Strepera graculina</i>	0.06	0.27
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	0.11	3.98
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	4.15	11.15
Willie Wagtail	<i>Rhipidura leucophrys</i>	13.47	41.07
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	3.76	13.64

### Exotic Terrestrial Birds

Common Name	Scientific Name	In KBAs	Outside KBAs
Common Blackbird	<i>Turdus merula</i>	0.21	7.35
Common Greenfinch	<i>Chloris</i>	0.00	0.01
Common Myna	<i>Acridotheres tristis</i>	0.00	0.01
Common Starling	<i>Sturnus vulgaris</i>	0.96	17.71
Eurasian Skylark	<i>Alauda arvensis</i>	0.08	0.36
European Goldfinch	<i>Carduelis</i>	0.08	2.09
House Sparrow	<i>Passer domesticus</i>	0.64	14.18
Rock Dove	<i>Columba livia</i>	0.04	4.63
Spotted Dove	<i>Spilopelia chinensis</i>	0.00	0.54

**Table A3.** Number of bird surveys compiled for analyses of bird reporting rates presented in Section 7.

Year	Area of interest (MDD)	KBAs	Outside KBA	% in KBAs
2000	3,718	1,642	2,076	44.16
2001	3,913	1,847	2,066	47.20
2002	1,997	1,129	868	56.53
2003	2,010	1,047	963	52.09
2004	1,500	315	1,185	21.00
2005	1,248	356	892	28.53
2006	2,158	1,013	1,145	46.94
2007	2,787	2,030	757	72.84
2008	2,085	1,453	632	69.69
2009	1,046	400	646	38.24
2010	1,084	546	538	50.37
2011	1,753	954	799	54.42
2012	1,803	1,004	799	55.68
2013	1,469	534	935	36.35
2014	1,830	1,081	749	59.07
2015	1,368	830	538	60.67
2016	1,172	500	672	42.66
2017	1,626	627	999	38.56
2018	1,941	633	1,308	32.61
2019	2,209	654	1,555	29.61
2000-2009	22,462	11,232	11,230	50.00
2010-2019	19,828	7,363	8,892	37.13
2000-2019	38,717	18,595	20,122	48.03

Source: Birddata, Birdlife Australia, accessed May 2021. Reporting rates were based on bird observations from all standardised 2ha 20 minute and 500 metre area searches undertaken in the area of interest during 2000 to 2019.

Records were collated from within a polygon bounded by:

Menindee to the north; top end of the Grampians to the south; Mount Barker to the west; Swan Hill to the east; and configured to include the Central NSW Mallee KBA in NSW and exclude the Coorong and lakes KBA in SA.

This polygon covers the main extent of mallee and the MDD bioregion and all mallee Key Biodiversity Areas (KBAs).

The data downloaded were spreadsheets of all bird species, their counts and reporting rates in each year for the entire area of interest (polygon) and for the Key Biodiversity Area layer within that polygon. The data allowed the reporting rates and number of surveys outside of KBAs to be calculated and compared with the KBA data.

**Table A4.** Most common bird species that had average reporting rates (RR) of >10% in Tables A1 and A2. Birds are listed in order of most to least abundant. Comparisons are made from within Key Biodiversity Areas (KBAs) and outside of KBAs. Aquatic/Marine birds were excluded but Birds of Prey, Common and Exotic species were included in the rankings.

Key Biodiversity Areas (KBAs)		Outside KBAs	
<b>RR &gt;40%</b>			
Mallee Associated	Weebill	Common	Australian Magpie
Mallee Associated	Spiny-cheeked Honeyeater	Common	Galah
		Common	Willie Wagtail
<b>RR&gt;20-40%</b>			
Mallee Dependent	Yellow-plumed Honeyeater	Common	Crested Pigeon
Common	Grey Butcherbird		White-plumed Honeyeater
Mallee Associated	Chestnut-rumped Thornbill		Welcome Swallow
		Common	Magpie-lark
			Red-rumped Parrot
			Striated Pardalote
			Red Wattlebird
		Common	Australian Raven
			Grey Shrike-thrush
		Mallee Associated	Weebill
		Mallee Associated	Spiny-cheeked Honeyeater
		Common	Noisy Miner
			Crimson Rosella
<b>RR&gt;10-20%</b>			
	Striated Pardalote		Singing Honeyeater
	Grey Shrike-thrush		Superb Fairy-wren
Mallee Dependent	White-eared Honeyeater	Mallee Associated	Brown Treecreeper
Common	Australian Magpie	Bird of Prey	Whistling Kite
Common	Australian Raven	Exotic	Common Starling
Mallee Dependent	Jacky Winter		New Holland Honeyeater
Mallee Dependent	Crested Bellbird	Exotic	House Sparrow
Mallee Dependent	Spotted Pardalote	Common	Laughing Kookaburra
Mallee Dependent	White-fronted Honeyeater	Common	Eastern Rosella
Common	Galah	Common	Yellow-rumped Thornbill
Mallee Associated	Australian Ringneck	Common	Little Raven
Common	Willie Wagtail		Masked Lapwing
Mallee Associated	Red-capped Robin	Mallee Associated	Australian Ringneck
	Rufous Whistler	Common	Pied Butcherbird
	Red Wattlebird		Tree Martin
			Common Bronzewing
			White-browed Babbler
			Rufous Whistler
			Black-faced Cuckoo-shrike
		Common	Sulphur-crested Cockatoo
			Grey Fantail
			White-winged Chough
		Common	Grey Butcherbird
		Mallee Associated	Yellow-throated Miner

Source: As for Tables A1 and A2.

**Table A5.** Summary of trends in average reporting rates for different groups of birds in the MDD region comparing intact mallee Key Biodiversity Areas with areas outside of KBAs.

Bird group	No spp. Total	No. spp. Decreasing outside KBAs	% spp. Decreasing	No. spp. Increasing outside KBAs	% spp. Increasing	No. spp. minor change ( $\pm 50\%$ )
Mallee Specialist	8	8	100	0	0.0	0
Mallee Dependent	12	9	75.0	0	0.0	3
Mallee Associated	17	8	47.1	3	17.7	6
Other Terrestrial	132	3	2.3	79	59.9	50
Aquatic/Marine	76	2	2.6	52	68.4	22
Bird of prey	20	1	5.0	16	80.0	3
Common	18	1	5.6	15	83.3	2
Exotic	9	0	0.0	6	66.7	3
<b>Total</b>	<b>292</b>	<b>32</b>	<b>11.0</b>	<b>171</b>	<b>58.6</b>	<b>89</b>

Source: As per Tables A1 and A2.

## APPENDIX B – DETERMINING THE MALLEE BIRD ASSEMBLAGE

This Appendix provides background information on how the mallee bird assemblage was determined, based on the sources below.

1. VSAC (2002) identified 20 mallee-dependent bird taxa and another 23 mallee-associated bird taxa that are present in, but not totally restricted to, mallee systems in the Murray Mallee of Victoria ([Table B1](#)). The State-listed *Victorian Mallee Bird Community* only comprises the 20 mallee-dependent taxa.
2. The mallee bird assemblage nominated for national listing by Anon (2015) comprised the 20 mallee-dependent taxa of the *Victorian Mallee Bird Community* plus an additional mallee-associated species, the White-browed Treecreeper ([Table B1](#)).
3. Birdlife Australia (2015a) identified an Eastern Mallee region covering the Murray Darling Depression, Eyre Yorke Block and adjacent parts of the Gawler and Flinders Lofty Block bioregions, where mallee was the dominant natural vegetation type present, and some substantial patches of mallee occur. They used range endemism and habitat preference metrics to identify 48 bird species as being mallee habitat dependent within the Eastern Mallee ([Table B2](#)).
4. The extensive records collated by the Atlas of Living Australia (2020) were used to check if bird species were more often associated with the MDD bioregion and mallee Major Vegetation Group. This was done by collating recent and reliable bird records from all of NSW, SA and Victoria for each of the bird species identified in [Tables B1 and B2](#) and analysing the proportion of known records ascribed to each IBRA bioregion and Major Vegetation Group ([Table B3](#)).
5. Feedback from consultations with mallee bird experts helped to refine and confirm the assemblage.

All of this information was used to support the designation of mallee bird species as specialist, dependent or associated with mallee habitats, which were cross-checked with mallee and bird experts. The resulting list of 20 mallee specialist and dependent bird species is presented in [Table 1.1](#) and [Table A1](#) in [Appendix A](#).

**Table B1.** Bird species noted in the Victorian Mallee Bird Community listing under the Victorian *Flora and Fauna Guarantee Act 1988*.

Common Name	Scientific Name
<i>Mallee dependent species (listed part of the community)</i>	
<b>Black-eared Miner</b>	<i>Manorina melanotis</i>
Brown-headed Honeyeater	<i>Melithreptus brevirostris pallidiceps</i>
<b>Chestnut Quail-thrush</b>	<i>Cinlosoma castanotus</i>
<b>Grey-fronted Honeyeater</b>	<i>Lichenostomus plumulus graingeri</i>
<b>Jacky Winter</b>	<i>Microeca fascinans assimilis</i>
<b>Mallee Emu-wren</b>	<i>Stipiturus mallee</i>
<b>Malleefowl</b>	<i>Leipoa ocellata</i>
<b>Purple-gaped Honeyeater</b>	<i>Lichenostomus cratitius</i>
<b>Red-ored Whistler</b>	<i>Pachycephala rufogularis</i>
Redthroat	<i>Pyrrholaemus brunneus</i>
<b>Regent Parrot</b>	<i>Polytelis anthopeplus monarchoides</i>
<b>Shy Heathwren</b>	<i>Calamanthus cautus</i>
Slender-billed Thornbill	<i>Acanthiza iredalei</i>
<b>Southern Scrub-robin</b>	<i>Drymodes brunneopygia</i>
<b>Splendid Fairy-wren</b>	<i>Malurus splendens</i>
<b>Striated Grasswren</b>	<i>Amytornis striatus</i>
<b>Mallee Western Whipbird</b>	<i>Psophodes nigrogularis leucogaster</i>
<b>White-eared Honeyeater</b>	<i>Lichenostomus leucotis novaenorca</i>
<b>Yellow-plumed Honeyeater</b>	<i>Lichenostomus ornatus</i>
<b>Yellow-rumped Pardalote</b>	<i>Pardalotus punctatus xanthopyge</i>
<i>Mallee associated species (not listed as part of the community)</i>	
Australian Bustard	<i>Ardeotis australis</i>
Black Kite	<i>Milvus mirans</i>
Black Honeyeater	<i>Sugomel niger</i>
Bluebonnet	<i>Northiella haematogaster</i>
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>
<b>Csted Bellbird</b>	<i>Oreoica guttaralis guttaralis</i>
Gilbert's Whisler	<i>Pachycephala inornata</i>
Inland Thornbill	<i>Acanthiza apicalis</i>
Major Mitchell's Cockatoo	<i>Cacatua leadbeateri</i>
Mallee Ringneck	<i>Barnardius zonarius barnardi</i>
Mulga Parrot	<i>Psephotellus varius</i>
Red-capped Robin	<i>Petroica goodenovii</i>
Singing Honeyeater	<i>Gavicalis virescens</i>
Southern Whiteface	<i>Aphelocephala leucopsis leucopsis</i>
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>
Spotted Nightjar	<i>Eurostopodus argus</i>
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>
Variegated Fairy-wren	<i>Malurus lamberti</i>
Weebill	<i>Smicromis brevirostris</i>
White-browed Treecreeper	<i>Climacteris affinis superciliosus</i>
<b>White-fronted Honeyeater</b>	<i>Purnella albifrons</i>
Yellow-throated Miner	<i>Manorina flavigula</i>

Source: VSAC (2002). Note: bird scientific names have not been updated from those used in the original listing.

Species identified as part of the nominated *Woodland and Woodland and Heathland Bird Community of the Murray Mallee Bioregion* include all the Mallee dependent species plus the White-browed Treecreeper.

**Bold** indicates members of the national **Mallee Bird Community**. Note the Scarlet-chested Parrot is the only member species not listed here.

**Table B2.** Bird species identified as mallee habitat dependent within the Eastern Mallee with their habitat and spatial metrics. Birds are listed in order of highest to lowest mallee habitat metric.

Common name	Scientific name	Mallee - habitat metric	Spatial representation	Spatial endemism	Common species
Black-eared Miner	<i>Manorina melanotis</i>	98.87	11.96	99.92	
Red-lored Whistler	<i>Pachycephala rufogularis</i>	96.34	15.73	99.25	
Scarlet-chested Parrot	<i>Neophema splendida</i>	95.65	43.54	6.43	
Chestnut Quail-thrush	<i>Cinclosoma castanotum</i>	95.30	67.47	7.05	
Mallee Emu-wren	<i>Stipiturus mallee</i>	92.47	7.69	99.25	
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>	86.92	93.13	20.71	X
Crested Bellbird	<i>Oreoica gutturalis</i>	85.40	90.84	4.20	X
Malleefowl	<i>Leipoa ocellata</i>	84.85	74.98	11.98	
Shy Heathwren	<i>Hylacola cauta</i>	82.13	66.09	25.64	
White-fronted Honeyeater	<i>Purnella albifrons</i>	80.91	95.40	6.14	
Gilbert's Whistler	<i>Pachycephala inornata</i>	80.45	82.57	21.73	
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	78.21	60.50	29.75	
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>	77.72	54.99	3.12	
White-eared Honeyeater	<i>Nesoptilotis leucotis</i>	77.14	76.57	11.37	X
Jacky Winter	<i>Microeca fascians</i>	73.60	100.49	4.51	
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>	72.81	48.95	8.43	
Spotted Pardalote	<i>Pardalotus punctatus</i>	72.53	89.78	12.00	X
Spotted Nightjar	<i>Eurostopodus argus</i>	70.30	99.99	3.87	
Purple-gaped Honeyeater	<i>Lichenostomus cratitius</i>	69.30	54.30	47.04	
Masked Woodswallow	<i>Artamus personatus</i>	67.63	100.92	3.70	
Mulga Parrot	<i>Psephotus varius</i>	66.92	92.48	8.01	
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	64.15	97.90	6.39	X
Grey Butcherbird	<i>Cracticus torquatus</i>	64.13	94.29	4.50	X
Splendid Fairy-wren	<i>Malurus splendens</i>	63.52	79.27	6.81	
Inland Thornbill	<i>Acanthiza apicalis</i>	63.41	89.27	5.19	
Little Crow	<i>Corvus bennetti</i>	61.55	63.52	3.19	
Grey Currawong	<i>Strepera versicolor</i>	61.11	73.66	13.98	X
Weebill	<i>Smicromis brevirostris</i>	60.89	101.84	3.95	X
Chestnut-crowned Babbler	<i>Pomatostomus ruficeps</i>	59.26	50.67	14.08	
White-browed Woodswallow	<i>Artamus superciliosus</i>	57.36	100.92	5.62	
Black-eared Cuckoo	<i>Chalcites osculans</i>	56.91	101.26	3.83	
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	55.12	95.86	12.70	



Common name	Scientific name	Mallee - habitat metric	Spatial representation	Spatial endemism	Common species
Golden Whistler	<i>Pachycephala pectoralis</i>	55.05	102.28	12.03	
Hooded Robin	<i>Melanodryas cucullata</i>	52.74	102.43	3.93	
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	51.94	100.46	3.60	
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	50.51	101.58	4.67	X
Red-capped Robin	<i>Petroica goodenovii</i>	49.22	101.85	4.36	
Australian Ringneck	<i>Barnardius zonarius</i>	48.01	95.62	5.10	X
Emu	<i>Dromaius novaehollandiae</i>	47.84	100.92	3.63	
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	47.76	101.85	3.58	X
Rainbow Bee-eater	<i>Merops ornatus</i>	47.32	100.62	3.62	
White-browed Babbler	<i>Pomatostomus superciliosus</i>	45.46	101.75	5.99	X
Varied Sittella	<i>Daphoenositta chrysoptera</i>	45.09	101.85	4.22	
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	44.21	59.44	4.26	
Restless Flycatcher	<i>Myiagra inquieta</i>	43.67	101.85	6.26	
Western Gerygone	<i>Gerygone fusca</i>	42.42	43.26	2.33	
Variegated Fairy-wren	<i>Malurus lamberti</i>	42.39	98.32	4.20	
Striated Pardalote	<i>Pardalotus striatus</i>	41.53	100.62	3.96	X

Source: Birdlife Australia (2015a). An explanation of the metrics is presented below, as quoted by Birdlife Australia (2015d). Note that three Mallee bird community species included in [Table A1](#) were not included in this report: Regent Parrot, Striated Grasswren and Mallee Western Whipbird.

**Habitat association - literature** (applied to habitat specific indices only): A binary classification: 1 means the species has been recorded to use mallee as a significant habitat.

**Mallee habitat metric** (applied to habitat specific indices only): The proportion of a species occurrence records as determined by all bird data which has a reliable spatial accuracy (recorded metadata) of 500m or better, which intersect a habitat type - as determined by groupings of NVIS mapping. The threshold applied varies based on regional characteristics and ecological characteristics of the focal habitat. [The higher the metric, the more associated a species is to mallee habitat. For instance, Black-eared Miners are very strongly associated with mallee woodlands while the Striated Pardalote has a lower association with mallee.] All mallee-dependent species shown were also noted in the ecological literature to use mallee as a habitat for feeding ('obtaining a non-trivial proportion of its nutrient and energy intake') or breeding, based on Garnett et al. 2015).

To qualify as a habitat indicator a species must be noted in ecological literature, have a habitat association of at least the threshold amount and have a majority association with the focal habitat. A threshold of >40 was applied for the Eastern Mallee habitat.

**Spatial representation:** the proportion of a region over which a species occurs (as determined by the species core Extent of Occurrence) - i.e. how widespread the species is in the region. [A higher metric means a species occurs more widely across the Eastern Mallee region. For instance, the Black-eared Miner is found only within about 12% of the Eastern Mallee region, while the Striated Pardalote is found over the entire region.]

**Spatial endemism:** the proportion of a species range that occurs within a region - i.e. how confined the species is to that region. [A higher metric means a species is more limited to the Eastern Mallee region. For instance, almost the entire known national range of the Black-eared Miner occurs within the Eastern Mallee region, while only 4% of the known national range for the Striated Pardalote occurs in the Eastern Mallee.]

Species must have a spatial representativeness of at least 25% or a spatial endemism at least 75% to qualify as an indicator for a region or in the case of common species indices have a spatial representativeness of at least 50%

**Common species** are a grouping that is neither ecologically based or habitat dependent and were identified as relatively abundant by Birdlife Australia (2015).

**Bold common names** indicate members of the **Mallee Bird Community**.

**Table B3.** Atlas of Living Australia records for Mallee Bird species collated for south-eastern Australia for the decades 1980-2019. This period represents when more substantial and reliable observations were collected. Data show the total number of observations per bird species with an IBRA bioregional or Major Vegetation Group attribution, and the proportion associated with specific bioregional or mallee MVG occurrences.

The list of bird species analysed included all birds in [Table A1](#), except the Australian Bustard and Black Kite due to their taxonomic relationship to aquatic and bird of prey taxa. Additional birds from [Table B2](#) were included if they had a mallee habitat metric of 60 or more and were not identified as a common species. The Little Crow was excluded because it is identified as a common species in the Eastern Mallee region by Simmonds et al. (2019).

**B3a) Observations by IBRA bioregion.** Birds are listed in order of highest to lowest percentage of records in the MDD bioregion.

Common Name	Scientific Name	No. obs – SE Australia	% MDD	% East Mallee	% West Mallee
<b>Black-eared Miner</b>	<i>Manorina melanotis</i>	1,384	98.77	99.57	0.07
<b>Red-lored Whistler</b>	<i>Pachycephala rufogularis</i>	1,006	97.02	100	0.00
<b>Striated Grasswren</b>	<i>Amytornis striatus</i>	1,776	90.32	99.16	0.62
<b>Chestnut Quail-thrush</b>	<i>Cinclosoma castanotum</i>	5,866	86.74	93.16	5.34
<b>Southern Scrub-robin</b>	<i>Drymodes brunneopygia</i>	7,022	79.35	90.00	9.73
<b>Yellow-plumed Honeyeater</b>	<i>Ptilotula ornata</i>	28,000	74.32	91.23	6.23
<b>Mallee Emu-wren</b>	<i>Stipiturus mallee</i>	1,183	71.68	99.75	0.17
<b>Scarlet-chested Parrot</b>	<i>Neophema splendida</i>	171	71.35	74.85	18.71
<b>Splendid Fairy-wren</b>	<i>Malurus splendens</i>	13,622	66.32	87.69	7.87
White-browed Treecreeper	<i>Climacteris affinis</i>	2,635	66.00	82.43	4.25
<b>Regent Parrot</b>	<i>Polytelis anthopeplus</i>	4,272	64.47	99.44	0.02
<b>Shy Heathwren</b>	<i>Calamanthus cautus</i>	6,842	63.96	91.64	5.88
<b>Yellow-rumped Pardalote</b>	<i>Pardalotus punctatus xanthopyge</i>	2,383	63.91	77.38	21.86
<b>Malleefowl</b>	<i>Leipoa ocellata</i>	4,180	55.19	67.85	25.72
<b>White-fronted Honeyeater</b>	<i>Purnella albifrons</i>	13,705	55.11	77.59	19.24
Mulga Parrot	<i>Psephotus varius</i>	13,093	54.76	84.15	8.20
<b>Crested Bellbird</b>	<i>Oreoica gutturalis</i>	22,554	52.69	79.74	11.52
Gilbert's Whistler	<i>Pachycephala inornata</i>	8,291	49.09	77.65	5.44
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	29,801	43.30	80.18	6.01
<b>Purple-gaped Honeyeater</b>	<i>Lichenostomus cratitius</i>	3,821	42.45	44.07	22.38
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	7,812	39.32	75.56	5.13
Spotted Nightjar	<i>Eurostopodus argus</i>	2,357	39.29	73.02	6.62
<b>Grey-fronted Honeyeater</b>	<i>Ptilotula plumula</i>	3,040	37.27	67.27	27.60
Australian Ringneck	<i>Barnardius zonarius</i>	39,259	32.62	76.15	8.73
Masked Woodswallow	<i>Artamus personatus</i>	15,498	32.40	62.81	5.43
Inland Thornbill	<i>Acanthiza apicalis</i>	19,496	31.93	58.92	15.86
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	77,248	31.11	60.04	10.33
Bluebonnet	<i>Northiella haematogaster</i>	24,904	29.46	73.19	4.24
Black Honeyeater	<i>Sugomel niger</i>	1,099	29.03	66.42	3.73
Slender-billed Thornbill	<i>Acanthiza iredalei</i>	1,293	28.92	33.57	66.13
Weebill	<i>Smicromis brevirostris</i>	91,879	27.02	67.70	4.60

Common Name	Scientific Name	No. obs – SE Australia	% MDD	% East Mallee	% West Mallee
Redthroat	<i>Pyrrholaemus brunneus</i>	2,607	23.90	68.51	18.87
Singing Honeyeater	<i>Gavicalis virescens</i>	62,847	23.70	55.25	19.57
Southern Whiteface	<i>Aphelocephala leucopsis</i>	4,337	23.22	65.39	26.93
Yellow-throated Miner	<i>Manorina flavigula</i>	35,032	23.16	64.94	14.16
Red-capped Robin	<i>Petroica goodenovii</i>	41,219	23.13	64.86	5.01
<b>Jacky Winter</b>	<i>Microeca fascinans</i>	64,842	17.56	43.24	1.91
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>	31,251	17.09	38.06	0.07
<b>White-eared Honeyeater</b>	<i>Nesoptilotis leucotis</i>	86,148	16.64	34.29	1.56
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	67,807	15.68	54.05	1.43
Brown Treecreeper	<i>Climacteris picumnus</i>	76,817	14.61	56.49	0.24
Variegated Fairy-wren	<i>Malurus lamberti</i>	46,874	9.16	20.99	1.81
<b>Spotted Pardalote</b>	<i>Pardalotus punctatus</i>	202,421	6.80	23.07	0.70
<b>Mallee Western Whipbird</b>	<i>Psophodes leucogaster</i>	237	0.00	24.05	74.68

Source: Atlas of Living Australia observation records per bird species downloaded January 2021. The ALA general data cleaning parameters were applied to exclude unreliable records. Observations with no bioregional attribution were also excluded.

No. obs – SE Australia refers to the number of records per species within NSW (excluding ACT), South Australia and Victoria that have a bioregional attribution.

% MDD refers to the proportion of records present in the Murray Darling Depression bioregion.

% East Mallee refers to the proportion of records present in bioregions with some mallee east of the Eyrean Barrier, effectively the MDD plus adjacent bioregions: Flinders Lofty Block, Broken Hill Complex, Darling Riverine Plains, Cobar Peneplain, Riverina, Victorian Midlands, Naracoorte Coastal Plain and Kanmantoo.

% West Mallee refers to the proportion of records present in bioregions with extensive mallee west of the Eyrean Barrier and accumulated for the Eyre Yorke Block, Gawler, Great Victoria Desert and Nullarbor bioregions.

**Bold** indicates members of the **Mallee Bird Community**

### B3b) Observations by Mallee MVGs

Common Name	Scientific Name	No. obs – SE Australia	% SE Mallee	No. Obs - MDD	% MDD Mallee
<b>Black-eared Miner</b>	<i>Manorina melanotis</i>	1,381	96.16	1,364	97.07
<b>Red-lored Whistler</b>	<i>Pachycephala rufogularis</i>	998	90.58	972	92.28
<b>Scarlet-chested Parrot</b>	<i>Neophema splendida</i>	162	74.69	113	92.04
<b>Striated Grasswren</b>	<i>Amytornis striatus</i>	1,773	90.81	1,600	91.75
<b>Mallee Emu-wren</b>	<i>Stipiturus mallee</i>	1,169	89.22	839	89.03
<b>Chestnut Quail-thrush</b>	<i>Cinlosoma castanotum</i>	5,832	80.33	5,079	84.56
<b>Crested Bellbird</b>	<i>Oreoica guttaralis</i>	21,915	52.66	11,842	79.07
<b>Yellow-plumed Honeyeater</b>	<i>Ptilotula ornata</i>	27,408	72.15	20,707	78.88
<b>Grey-fronted Honeyeater</b>	<i>Ptilotula plumula</i>	3,008	44.78	1,133	75.55
<b>Shy Heathwren</b>	<i>Hylacola cauta</i>	6,588	69.66	4,340	72.86
<b>White-fronted Honeyeater</b>	<i>Purnella albifrons</i>	13,518	55.00	7,481	70.90
<b>White-eared Honeyeater</b>	<i>Nesoptilotis leucotis</i>	80,800	17.94	14,170	69.99
<b>Malleefowl</b>	<i>Leipoa ocellata</i>	4,023	64.35	2,267	68.68
<b>Spotted Pardalote</b>	<i>Pardalotus punctatus</i>	193,825	6.35	13,610	68.31
Gilbert's Whistler	<i>Pachycephala inornata</i>	7,812	44.50	4,042	68.21
Spotted Nightjar	<i>Eurostopodus argus</i>	2,269	36.36	915	66.99
<b>Yellow-rumped Pardalote</b>	<i>Pardalotus punctatus xanthopyge</i>	2,297	64.26	1,500	66.40
<b>Southern Scrub-robin</b>	<i>Drymodes brunneopygia</i>	6,904	61.02	5,529	66.12
Mulga Parrot	<i>Psephotus varius</i>	12,441	44.68	7,071	66.06
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>	29,426	14.56	5,291	65.98
<b>Jacky Winter</b>	<i>Microeca fascinans</i>	61,407	15.51	11,258	65.79
Weebill	<i>Smicromis brevirostris</i>	88,318	24.44	24,548	64.93
Inland Thornbill	<i>Acanthiza apicalis</i>	18,121	40.55	6,159	63.79
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	28,534	34.23	12,778	61.59
<b>Regent Parrot</b>	<i>Polytelis anthopeplus</i>	4,208	41.33	2,738	60.37
Masked Woodswallow	<i>Artamus personatus</i>	14,879	24.44	4,974	58.10
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	7,558	27.27	3,026	56.77
Australian Ringneck	<i>Barnardius zonarius</i>	37,118	27.30	12,579	55.48
<b>Purple-gaped Honeyeater</b>	<i>Lichenostomus cratitius</i>	3,627	61.26	1,584	54.92
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	72,255	23.71	23,715	53.41
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	64,142	14.03	10,495	51.19
Red-capped Robin	<i>Petroica goodenovii</i>	38,863	19.10	9,378	51.04
White-browed Treecreeper	<i>Climacteris affinis</i>	2,608	35.47	1,733	50.55
<b>Splendid Fairy-wren</b>	<i>Malurus splendens</i>	13,206	37.54	8,971	44.41
Slender-billed Thornbill	<i>Acanthiza iredalei</i>	1,247	18.04	349	41.83
Black Honeyeater	<i>Sugomel niger</i>	1,039	16.65	313	41.21
Yellow-throated Miner	<i>Manorina flavigula</i>	33,059	15.25	7,989	37.16
Brown Treecreeper	<i>Climacteris picumnus</i>	72,008	7.45	11,090	34.98
Variiegated Fairy-wren	<i>Malurus lamberti</i>	45,115	4.46	4,250	32.42
Southern Whiteface	<i>Aphelocephala leucopsis</i>	4,315	16.36	1,004	30.98

Common Name	Scientific Name	No. obs – SE Australia	% SE Mallee	No. Obs - MDD	% MDD Mallee
Redthroat	<i>Pyrrholaemus brunneus</i>	2,581	16.66	621	23.83
Bluebonnet	<i>Northiella haematogaster</i>	22,928	9.49	7,229	23.41
Singing Honeyeater	<i>Gavicalis virescens</i>	57,861	9.97	14,655	22.88
<b>Mallee Western Whipbird</b>	<i>Psophodes leucogaster</i>	227	59.47	0	0.00

Source: *Atlas of Living Australia* (ALA) records for each mallee bird species, accessed January 2021. The data collated ALA records for each species during the period 1980-2019 applied to general ALA general data cleaning protocol to exclude unreliable observations. The numbers with no or an unknown MVG habitat attribution were disregarded. The timeframe since 1980 was selected due to the increased number and reliability of observations since 1980, and especially so since 2000. No observations for the Rufous Grasswren were available within the defined region from this dataset during this period.

Source: *Atlas of Living Australia* observation records per bird species downloaded January 2021. The ALA general data cleaning parameters were applied to exclude unreliable records. Observations with no or unknown MVG attribution were also excluded.

No. obs – SE Australia refers to the number of records per species within NSW (excluding ACT), South Australia and Victoria that have a bioregional attribution.

% MDD refers to the proportion of records present in the Murray Darling Depression bioregion.

% East Mallee refers to the proportion of records present in bioregions with some mallee east of the Eyrean Barrier, effectively the MDD plus adjacent bioregions: Flinders Lofty Block, Broken Hill Complex, Darling Riverine Plains, Cobar Penepplain, Riverina, Victorian Midlands, Naracoorte Coastal Plain and Kanmantoo.

% West Mallee refers to the proportion of records present in bioregions with extensive mallee west of the Eyrean Barrier and accumulated for the Eyre Yorke Block, Gawler, Great Victoria Desert and Nullarbor bioregions.

**Bold** indicates members of the **Mallee Bird Community**

## APPENDIX C - RELATIONSHIP TO OTHER CLASSIFICATIONS

Ecological communities are complex to classify. Each jurisdiction applies their own system to classify vegetation communities, while faunal communities generally are poorly and less systematically defined. Reference to vegetation and mapping units as equivalent to the habitat for this ecological community, at the time of listing, should be taken as indicative rather than definitive. Note that the vegetative habitats have been very broadly defined at the Major Vegetation Group level for the purposes of this ecological community

Two bird assemblage schemes are most relevant to the Mallee Bird Community for demonstrating relationships with other classifications.

Firstly, woodland bird communities in southern Australia were identified by Anon (2017) through an expert panel approach for the purpose of determining threatened woodland bird assemblages for assessment as potential nationally threatened ecological community listings. Of these, three bird assemblages overlap with regions of extensive mallee in southern Australia ([Table C1](#)).

- The Temperate South Australia woodland bird community occurs in the Eyre Yorke Block, Flinders Lofty Block, Kanmantoo, and Naracoorte Coastal Plain bioregions. It does not overlap in extent with the Mallee Bird Community but lies adjacent to the eastern and southern boundaries of the MDD bioregion. Extensive mallee woodlands occurred in this region in the EYB and NCP bioregions though much of the vegetation, including the mallee have been cleared.
- The Temperate South-eastern Mainland Australia woodland bird community occurs in bioregions within, and south of, the Darling Riverine Plain and New England Tablelands bioregions, and east from the MDD bioregion to the south-east coast but excludes the Australian Alps bioregion. This community overlaps with the MDD so covers the extent of the Mallee Bird Community but extends further east and north. Extensive mallee woodlands occur in the MDD but not the remainder of this region.
- The South-west Western Australia Eucalypt woodland bird community occurs in all bioregions across south-western Australia within, and south of, the Geraldton Sandplains and Yalgoo bioregions, east to the Nullarbor, but excluding the Swan Coastal Plain bioregion. The distribution of this community is distant from the Mallee Bird Community and covers the mallee and other woodlands of southern WA, notably the Great Western Woodlands.

Seven Mallee Bird species also occur in both the Temperate South-eastern Mainland and South Australia woodland bird communities ([Table C1](#)). All of these are mallee dependent birds with a wider range. Five other Mallee Bird species occur in the South-west Australian Eucalypt woodland bird community but not the other assemblages. Two of these are mallee specialists: Chestnut Quail-thrush and the Malleefowl. The eight remaining Mallee Bird species are unique to the Mallee Bird Community.

Secondly, Birdlife Australia (2015) identified a separate group of bird assemblages, two of which are woodland/shrubland assemblages adjacent to the MDD bioregion and one of which overlaps directly with the MDD bioregion and the Mallee Bird Community ([Table C2](#)).

- The Eastern Mallee bird assemblage covers the MDD, Eyre Yorke Block, southern Gawler and bioregions with the Flinders Lofty Block subregion Broughton to link the MDD and EYB bioregions. This area covers the major extent of mallee in south-eastern Australia and represents a major overlap with the Mallee Birds. Details of this bird assemblage are provided in [Table B2](#).
- The South-eastern Mainland Dry Sclerophyll Woodland/Forests bird assemblage occurs from Kangaroo Island, Fleurieu Peninsula and the Coorong of SA into Victoria and central NSW east of the MDD bioregion. It overlaps with the MDD to a minor degree around the

Coorong where there is only minor extent of mallee. Only three of the more widely distributed mallee dependent bird species also occur in the bird assemblage.

- The Arid Zone Woodlands and Shrublands bird community covers the extensive arid regions to the north of the MDD into the Northern Territory, much of Western Australia and the far western parts of NSW and Queensland. It overlaps with areas of mallee that lie in the northern Gawler and Great Victoria Desert bioregions. Seven Mallee Bird species are also part of the Arid Zone assemblage, including two mallee specialist species: the Chestnut Quail-thrush and the nomadic Scarlet-chested Parrot.

**Table C1.** Overlap between the Mallee Bird Community (MBC) and the Temperate SA, Temperate SE Mainland Australia and WA Eucalypt woodland bird communities.

Common Name of MBC species	SE Mainland	Temperate SA	WA Eucalypt
<b>Total no of birds in assemblage</b>	121	101	109
Black-eared Miner			
Chestnut Quail-thrush			X
Crested Bellbird	X	X	X
Grey-fronted Honeyeater			
Jacky Winter	X	X	X
Mallee Emu-wren			
Malleefowl			X
Purple-gaped Honeyeater			
Red-lored Whistler			
Regent Parrot			X
Scarlet-chested Parrot			
Shy Heathwren			X
Southern Scrub-robin	X	X	
Splendid Fairy-wren	X	X	X
Spotted Pardalote	X	X	X
Striated Grasswren			
Mallee Western Whipbird			
White-eared Honeyeater	X	X	X
White-fronted Honeyeater			X
Yellow-plumed Honeyeater	X	X	X

Sources: Anon (2017).

**Table C2.** Overlap between the Mallee Bird Community (MBC) and Birdlife Australia's (2015) terrestrial bird assemblages: Eastern Mallee, South-eastern Mainland dry sclerophyll woodlands/forests, and Arid Zone woodlands/shrublands. The comparison is based on the bird species identified as being indicative for these bird communities.

Common name of MBC species	Eastern Mallee	SE Mainland	Arid Zone
<b>Total no birds in assemblage</b>	48	81	104
Black-eared Miner	X		
Chestnut Quail-thrush	X		X
Crested Bellbird	X	X	X
Grey-fronted Honeyeater	X		X
Jacky Winter	X	X	X
Mallee Emu-wren	X		
Malleefowl	X		
Purple-gaped Honeyeater	X		
Red-lored Whistler	X		
Regent Parrot			
Scarlet-chested Parrot	X		X
Shy Heathwren	X		
Southern Scrub-robin	X		
Splendid Fairy-wren	X		X
Spotted Pardalote	X	X	
Striated Grasswren			
Mallee Western Whipbird			
White-eared Honeyeater	X		
White-fronted Honeyeater	X		X
Yellow-plumed Honeyeater	X		

Source: Birdlife Australia (2015).



## APPENDIX D – ADDITIONAL INFORMATION RELEVANT TO THE ECOLOGICAL COMMUNITY

**Table D1.** Extent of mallee vegetation in south-eastern Australia relative to the Eyrean Barrier.

Bioregion	Pre-1750 (ha)	Current (ha)
<b><i>East of Eyrean barrier</i></b>		
Murray Darling Depression	9,724,798	5,601,930
Adjacent to MDD*	1,750,183	1,022,077
<i>Total</i>	<i>11,474,981</i>	<i>6,624,007</i>
<b><i>West of Eyrean barrier</i></b>		
Eyre Yorke Block & Gawler	5,126,974	2,000,881
Great Victoria Desert & Nullarbor	6,548,690	6,517,676
<i>Total</i>	<i>11,675,664</i>	<i>8,518,557</i>

Source: NVIS v5.1 (DAWE 2020b); data compiled for two mallee Major Vegetation Groups (MVGs 14 and 32) within the bioregions specified. Current extent estimates relate to data for 2016.

\*Bioregions directly adjacent to MDD comprise: Flinders Lofty Block, Broken Hill Complex, Darling Riverine Plain, Cobar Penneplain, Riverina, Victorian Midlands, Naracoorte Coastal Plain and Kanmantoo.

Note that the Great Victoria Desert & Nullarbor bioregions extend substantially into Western Australia.

This table highlights the distribution of mallee vegetation either side of the Eyrean barrier and that the greatest extent of mallee east of the barrier lies in the MDD Bioregion.

**Table D2.** Extent and decline of individual NVIS Major Vegetation Groups present in the MDD bioregion.

MVG no. and name	Murray Darling Depression		
	pre1750 (ha)	2016 (ha)	Change (%)
03 Eucalypt Open Forests	16,146	15,697	2.8
04 Eucalypt Low Open Forests	261	260	0.4
05 Eucalypt Woodlands	2,020,160	426,391	78.9
06 Acacia Forests and Woodlands	3927	3478	11.4
07 Callitris Forests and Woodlands	343,486	342,952	0.2
08 Casuarina Forests and Woodlands	1,215,123	262,102	78.4
09 Melaleuca Forests and Woodlands	176	176	0
10 Other Forests and Woodlands	46,687	4	99.9
11 Eucalypt Open Woodlands	34,680	33,118	4.5
13 Acacia Open Woodlands	1108	1108	0
<b>14 Mallee Woodlands and Shrublands</b>	<b>8,898,742</b>	<b>5,242,554</b>	<b>41.1</b>
15 Low Closed Forests and Tall Closed Shrublands	290	284	2.1
16 Acacia Shrublands	862,068	862,037	0
17 Other Shrublands	86,040	74,142	13.8
18 Heathlands	308,354	300,603	2.5
19 Tussock Grasslands	340,638	122,634	64.0
20 Hummock Grasslands	208	208	0
21 Other Grasslands, Herblands, Sedgeland and Rushlands	29,177	25,523	12.5
22 Chenopod, Samphire Shrublands and Forblands	1,736,795	1,474,561	15.1
31 Other Open Woodlands	2,985,827	2,986,293	+0.02
<b>32 Mallee Open Woodlands and Sparse Mallee Shrublands</b>	<b>826,056</b>	<b>359,376</b>	<b>56.5</b>

Source: DAWE (2020b) NVIS v5.1 dataset for Major Vegetation Groups.

Notes: Some MVGs are naturally absent from these bioregions: 01 Rainforests and Vine Thickets; 02 Eucalypt Tall Open Forests; 12 Tropical Eucalypt Woodlands/Grasslands and 23 Mangroves. MVGs that code for non-vegetated, unclassified or modified groups that apply to current extent also were not included.

**Bold** indicates mallee MVGs relevant as habitat for the Mallee Bird Community.

This table highlights the dominance of mallee Major Vegetation Groups in the MDD bioregion and relative declines of all MVGs present.

**Table D3.** Extent and decline of mallee Ecological Vegetation Classes (EVC) in the Victorian Mallee part of the MDD bioregion.

**D3A)** Extent and decline of mallee EVCs by Victorian mallee subregions.

Vic Bioregion	Lowan Mallee			Murray Mallee			Wimmera		
	Pre-1750 (ha)	Current (ha)	Decline (%)	Pre-1750 (ha)	Current (ha)	Decline (%)	Pre-1750 (ha)	Current (ha)	Decline (%)
48 Heathy Woodland	51	22	57.5	0	0	n/a	52,662	46,516	11.7
86 Woorinen Sands Mallee	79,124	68,601	13.3	390,445	154,455	60.4	0	0	n/a
87 Lowan Sands Mallee	217,246	131,765	39.4	780	267	65.8	323	149	53.9
88 Heathy Mallee	323,413	307,795	4.8	2,137	721	66.3	153	27	<b>82.6</b>
91 Loamy Sands Mallee	312,993	279,641	10.7	156,920	98,659	37.1	0	0	n/a
93 Sandstone Ridge Shrubland	128,388	103,236	19.6	15,288	11,607	24.1	21,683	7,630	64.8
95 Red Swale Mallee	60,421	42,742	29.3	353	50	<b>85.8</b>	224	13	<b>94.3</b>
96 Ridged Plains Mallee	1,351	674	50.1	468,866	30,156	<b>93.6</b>	142,312	8,463	<b>94.1</b>
158 Chenopod Mallee	18,255	18,125	0.7	228,653	60,807	<b>73.4</b>	0	0	n/a
824 Woorinen Mallee	29,122	22,932	21.3	689,000	146,982	<b>78.7</b>	1,953	167	<b>91.5</b>
981 Parilla Mallee	2,527	865	65.8	168,147	15,332	<b>90.9</b>	15,760	1,187	<b>92.5</b>
Total – Mallee EVCs	1,172,891	976,398	16.8	2,120,589	519,036	<b>75.5</b>	235,070	64,152	<b>72.7</b>

**D3B)** Total extent and decline of mallee EVCs within the Victorian Mallee. EVCs are ordered from largest to lowest pre-1750 extent.

<b>Ecological Vegetation Class</b>	<b>Pre-1750 (ha)</b>	<b>Current (ha)</b>	<b>Decline (%)</b>
824 Woorinen Mallee	720,075	170,081	<b>76.38</b>
96 Ridged Plains Mallee	612,529	39,293	<b>93.59</b>
91 Loamy Sands Mallee	469,913	378,300	19.50
86 Woorinen Sands Mallee	469,569	223,056	52.50
88 Heathy Mallee	325,703	308,543	5.27
158 Chenopod Mallee	246,908	78,932	68.03
87 Lowan Sands Mallee	218,349	132,181	39.46
981 Parilla Mallee	186,434	17,384	<b>90.68</b>
93 Sandstone Ridge Shrubland	165,359	122,473	25.94
95 Red Swale Mallee	60,998	42,805	29.83
48 Heathy Woodland	52,713	46,538	11.71
<b>Total – Mallee EVCs</b>	<b>3,528,550</b>	<b>1,559,586</b>	<b>55.80</b>

Source: Victorian Department of Sustainability and Environment (2007) EVC Area Statement, Excel spreadsheet.

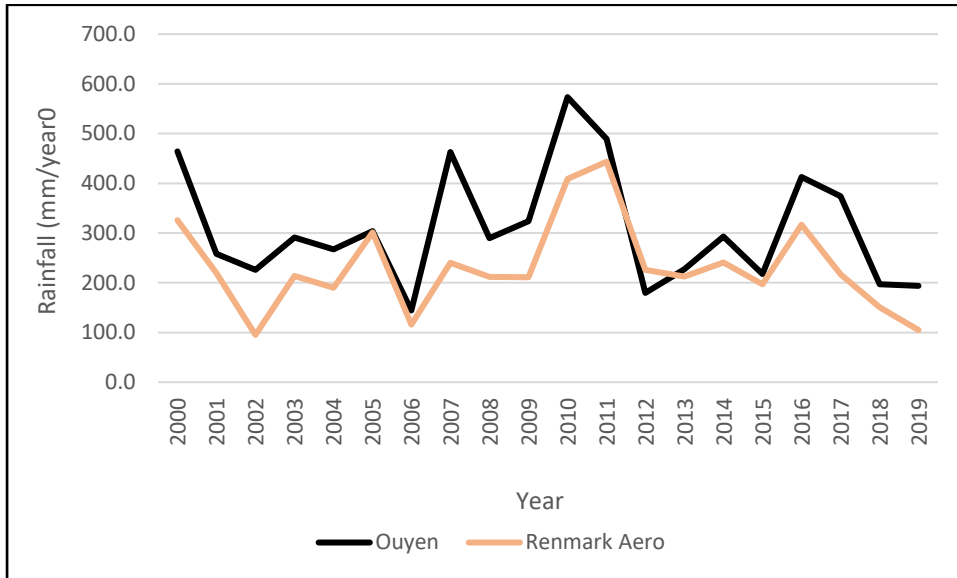
Each of these EVCs was confirmed as a mallee eucalypt woodland or shrubland based on descriptions given in the EVC benchmarks (DELWP, 2019). The three Victorian bioregions indicated are broadly equivalent to IBRA subregions with the same name: MDD02 Murray Mallee, MDD04 Lowan Mallee and MDD05 Wimmera, with the obvious exception that their distributions are limited to Victoria.

**Bold values** indicate decline in EVC extent of >70%.

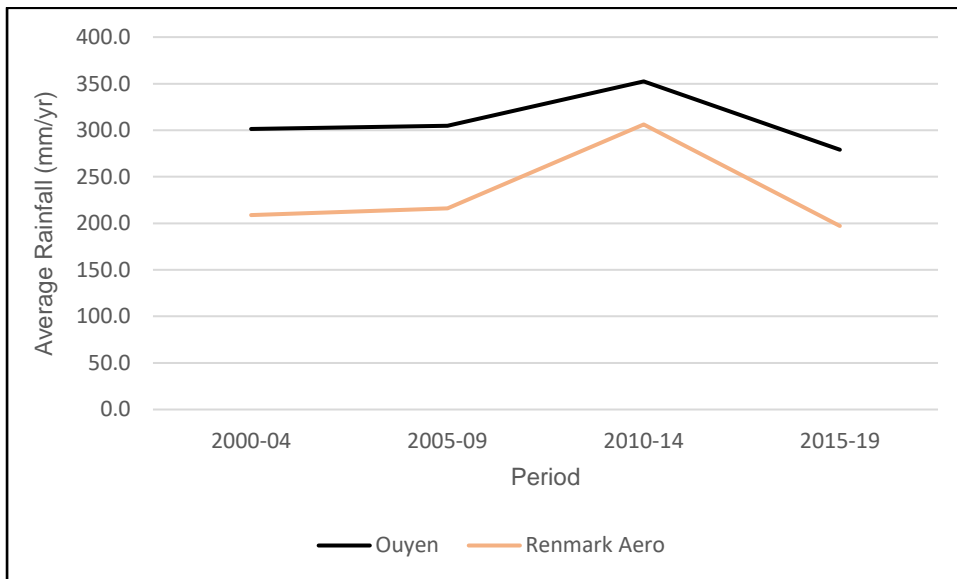
These tables show the relative extent and declines of specific kinds of mallee vegetation at the EVC level in northwestern Victoria. These represent different habitat resources for various members of the Mallee Bird Community.

**Figure D1.** Annual rainfall patterns in the Murray Darling Depression bioregion at two sites during the period relevant to analyses of data for eligibility criteria. Data are shown for two sites that had complete annual records available for 2000 to 2019: Ouyen in the Victorian mallee and Renmark Aero on the mid-Murray River in South Australia.

**D1a)** Annual rainfall patterns.



**D1b)** Pattern of average rainfall over 5-year period between 2000 and 2019.



These figures are relevant to the eligibility criteria analyses in [Section 7](#) where pattern of annual or average bird reporting rates are presented, to indicate patterns of rainfall over the same period that may influence bird responses.

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2015b. Arid Zone regional report: Terrestrial Species ABIs and Species Trends in Detail.

2015c. South-eastern mainland regional report: Terrestrial Species ABIs and Species Trends in Detail.

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# Appendix 5: Mercunda Strandline vegetation clearance figures

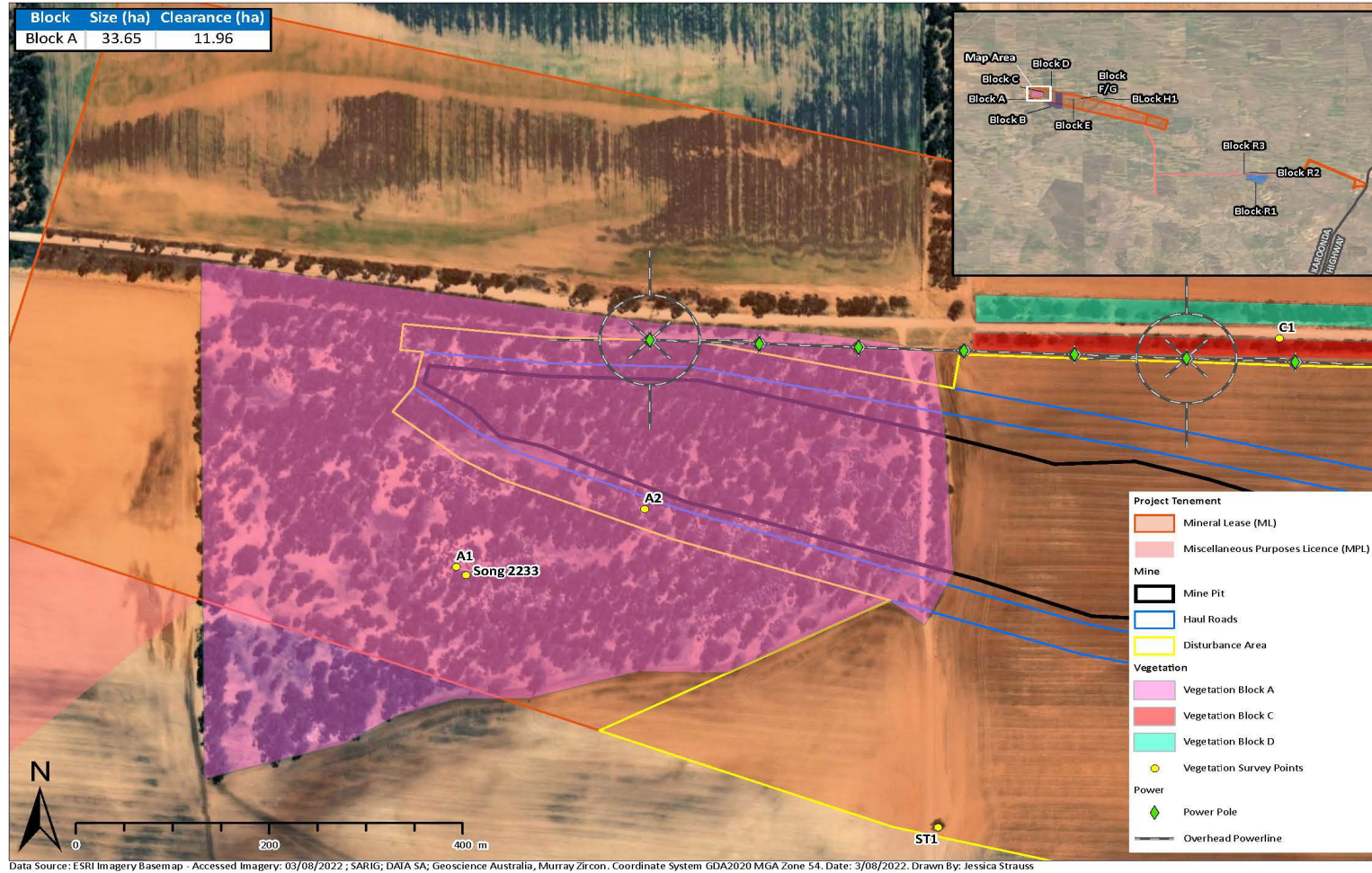


Figure 1. Vegetation Clearance for Block A within the Mercunda Strandline

Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

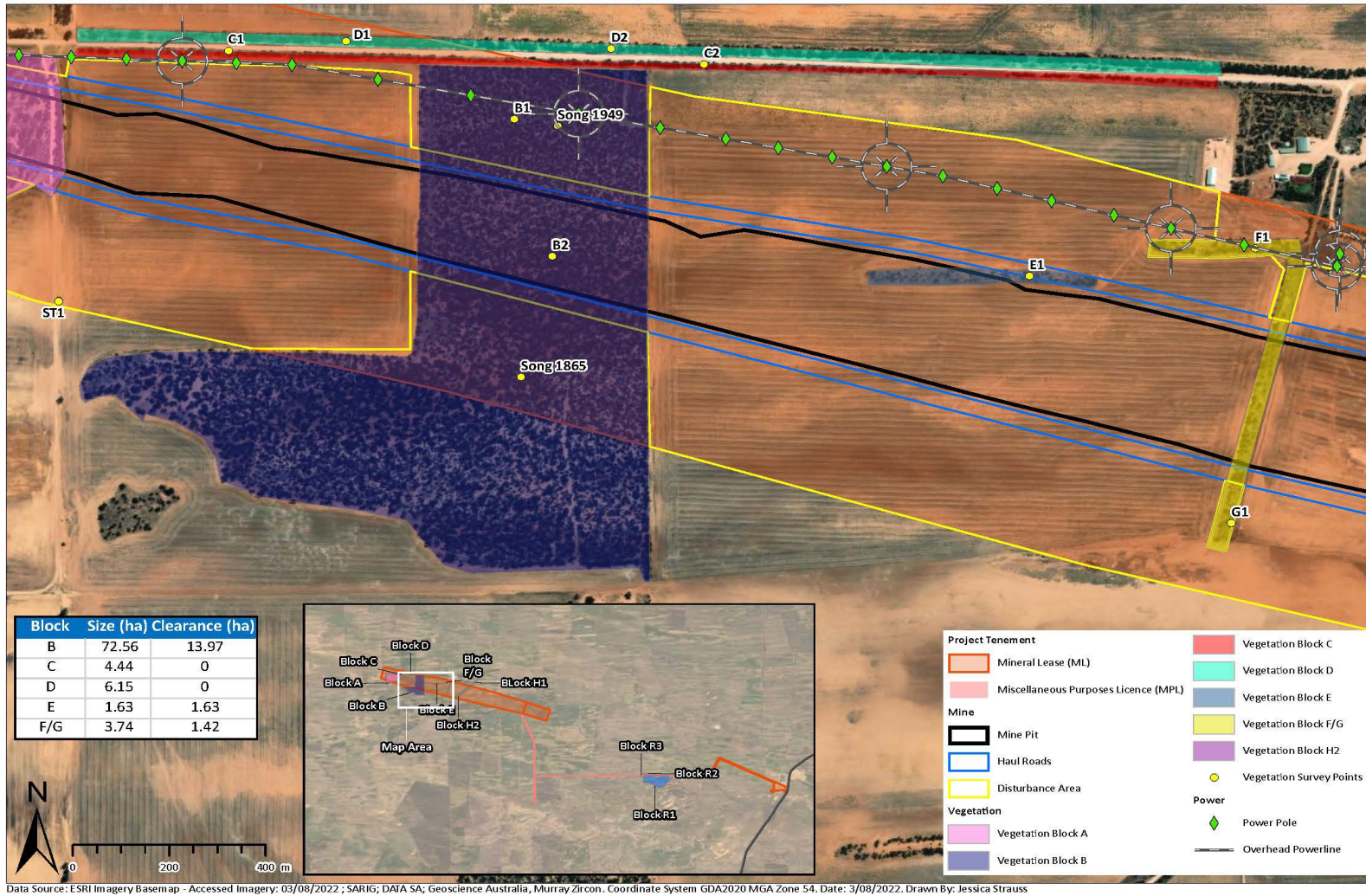


Figure 2. Vegetation Clearance for Block B, E, and F/G within the Mercunda Stranline



Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

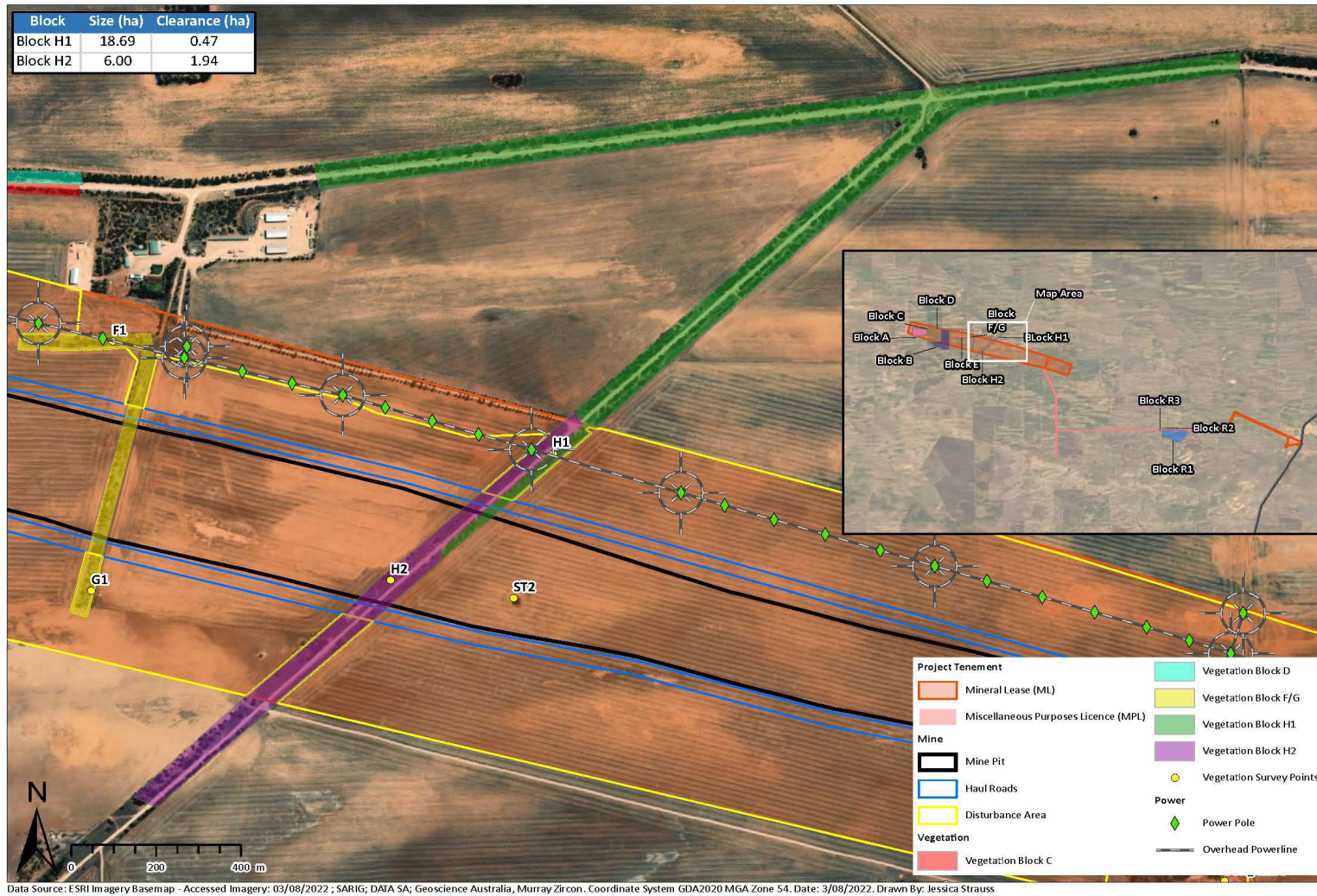


Figure 3. Vegetation Clearance for Blocks H1 and H2 within the Mercunda Strandline

Mercunda Ecological Survey and Native Vegetation Management Plan – August 2022

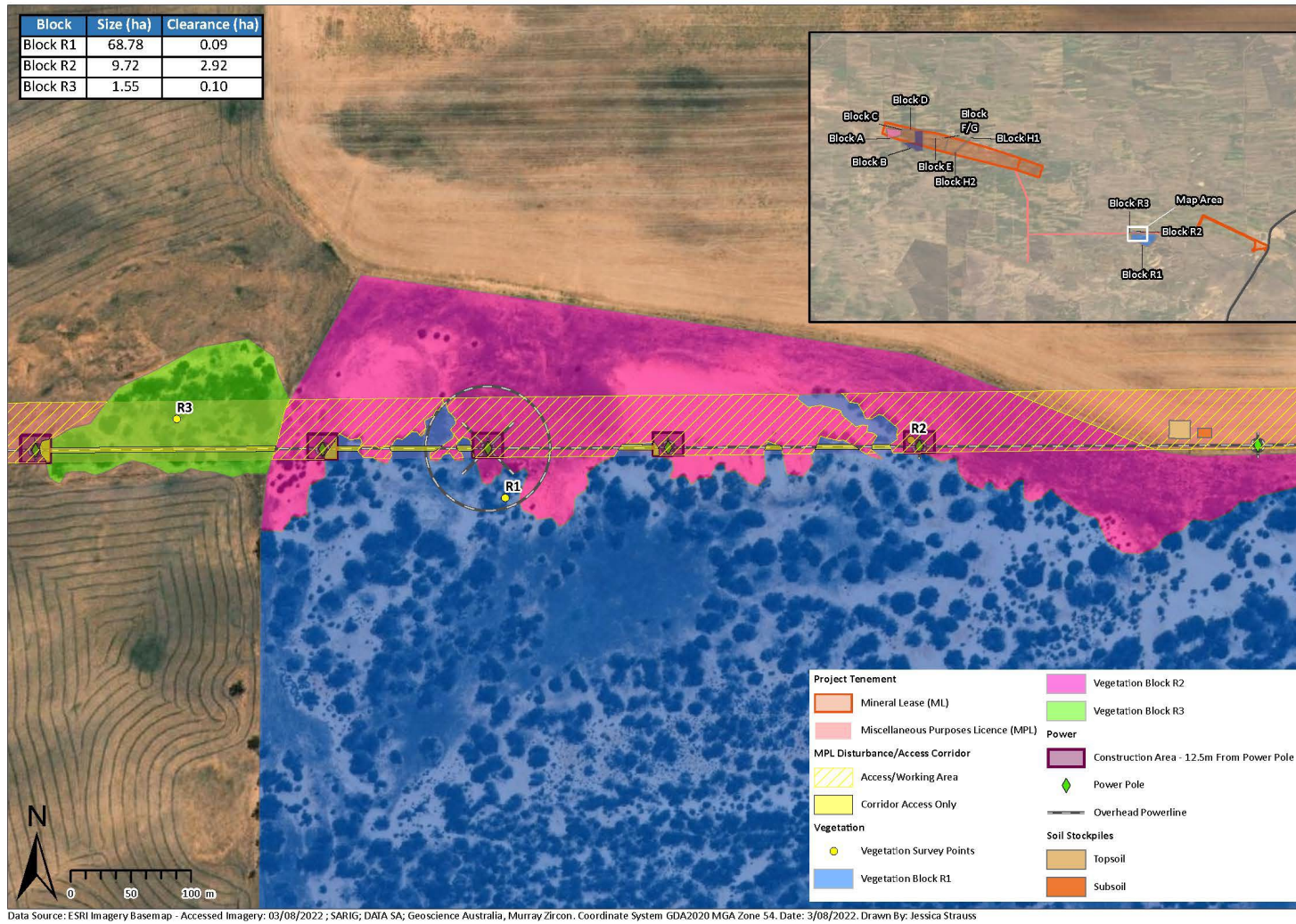


Figure 4. Vegetation Clearance for Block R1, R2 and R3 within the MPL 77

## Appendix 6: Clearance Summary Table - Mercunda Strandline and MPL77

Clearance summary Table - Agricultural region														
Bushland assessment														
Block	Site	Native species diversity score	Threatened Ecological community Score	Threatened plant score	Threatened fauna score	UBS	Area (ha)	Total Biodiversity score	Loss factor	Loadings	Reductions	SEB Points required	SEB payment	Admin Fee
A	1	24	1.4	0	0.1	103.665	11.96	1239.83	1		0.5	650.91	\$179,160.18	\$9,853.81
B	1	28	1.4	0	0.1	102.92	6.5	668.98	1		0.5	351.21	\$96,669.91	\$5,316.84
B	2	20	1.4	0	0.1	91.25	7.47	681.64	1		0.5	357.86	\$98,498.96	\$5,417.44
E	1	16	1	0	0.04	49.87	1.63	81.29	1		0.5	42.68	\$11,746.41	\$646.05
G	1	14	1	0	0.04	44.32	1.42	62.93	1		0.5	33.04	\$9,094.24	\$500.18
H	1	30	1.4	0	0.1	107.08	0.47	50.33	1		0.5	26.42	\$7,272.51	\$399.99
H	2	24	1	0	0.04	56.77	1.94	110.13	1		0.5	57.82	\$15,914.71	\$875.31
R	1	8	1	0	0.06	5.08	0.09	0.46	0.8		0.5	0.19	\$52.85	\$2.91
R	2	26	1.3	0	0.06	76.54	2.92	223.50	0.8		0.5	93.87	\$25,836.84	\$1,421.03
R	3	6	1	0	0.06	17.81	0.1	1.78	0.8		0.5	0.75	\$205.89	\$11.32
<i>Insert additional rows into the table as required.</i>							<b>Total</b>	<b>34.5</b>	<b>3120.8698</b>			<b>1614.75</b>	<b>\$444,452.51</b>	<b>\$24,444.89</b>
Scattered Tree assessment														
Tree or Cluster ID	Number of trees	Fauna Habitat score	Threatened flora score	Biodiversity score	Loss factor	SEB Points required	SEB Payment	Admin Fee						
1	1	1	0	1.18	1	1.24	\$341.03	\$18.76						
2	1	1	0	1.98	1	2.08	\$572.23	\$31.47						
3	1	1	0	4.02	1	4.22	\$1,161.81	\$63.90						
4	1	1	0	2.22	1	2.33	\$641.60	\$35.29						
5	1	1	0	2.29	1	2.40	\$661.83	\$36.40						
<b>Total</b>	<b>5</b>			<b>11.69</b>		<b>12.27</b>	<b>\$3,378.49</b>	<b>\$185.82</b>						
<i>Insert additional rows into the table as required.</i>														
<b>IBRA Association percent vegetation remnancy (%)</b>							9							
<b>IBRA Subregion percent vegetation remnancy (%)</b>							21							
<b>Is the vegetation associated with a Wetland</b>							No							
<b>Economies of Scale Factor</b>							0.35							
<b>Rainfall (mm)</b>							294							
		<b>Total Biodiversity score</b>	<b>Total SEB points required</b>	<b>SEB Payment</b>	<b>Admin Fee</b>	<b>Total Payment</b>								
<b>Application</b>		3132.56	1627.03	\$447,831.00	\$24,630.70	\$472,461.70								
<b>Risk level</b>	<b>4</b>													
<b>Level 2, 3 or 4</b>														
Principle	Seriously at variance	Vegetation Association	Trees	At variance	Vegetation Association	Trees								
a - Plant species diversity	Yes	A1, B1, H1, H2, R2, T1		Yes	B2, E1, G1									
b - Wildlife habitat	Yes	H1, H2, R1, R2, T1		Yes	E1, G1	1, 2, 3, 4, 5								
c - Rare plant species														
d - Rare plant communities	Yes	A1, B1, B2, H1, R2, T1												
e - Remnancy	Yes	All	All											
f - Wetland														

## Appendix 7: Mercunda Project Block 'R' Ecological Assessment including Bushland Assessment Scoresheets for the SEB Calculation

# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	A
<b>Size of Block (Ha)</b>	33.647
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	16/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

% native veg. remaining in IBRA Assoc.	9
% native veg. remaining in IBRA subregion	21
0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	
<b>Score</b>	0.08
Score received for both IBRA assoc. and subregion then summed	

<b>Percent Vegetation Cover (5km radius) (%)</b>	3
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts	
<b>Score</b>	0

% native veg. protected IBRA Assoc.	37
0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	
<b>Score</b>	0.01

<b>Block Shape</b> Cleared perimeter:Area (km/km2)	
<b>Cleared Perimeter (m) =</b>	2479
<b>Cleared Perimeter to area ratio</b>	7.37
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt	
<b>Score</b>	0.02

<b>Wetland or Riparian Habitat present</b>	
Riparian zone present (Yes/No) = 0.02 pt	No
Swamp/wetland present (Yes/No) = 0.03 pts	No
(Swamp/wetland may be +/- riparian zone)	
<b>Score</b>	0

Note; Blocks will score a minimum Landscape Context Score of 1

<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>	1.11
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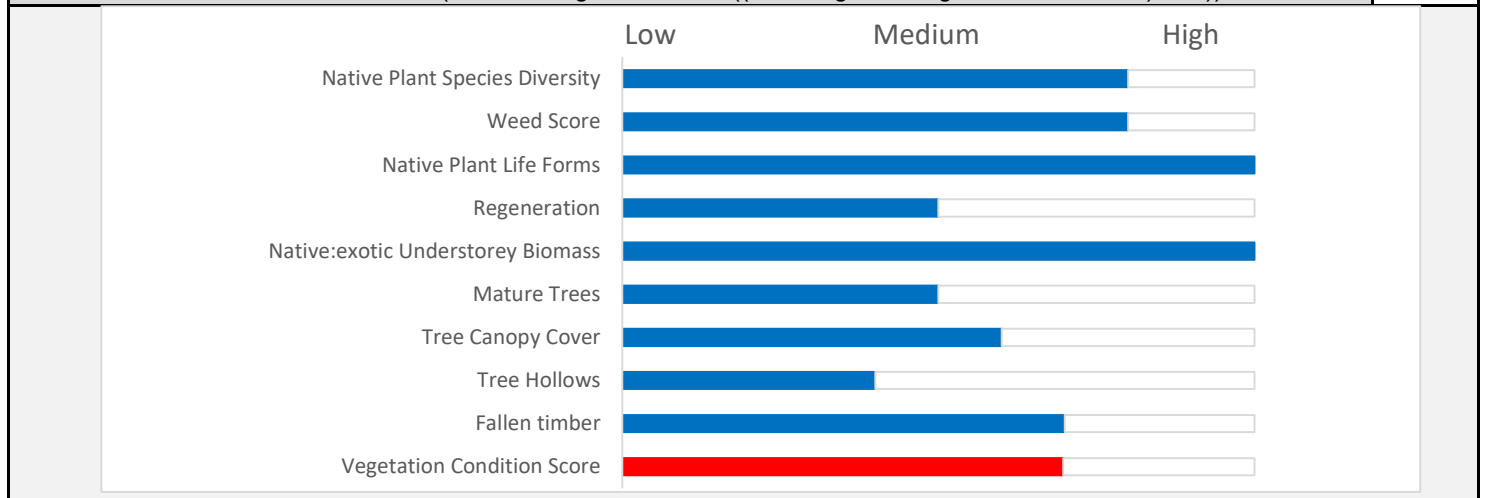
# Vegetation Condition Scores

<b>SITE:</b>	A1
<b>BCM COMMUNITY</b>	MDBSA 3.3 Mallee with Open Sclerophyll / Chenopod shrub Understorey / Tridodia Sandy Loam Flats/Swales
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	Open Mallee over Tridodia
<b>SIZE OF SITE (Ha)</b>	5.98

<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)				<b>Native Plant Life Forms</b>	<b>Cover rating</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)	19			Trees > 15m	
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>	24.0			Trees 5 - 15 m	
				Trees < 5m	
				Mallee > 5m	2
				Mallee < 5m	4
<b>Number of regenerating native species</b>	2			Shrubs > 2m	3
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5	6			Shrubs 0.5 - 2m	3
				Shrubs < 0.5	2
				Forbs	1
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6)	Weed Threat Rating (max 5)	C x I	Mat Plants	
Hordeum sp.	1	1	1	Grasses > 0.2m	1
Avena spp.	1	2	2	Grasses < 0.2m	1
Reichardia tingitana	1	2	2	Sedges > 1m	
Hypochaeris glabra	1	1	1	Sedges < 1m	1
			0	Hummock grasses	4
			6	Vines, scramblers	1
				Mistletoe	
<b>Weed Score (max 15) from benchmark community</b>			12	Ferns	
				Grass-tree	
				<b>Total</b>	23
<b>Native Plant Life Forms (max 20) from benchmark score</b> weighted by a factor of 2					<b>20.0</b>

<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)		<i>Is the community naturally treeless?</i>	<input type="checkbox"/>
<b>Native:exotic Understorey biomass Score (max 5)</b>	5	<b>Fallen Timber/Debris (max 5)</b>	3.5
		<b>Hollow-bearing trees Score (max 5)</b>	2
		<b>Mature Tree Score (max 8)</b>	4
		<b>Tree Canopy Cover Score (max 5)</b>	3

<b>Vegetation Condition Score calculation</b>	
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees	
- If the community Score is Not Benchmarked (SNB) for regeneration this score is multiplied 1.24	
- If the community is naturally treeless this score is multiplied by 1.29	59.50
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score)exp2/2)	5.00
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))	<b>55.78</b>



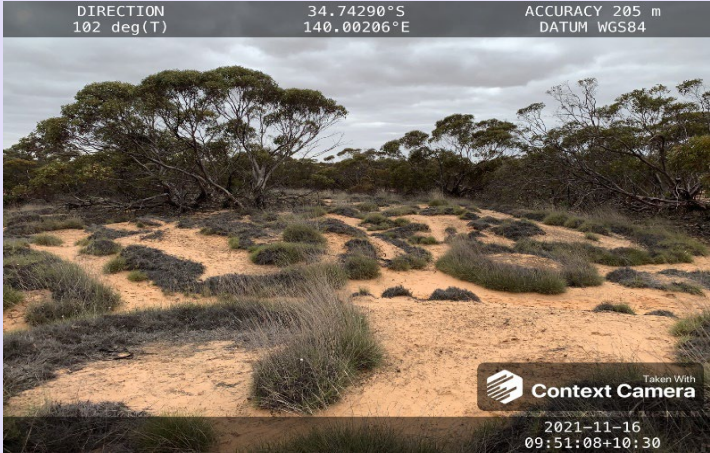
# Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input checked="" type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	<b>Threatened Community Score</b> <b>1.4</b>
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>Threatened Flora Score</b> <b>0</b>
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	6
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	0
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	2
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>Threatened Fauna Score</b> <b>0.1</b>
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.5</b>

## Total Scores for the Site

	<b>Score</b>	Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>1.11</b>	<b>UNIT BIODIVERSITY SCORE</b>	<b>92.88</b>
<b>VEGETATION CONDITION SCORE</b>	<b>55.78</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.50</b>	<b>(Biodiversity Score x hectares)</b>	555.40

## Photo Point and Vegetation Survey Location

	<b>Direction of the Photo</b>	
	West	
	<b>GPS Reference</b>	
	Datum	GDA94
	Zone (52, 53 or 54)	54
	Easting (6 digits)	408622
	Northing (7 digits)	6155055
<b>Description</b>		

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	1.0	Approximate hectares required	36.45
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	294
<b>SEB Points required</b>	<b>291.58</b>	<b>Payment into the fund (GST Exclusive)</b>	<b>\$79,150.40</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$4,353.27</b>

# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	A
<b>Size of Block (Ha)</b>	33.647
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	16/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

<b>Percent Vegetation Cover (5km radius) (%)</b>	3	<b>% native veg. remaining in IBRA Assoc.</b>	9
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts;		<b>% native veg. remaining in IBRA subregion</b>	21
>25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts		0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts;	
<b>Score</b>	0	>30-60% = 0.02 pts; > 60 = 0 pts	<b>Score</b> 0.08
		Score received for both IBRA assoc. and subregion then summed	
<b>Block Shape Cleared perimeter:Area (km/km2)</b>		<b>% native veg. protected IBRA Assoc.</b>	37
<b>Cleared Perimeter (m) =</b>	2479	0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt;	
<b>Cleared Perimeter to area ratio</b>	7.37	>40% = 0	<b>Score</b> 0.01
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt		<b>Wetland or Riparian Habitat present</b>	
<b>Score</b>	0.02	Riparian zone present (Yes/No) = 0.02 pt	No
		Swamp/wetland present (Yes/No) = 0.03 pts	No
		(Swamp/wetland may be +/- riparian zone)	
		<b>Score</b>	0
<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>		<b>1.11</b>	

Note; Blocks will score a minimum Landscape Context Score of 1













# Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input checked="" type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	<b>Threatened Community Score</b> <b>1.4</b>
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>0</b>
<b>Threatened Flora Score</b>	<b>0</b>
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	6
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	0
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	2
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>26</b>
<b>Threatened Fauna Score</b>	<b>0.1</b>
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.5</b>

## Total Scores for the Site

	<b>Score</b>	Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>1.11</b>	<b>UNIT BIODIVERSITY SCORE</b>	<b>114.45</b>
<b>VEGETATION CONDITION SCORE</b>	<b>68.74</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.50</b>	<b>(Biodiversity Score x hectares)</b>	<b>684.40</b>

<b>Photo Point and Vegetation Survey Location</b>		<b>Direction of the Photo</b>	
		North	
		<b>GPS Reference</b>	
		Datum	GDA94
		Zone (52, 53 or 54)	54
		Easting (6 digits)	408817
		Northing (7 digits)	6155122
		<b>Description</b>	

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	1.0	Approximate hectares required	44.91
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	294
<b>SEB Points required</b>	<b>359.31</b>	<b>Payment into the fund (GST Exclusive)</b>	<b>\$97,534.58</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$5,364.40</b>

# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	B1
<b>Size of Block (Ha)</b>	72.560
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	16/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

<b>Percent Vegetation Cover (5km radius) (%)</b>	4	<b>% native veg. remaining in IBRA Assoc.</b>	9
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts		<b>% native veg. remaining in IBRA subregion</b>	21
<b>Score</b>	0	0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	<b>Score</b> 0.08
Score received for both IBRA assoc. and subregion then summed			
<b>Block Shape Cleared perimeter:Area (km/km2)</b>		<b>% native veg. protected IBRA Assoc.</b>	37
<b>Cleared Perimeter (m) =</b>	4437	0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	<b>Score</b> 0.01
<b>Cleared Perimeter to area ratio</b>	6.11	<b>Wetland or Riparian Habitat present</b>	
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt		Riparian zone present (Yes/No) = 0.02 pt	No
<b>Score</b>	0.02	Swamp/wetland present (Yes/No) = 0.03 pts	No
(Swamp/wetland may be +/- riparian zone)			
<b>Score</b>			0
<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>			<b>1.11</b>

Note; Blocks will score a minimum Landscape Context Score of 1









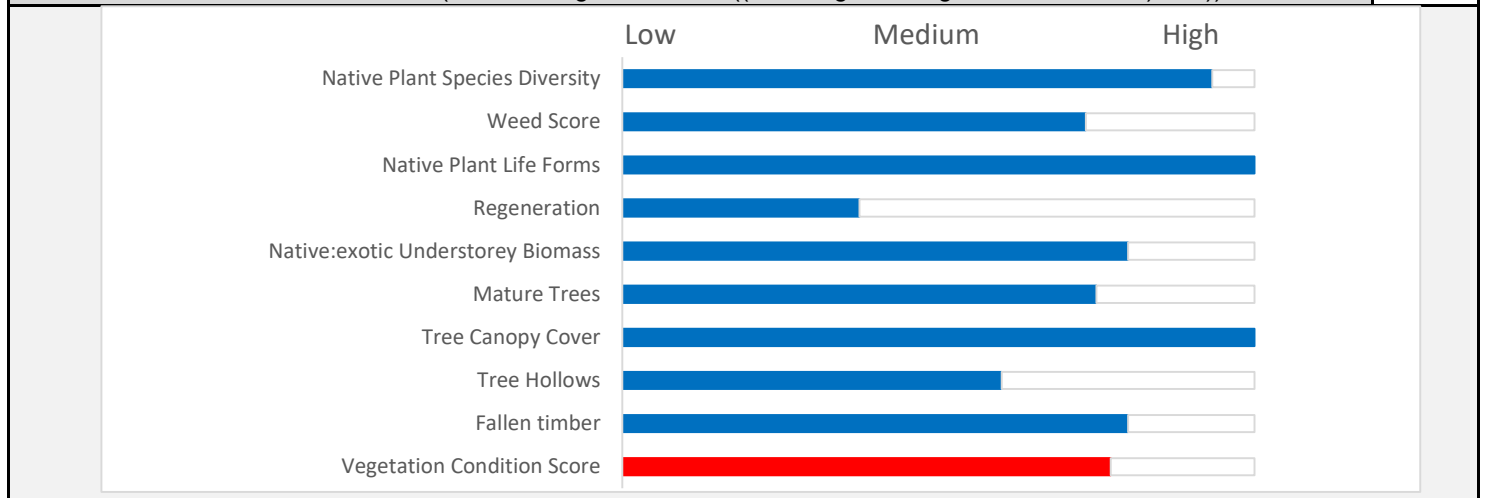
# Vegetation Condition Scores

<b>SITE:</b>	B1
<b>BCM COMMUNITY</b>	MDBSA 3.3 Mallee with Open Sclerophyll / Chenopod shrub Understorey / Triodia Sandy Loam Flats/Swales
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	Mallee over triodia
<b>SIZE OF SITE (Ha)</b>	6.5

<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)				<b>Native Plant Life Forms</b>	<b>Cover rating</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)	24			Trees > 15m	
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>	28.0			Trees 5 - 15 m	
<b>Number of regenerating native species</b>	1			Trees < 5m	
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5	4.5			Mallee > 5m	2
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6)	Weed Threat Rating (max 5)	C x I	Mallee < 5m	5
Brassica spp.	2	2	4	Shrubs > 2m	3
Hypochaeris glabra	1	1	1	Shrubs 0.5 - 2m	3
Reichardia tingitana	1	2	2	Shrubs < 0.5	2
Aira spp.	1	1	1	Forbs	1
			0	Mat Plants	
	<b>Cover x Threat</b>		8	Grasses > 0.2m	1
<b>Weed Score (max 15) from benchmark community</b>	11			Grasses < 0.2m	1
				Sedges > 1m	
				Sedges < 1m	1
				Hummock grasses	4
				Vines, scramblers	1
				Mistletoe	
				Ferns	
				Grass-tree	
				<b>Total</b>	24
<b>Native Plant Life Forms (max 20) from benchmark score</b> weighted by a factor of 2					<b>20.0</b>

<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)		<i>Is the community naturally treeless?</i>	<input type="checkbox"/>
<b>Native:exotic Understorey biomass Score (max 5)</b>	4	<b>Fallen Timber/Debris (max 5)</b>	4
		<b>Hollow-bearing trees Score (max 5)</b>	3
		<b>Mature Tree Score (max 8)</b>	6
		<b>Tree Canopy Cover Score (max 5)</b>	5

<b>Vegetation Condition Score calculation</b>	
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees - If the community Score is Not Benchmarked (SNB) for regeneration this score is multiplied 1.24 - If the community is naturally treeless this score is multiplied by 1.29	65.50
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score)exp2/2)	4.50
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))	<b>61.82</b>





# Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input checked="" type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	<b>Threatened Community Score</b> <b>1.4</b>
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>0</b>
<b>Threatened Flora Score</b>	<b>0</b>
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	6
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	0
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	2
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>26</b>
<b>Threatened Fauna Score</b>	<b>0.1</b>
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.5</b>

## Total Scores for the Site

	<b>Score</b>	Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>1.11</b>	<b>UNIT BIODIVERSITY SCORE</b>	<b>102.92</b>
<b>VEGETATION CONDITION SCORE</b>	<b>61.82</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.50</b>	<b>(Biodiversity Score x hectares)</b>	<b>669.00</b>

<b>Photo Point and Vegetation Survey Location</b>	<b>Direction of the Photo</b>	
	North-west	
	<b>GPS Reference</b>	
	Datum	GDA94
	Zone (52, 53 or 54)	54
	Easting (6 digits)	410065
	Northing (7 digits)	6155163
	<b>Description</b>	

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	1.0	Approximate hectares required	43.90
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	294
<b>SEB Points required</b>	<b>351.22</b>	<b>Payment into the fund (GST Exclusive)</b>	<b>\$95,340.04</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$5,243.70</b>

# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	B2
<b>Size of Block (Ha)</b>	72.560
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	16/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

<b>Percent Vegetation Cover (5km radius) (%)</b>	4	<b>% native veg. remaining in IBRA Assoc.</b>	9
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts		<b>% native veg. remaining in IBRA subregion</b>	21
<b>Score</b>	0	0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	<b>Score</b> 0.08
Score received for both IBRA assoc. and subregion then summed			
<b>Block Shape Cleared perimeter:Area (km/km2)</b>		<b>% native veg. protected IBRA Assoc.</b>	37
<b>Cleared Perimeter (m) =</b>	4437	0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	<b>Score</b> 0.01
<b>Cleared Perimeter to area ratio</b>	6.11		
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt		<b>Wetland or Riparian Habitat present</b>	
<b>Score</b>	0.02	Riparian zone present (Yes/No) = 0.02 pt	No
		Swamp/wetland present (Yes/No) = 0.03 pts	No
		(Swamp/wetland may be +/- riparian zone)	
		<b>Score</b>	0
<i>Note; Blocks will score a minimum Landscape Context Score of 1</i>		<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>	<b>1.11</b>









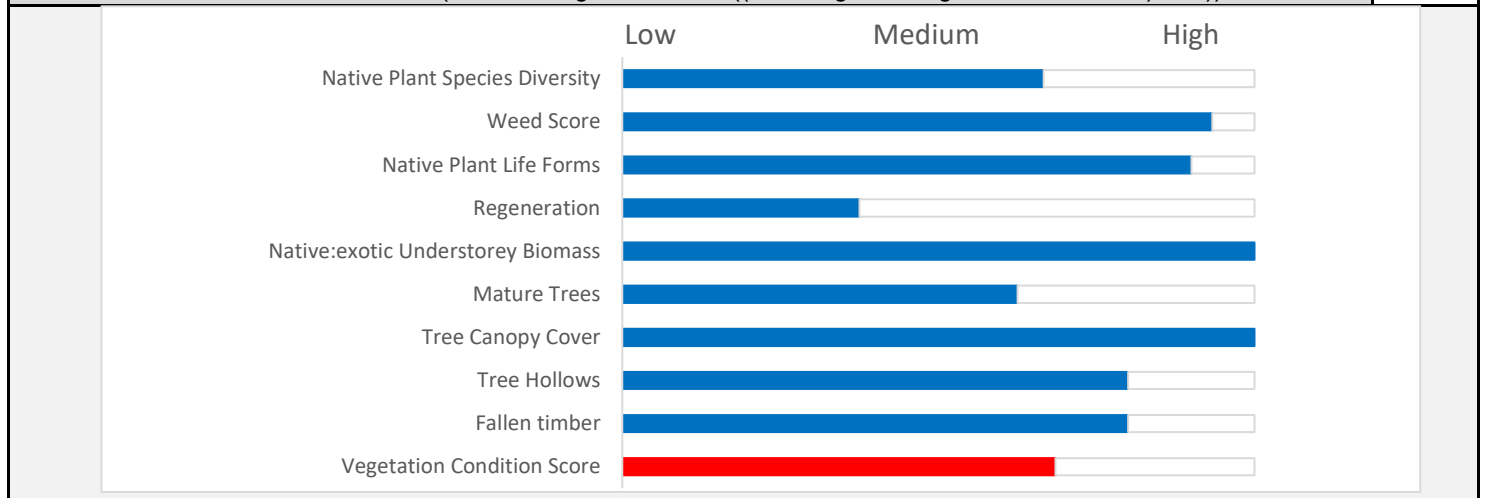
# Vegetation Condition Scores

<b>SITE:</b>	B2
<b>BCM COMMUNITY</b>	MDBSA 3.2 Mallee with Open Sclerophyll / Chenopod Shrub Understorey
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	Mallee over triodia
<b>SIZE OF SITE (Ha)</b>	7.47

<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)				<b>Native Plant Life Forms</b>	<b>Cover rating</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)	18			Trees > 15m	
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>	<b>20.0</b>			Trees 5 - 15 m	
				Trees < 5m	
				Mallee > 5m	3
				Mallee < 5m	5
<b>Number of regenerating native species</b>	1			Shrubs > 2m	1
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5	<b>4.5</b>			Shrubs 0.5 - 2m	2
				Shrubs < 0.5	2
				Forbs	1
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6)	Weed Threat Rating (max 5)	C x I	Mat Plants	
Aira spp.	2	1	2	Grasses > 0.2m	1
Sisymbrium spp.	1	1	1	Grasses < 0.2m	1
			0	Sedges > 1m	
			0	Sedges < 1m	
			0	Hummock grasses	
			0	Vines, scramblers	
			3	Mistletoe	
<b>Weed Score (max 15) from benchmark community</b>	<b>Cover x Threat</b>		<b>14</b>	Ferns	
				Grass-tree	
				<b>Total</b>	<b>16</b>
<b>Native Plant Life Forms (max 20) from benchmark score</b> <i>weighted by a factor of 2</i>					<b>18.0</b>

<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)		<i>Is the community naturally treeless?</i>	<input type="checkbox"/>
<b>Native:exotic Understorey biomass Score (max 5)</b>	<b>5</b>	<b>Fallen Timber/Debris (max 5)</b>	<b>4</b>
		<b>Hollow-bearing trees Score (max 5)</b>	<b>4</b>
		<b>Mature Tree Score (max 8)</b>	<b>5</b>
		<b>Tree Canopy Cover Score (max 5)</b>	<b>5</b>

<b>Vegetation Condition Score calculation</b>	
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees - If the community Score is Not Benchmarked (SNB) for regeneration this score is multiplied 1.24 - If the community is naturally treeless this score is multiplied by 1.29	<b>55.50</b>
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score)exp2/2)	<b>1.00</b>
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))	<b>54.81</b>



# Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input checked="" type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	<b>Threatened Community Score</b> <b>1.4</b>
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>Threatened Flora Score</b> <b>0</b>
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	6
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	0
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	2
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>Threatened Fauna Score</b> <b>0.1</b>
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.5</b>

## Total Scores for the Site

	<b>Score</b>	Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>1.11</b>	<b>UNIT BIODIVERSITY SCORE</b>	<b>91.25</b>
<b>VEGETATION CONDITION SCORE</b>	<b>54.81</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.50</b>	<b>(Biodiversity Score x hectares)</b>	<b>681.66</b>

## Photo Point and Vegetation Survey Location



<b>Direction of the Photo</b>	
South-east	
<b>GPS Reference</b>	
Datum	GDA94
Zone (52, 53 or 54)	54
Easting (6 digits)	410065
Northing (7 digits)	6155163
<b>Description</b>	

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	1.0	Approximate hectares required	44.73
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	294
<b>SEB Points required</b>	<b>357.87</b>	<b>Payment into the fund (GST Exclusive)</b>	<b>\$97,143.65</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$5,342.90</b>



# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	E1
<b>Size of Block (Ha)</b>	1.631
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	16/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

<b>Percent Vegetation Cover (5km radius) (%)</b>	6	<b>% native veg. remaining in IBRA Assoc.</b>	9
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts		<b>% native veg. remaining in IBRA subregion</b>	21
<b>Score</b>	0.02	0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	<b>Score</b> 0.08
Score received for both IBRA assoc. and subregion then summed			
<b>Block Shape Cleared perimeter:Area (km/km2)</b>		<b>% native veg. protected IBRA Assoc.</b>	37
<b>Cleared Perimeter (m) =</b>	1012	0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	<b>Score</b> 0.01
<b>Cleared Perimeter to area ratio</b>	62.05	<b>Wetland or Riparian Habitat present</b>	
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt		Riparian zone present (Yes/No) = 0.02 pt	No
<b>Score</b>	0	Swamp/wetland present (Yes/No) = 0.03 pts	No
(Swamp/wetland may be +/- riparian zone)			
<b>Score</b>			0
<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>			<b>1.11</b>

Note; Blocks will score a minimum Landscape Context Score of 1









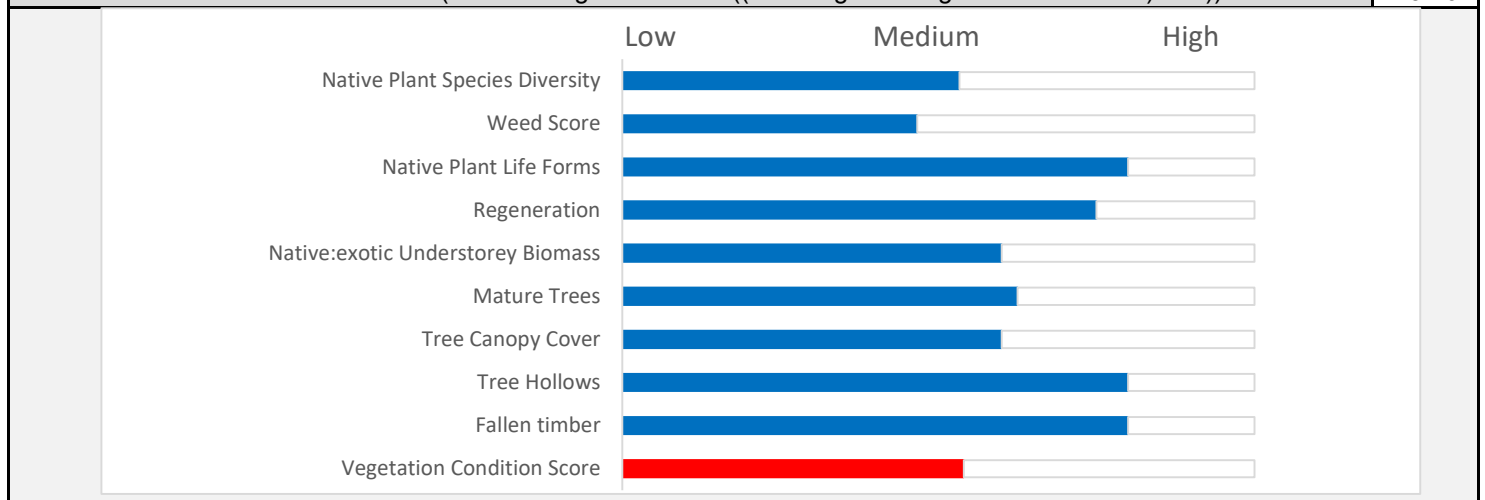
# Vegetation Condition Scores

<b>SITE:</b>	E1
<b>BCM COMMUNITY</b>	MDBSA 3.2 Mallee with Open Sclerophyll / Chenopod Shrub Understorey
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	Open mallee over chenopod
<b>SIZE OF SITE (Ha)</b>	1.63

<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)				<b>Native Plant Life Forms</b>	<b>Cover rating</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)			14	Trees > 15m	
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>			<b>16.0</b>	Trees 5 - 15 m	
				Trees < 5m	1
				Mallee > 5m	2
				Mallee < 5m	3
<b>Number of regenerating native species</b>			3	Shrubs > 2m	2
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5			<b>9</b>	Shrubs 0.5 - 2m	3
				Shrubs < 0.5	2
				Forbs	
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6)	Weed Threat Rating (max 5)	C x I	Mat Plants	
Hordeum sp.	3	1	3	Grasses > 0.2m	
Brassica spp.	3	2	6	Grasses < 0.2m	1
Tribulus terrestris	1	2	2	Sedges > 1m	
Reichardia tingitana	1	2	2	Sedges < 1m	
Avena spp.	1	2	2	Hummock grasses	1
	<b>Cover x Threat</b>		15	Vines, scramblers	
<b>Weed Score (max 15) from benchmark community</b>			<b>7</b>	Mistletoe	
				Ferns	
				Grass-tree	
				<b>Total</b>	15
<b>Native Plant Life Forms (max 20) from benchmark score</b> <i>weighted by a factor of 2</i>					<b>16.0</b>

<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)		<i>Is the community naturally treeless?</i>	<input type="checkbox"/>
<b>Native:exotic Understorey biomass Score (max 5)</b>	3	<b>Fallen Timber/Debris (max 5)</b>	4
		<b>Hollow-bearing trees Score (max 5)</b>	4
		<b>Mature Tree Score (max 8)</b>	5
		<b>Tree Canopy Cover Score (max 5)</b>	3

<b>Vegetation Condition Score calculation</b>	
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees	
- If the community Score is Not Benchmarked (SNB) for regeneration this score is multiplied 1.24	
- If the community is naturally treeless this score is multiplied by 1.29	54.00
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score)exp2/2)	16.00
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))	<b>43.20</b>



# Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	<b>Threatened Community Score</b> 1
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>Threatened Flora Score</b> 0
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	2
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	0
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>Threatened Fauna Score</b> 0.04
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.04</b>

## Total Scores for the Site

	<b>Score</b>	Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>1.11</b>	<b>UNIT BIODIVERSITY SCORE</b>	49.87
<b>VEGETATION CONDITION SCORE</b>	<b>43.20</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.04</b>	<b>(Biodiversity Score x hectares)</b>	81.29

<b>Photo Point and Vegetation Survey Location</b>		<b>Direction of the Photo</b>	
		West	
		<b>GPS Reference</b>	
		Datum	GDA94
		Zone (52, 53 or 54)	54
		Easting (6 digits)	411135
		Northing (7 digits)	6154810
		<b>Description</b>	

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	1.0	Approximate hectares required	5.33
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	294
<b>SEB Points required</b>	<b>42.68</b>	<b>Payment into the fund (GST Exclusive)</b>	<b>\$11,584.50</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$637.15</b>

# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	G1
<b>Size of Block (Ha)</b>	2.765
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	17/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

% native veg. remaining in IBRA Assoc.	9
% native veg. remaining in IBRA subregion	21
0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	
<b>Score</b>	0.08
Score received for both IBRA assoc. and subregion then summed	

<b>Percent Vegetation Cover (5km radius) (%)</b>	7
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts	
<b>Score</b>	0.02

% native veg. protected IBRA Assoc.	37
0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	
<b>Score</b>	0.01

<b>Block Shape</b> Cleared perimeter:Area (km/km2)	
<b>Cleared Perimeter (m) =</b>	1410
<b>Cleared Perimeter to area ratio</b>	50.99
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt	
<b>Score</b>	0

<b>Wetland or Riparian Habitat present</b>	
Riparian zone present (Yes/No) = 0.02 pt	No
Swamp/wetland present (Yes/No) = 0.03 pts	No
(Swamp/wetland may be +/- riparian zone)	
<b>Score</b>	0

Note; Blocks will score a minimum Landscape Context Score of 1

<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>	1.11
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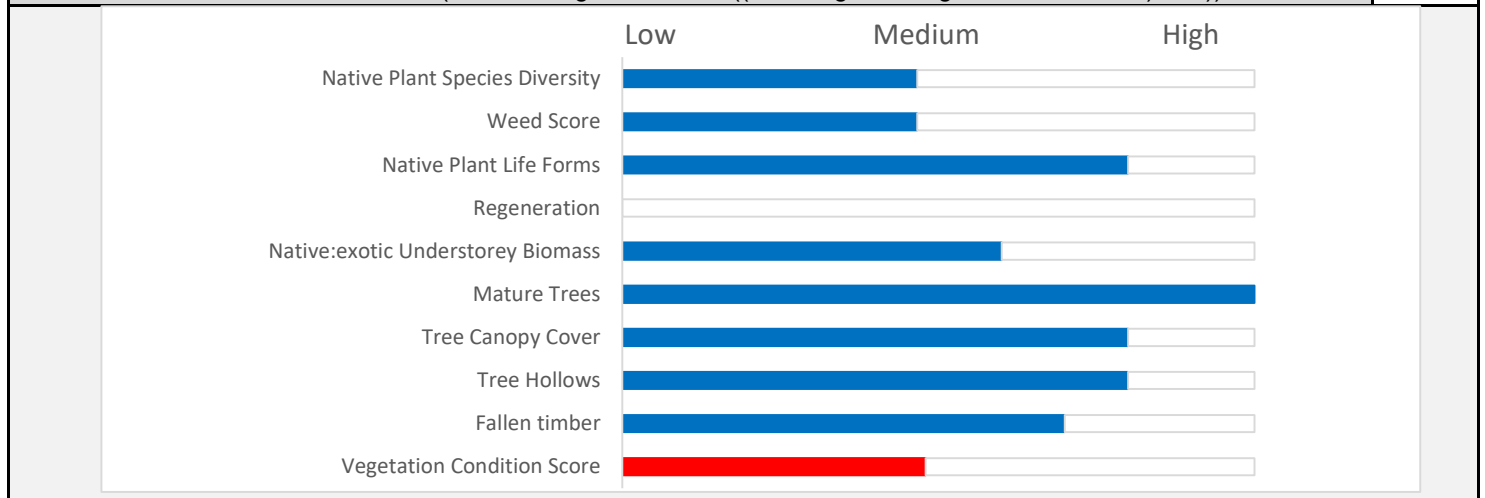
# Vegetation Condition Scores

<b>SITE:</b>	G1
<b>BCM COMMUNITY</b>	MDBSA 3.1 Mallee with Very Open Sclerophyll / Chenopod Shrub Understorey
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	Open mallee over sparse chenopod
<b>SIZE OF SITE (Ha)</b>	1.42

<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)				<b>Native Plant Life Forms</b>	<b>Cover rating</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)			10	Trees > 15m	
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>			<b>14.0</b>	Trees 5 - 15 m	
				Trees < 5m	
				Mallee > 5m	3
				Mallee < 5m	4
<b>Number of regenerating native species</b>			0	Shrubs > 2m	1
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5			<b>0</b>	Shrubs 0.5 - 2m	2
				Shrubs < 0.5	2
				Forbs	
				Mat Plants	
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6)	Weed Threat Rating (max 5)	C x I	Grasses > 0.2m	
Hordeum sp.	3	1	3	Grasses < 0.2m	
Brassica spp.	2	2	4	Sedges > 1m	
Aira spp.	2	1	2	Sedges < 1m	
Reichardia tingitana	1	2	2	Hummock grasses	1
Marrubium vulgare	1	3	3	Vines, scramblers	
	<b>Cover x Threat</b>		14	Mistletoe	
<b>Weed Score (max 15) from benchmark community</b>			<b>7</b>	Ferns	
				Grass-tree	
				<b>Total</b>	13
<b>Native Plant Life Forms (max 20) from benchmark score</b> <i>weighted by a factor of 2</i>					<b>16.0</b>

<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)		<i>Is the community naturally treeless?</i>	<input type="checkbox"/>
<b>Native:exotic Understorey biomass Score (max 5)</b>	3	<b>Fallen Timber/Debris (max 5)</b>	3.5
		<b>Hollow-bearing trees Score (max 5)</b>	4
		<b>Mature Tree Score (max 8)</b>	8
		<b>Tree Canopy Cover Score (max 5)</b>	4

<b>Vegetation Condition Score calculation</b>	
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees - If the community Score is Not Benchmarked (SNB) for regeneration this score is multiplied 1.24 - If the community is naturally treeless this score is multiplied by 1.29	45.50
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score)exp2/2)	12.50
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))	<b>38.39</b>



# Conservation Significance Score

<b>Is the vegetation association considered a Threatened Ecological community or Ecosystem?</b>	<b>Yes/No</b>
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	<b>Threatened Community Score</b> 1
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>Threatened Flora Score</b> 0
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	3
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	0
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>Threatened Fauna Score</b> 0.04
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.04</b>

## Total Scores for the Site

<b>LANDSCAPE CONTEXT SCORE</b>	<b>Score</b> 1.11	Vegetation Condition x Landscape Context x Conservation Significance = <b>UNIT BIODIVERSITY SCORE</b> 44.32 <b>Total Biodiversity Score</b> (Biodiversity Score x hectares) 62.93
<b>VEGETATION CONDITION SCORE</b>	<b>38.39</b>	
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.04</b>	

## Photo Point and Vegetation Survey Location

	<b>Direction of the Photo</b>	North
	<b>GPS Reference</b>	
	Datum	GDA94
	Zone (52, 53 or 54)	54
	Easting (6 digits)	411555
	Northing (7 digits)	6154254
	<b>Description</b>	

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	1.0	Approximate hectares required	4.13
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	294
<b>SEB Points required</b>	<b>33.04</b>	<b>Payment into the fund (GST Exclusive)</b>	<b>\$8,968.49</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$493.27</b>

# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	H1
<b>Size of Block (Ha)</b>	24.168
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	17/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

% native veg. remaining in IBRA Assoc.	9
% native veg. remaining in IBRA subregion	21
0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	
<b>Score</b>	0.08
Score received for both IBRA assoc. and subregion then summed	

<b>Percent Vegetation Cover (5km radius) (%)</b>	7
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts	
<b>Score</b>	0.02

<b>% native veg. protected IBRA Assoc.</b>	37
0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	
<b>Score</b>	0.01

<b>Block Shape Cleared perimeter:Area (km/km2)</b>	
<b>Cleared Perimeter (m) =</b>	7970
<b>Cleared Perimeter to area ratio</b>	32.98
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt	
<b>Score</b>	0

<b>Wetland or Riparian Habitat present</b>	
Riparian zone present (Yes/No) = 0.02 pt	No
Swamp/wetland present (Yes/No) = 0.03 pts	No
(Swamp/wetland may be +/- riparian zone)	
<b>Score</b>	0

Note; Blocks will score a minimum Landscape Context Score of 1

<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>	1.11
---	------














# Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?		Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)		<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)		<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)		<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)		<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)		<input checked="" type="checkbox"/>
Note: all sites will score a minimum Conservation Significance Score of 1		<b>Threatened Community Score</b> <b>1.4</b>
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>		<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>		
State <b>Rare</b> species recorded (1 pt each)		0
State <b>Vulnerable</b> species recorded (2.5 pt each)		0
State <b>Endangered</b> recorded (5 pts each)		0
Nationally <b>Vulnerable</b> species recorded (10 pts each)		0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)		0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts		<b>0</b>
<b>Threatened Flora Score</b>		<b>0</b>
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>		<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>		
State <b>Rare</b> species observed or locally recorded (1 pt each)		6
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)		0
State <b>Endangered</b> species observed or locally recorded (5 pt each)		0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)		2
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)		0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts		<b>26</b>
<b>Threatened Fauna Score</b>		<b>0.1</b>
<b>CONSERVATION SIGNIFICANCE SCORE</b>		<b>1.5</b>

## Total Scores for the Site

		Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>Score</b> <b>1.11</b>	<b>UNIT BIODIVERSITY SCORE</b>	<b>107.08</b>
<b>VEGETATION CONDITION SCORE</b>	<b>64.31</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.50</b>	<b>(Biodiversity Score x hectares)</b>	<b>50.33</b>

## Photo Point and Vegetation Survey Location

 <p>DIRECTION 44 deg(T)      34.74707°S 140.04565°E      ACCURACY 5 m DATUM WGS84</p> <p>Context Camera Taken With 2021-11-17 08:26:50+10:30</p>	<b>Direction of the Photo</b>	
	North East	
	<b>GPS Reference</b>	
	Datum	GDA94
	Zone (52, 53 or 54)	54
	Easting (6 digits)	412644
	Northing (7 digits)	6154594
<b>Description</b>		

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	1.0	Approximate hectares required	3.30
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	294
<b>SEB Points required</b>	<b>26.42</b>	<b>Payment into the fund (GST Exclusive)</b>	<b>\$7,172.28</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$394.48</b>

# Bushland Assessment Scoresheets

(Version - 1 July 2020)

<b>Block</b>	H2
<b>Size of Block (Ha)</b>	4.710
<b>Landscape Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Greg Smith and Phil Barron
<b>DATE OF ASSESSMENT</b>	17/11/2021

## Map of the Block (Including the Sites)



## Landscape Context Scores

% native veg. remaining in IBRA Assoc.	9
% native veg. remaining in IBRA subregion	21
0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	
<b>Score</b>	0.08
Score received for both IBRA assoc. and subregion then summed	

<b>Percent Vegetation Cover (5km radius) (%)</b>	7
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts	
<b>Score</b>	0.02

<b>% native veg. protected IBRA Assoc.</b>	37
0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	
<b>Score</b>	0.01

<b>Block Shape Cleared perimeter:Area (km/km2)</b>	
<b>Cleared Perimeter (m) =</b>	1680
<b>Cleared Perimeter to area ratio</b>	35.67
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt	
<b>Score</b>	0

<b>Wetland or Riparian Habitat present</b>	
Riparian zone present (Yes/No) = 0.02 pt	No
Swamp/wetland present (Yes/No) = 0.03 pts	No
(Swamp/wetland may be +/- riparian zone)	
<b>Score</b>	0

Note; Blocks will score a minimum Landscape Context Score of 1

<b>LANDSCAPE CONTEXT SCORE (max 1.25)</b>	1.11
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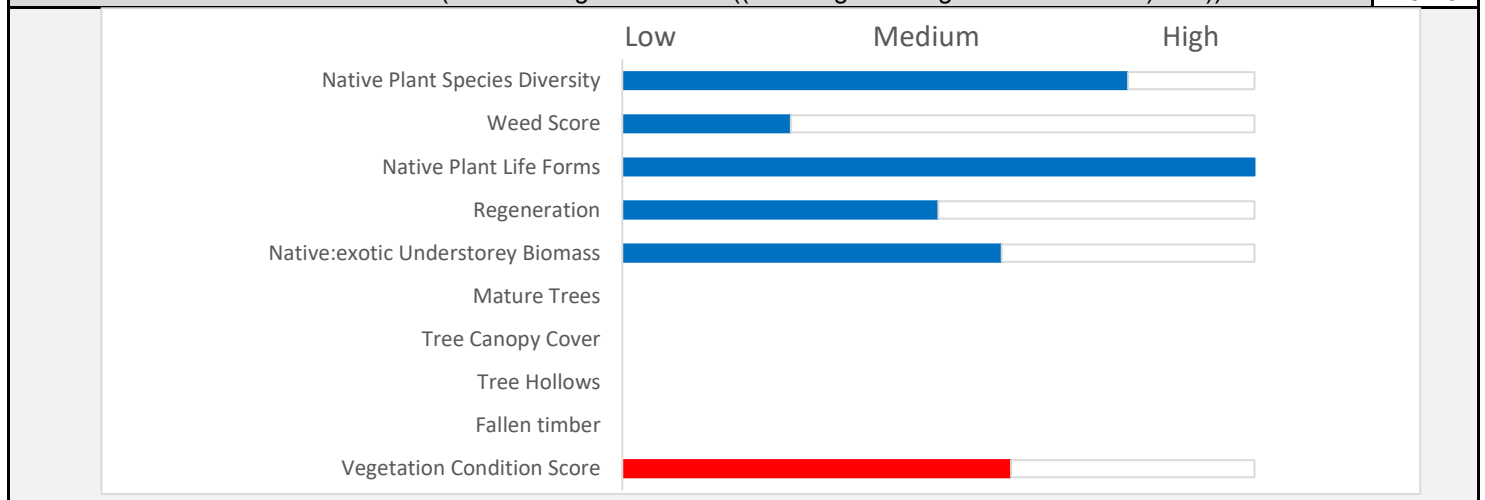
# Vegetation Condition Scores

<b>SITE:</b>	H2
<b>BCM COMMUNITY</b>	MDBSA 2.2 Chenopod Open Shrublands
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	Mallee over chenopod
<b>SIZE OF SITE (Ha)</b>	1.94

<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)				<b>Native Plant Life Forms</b>	<b>Cover rating</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)	14			Trees > 15m	
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>	<b>24.0</b>			Trees 5 - 15 m	
				Trees < 5m	
				Mallee > 5m	2
				Mallee < 5m	2
<b>Number of regenerating native species</b>	2			Shrubs > 2m	1
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5	<b>6</b>			Shrubs 0.5 - 2m	3
				Shrubs < 0.5	4
				Forbs	1
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6)	Weed Threat Rating (max 5)	C x I	Mat Plants	1
Avena spp.	4	2	8	Grasses > 0.2m	1
Reichardia tingitana	3	2	6	Grasses < 0.2m	1
Hordeum sp.	2	1	2	Sedges > 1m	
Asphodelus fistulosus	1	2	2	Sedges < 1m	
Marrubium vulgare	1	3	3	Hummock grasses	
	<b>Cover x Threat</b>		<b>21</b>	Vines, scramblers	
<b>Weed Score (max 15) from benchmark community</b>			<b>4</b>	Mistletoe	
				Ferns	
				Grass-tree	
				<b>Total</b>	<b>16</b>
<b>Native Plant Life Forms (max 20) from benchmark score</b> weighted by a factor of 2					<b>20.0</b>

<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)		<i>Is the community naturally treeless?</i>	<input type="checkbox"/>
<b>Native:exotic Understorey biomass Score (max 5)</b>	<b>3</b>	<i>Tree attributes not scored for treeless communities or communities with only emergent trees</i>	<b>0-5</b>
			<b>2</b>
			<b>2</b>
			<b>0</b>

<b>Vegetation Condition Score calculation</b>	
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees - If the community Score is Not Benchmarked (SNB) for regeneration this score is multiplied 1.24 - If the community is naturally treeless this score is multiplied by 1.29	<b>64.50</b>
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - (Biomass score x 2))exp2/2)	<b>19.00</b>
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))	<b>49.18</b>



# Conservation Significance Score

<b>Is the vegetation association considered a Threatened Ecological community or Ecosystem?</b>	<b>Yes/No</b>
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	<b>Threatened Community Score</b> 1
<b>Number of Threatened Flora Species recorded for the site (within the site)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>Threatened Flora Score</b> 0
<b>Potential habitat for Threatened Fauna Species (number observed or previously recorded)</b>	<b>Number</b>
<i>*If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	2
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	0
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>Threatened Fauna Score</b> 0.04
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.04</b>

<b>Total Scores for the Site</b>	Vegetation Condition x Landscape Context x Conservation Significance =
<b>LANDSCAPE CONTEXT SCORE</b> 1.11	<b>UNIT BIODIVERSITY SCORE</b> 56.77
<b>VEGETATION CONDITION SCORE</b> 49.18	<b>Total Biodiversity Score</b>
<b>CONSERVATION SIGNIFICANCE SCORE</b> 1.04	<b>(Biodiversity Score x hectares)</b> 110.14

<b>Photo Point and Vegetation Survey Location</b>	<b>Direction of the Photo</b>
<p>DIRECTION 39 deg(T)      34,74989°S      ACCURACY 7 m 140.04154°E      DATUM WGS84</p> <p>Context Camera 2021-11-17 09:28:25+10:30</p>	North East
	<b>GPS Reference</b>
	Datum GDA94
	Zone (52, 53 or 54) 54
	Easting (6 digits) 412261
	Northing (7 digits) 6154280
	<b>Description</b>

What is the purpose of Assessment?	<input type="button" value="Clearance"/> <input type="button" value="SEB Area"/> <input type="button" value="Other"/>
<b>Assessment for Clearance</b>	<b>Approximate hectares required</b> 7.23
Loss Factor 1.0	<b>Economies of Scale Factor</b> 0.35
Loadings for clearance of protected areas	<b>Mean Annual rainfall for the site (mm)</b> 294
Reductions for rehabilitation of impact site 0.5	<b>Payment into the fund (GST Exclusive)</b> \$15,696.65
<b>SEB Points required</b> 57.83	<b>Administration fee (GST Inclusive)</b> \$863.32

# SEB Required for Scattered Trees

(Version - 1 July 2020)

Landscapes Region	M&R
Mean Annual Rainfall (mm)	298
Economies of Scale factor	0.35

Total Biodiversity Score	26.67
Total SEB Points required	28.01
Total SEB \$ required	\$8,129.58

IBRA Association	Kunlara
------------------	---------

Tree Species	Number of Trees	Total SEB Points required	Payment in NV Fund (GST Exclusive)	Administration fee (GST Inclusive)	Total
Eucalyptus incrassata	9	14.46	\$3,979.68	\$218.88	\$4,198.56
Eucalyptus phenax ssp phenax	5	10.34	\$2,844.69	\$156.46	\$3,001.14
Eucalyptus oleosa	2	0.59	\$162.22	\$8.92	\$171.14
Melaleuca lanceolata	2	2.61	\$719.18	\$39.56	\$758.74
	0	0.00	\$0.00	\$0.00	\$0.00

Tree No.	Species description)	Number of trees in a clump (enter 1 for individual trees)	Height (m)	Diameter at 1m above ground level (cm)	Dieback %	Number of Hollows			Suitability for fauna threatened species					Threatened sp.  Tree species is; R = Rare V = Vulnerable E = Endangered	Remnancy IBRA Assoc. % veg remaining	Loss Factor
						Small	Medim	Large	Number of species							
									Uncommon	NP&W Act - Rare	NP&W Act - Endangered or Vulnerable (exclude EBPC Spp)	EPBC Listed spp.				
1	<i>Eucalyptus incrassata</i>	1	7.0	19	30				6	1				9	1.0	
2	<i>Eucalyptus incrassata</i>	1	4.0	21.5	5		2	2	6	1				9	1.0	
3	<i>Eucalyptus phenax ssp phenax</i>	1	6.6	43	30	1		1	6	1				9	1.0	
4	<i>Eucalyptus incrassata</i>	1	5.0	25	30	1	1		6	1				9	1.0	
5	<i>Eucalyptus incrassata</i>	1	8.0	26.5	40	4	1		6	1				9	1.0	
6	<i>Eucalyptus incrassata</i>	1	5.0	22.5	70				6	1				9	1.0	
7	<i>Eucalyptus incrassata</i>	1	6.5	33	50	3	3	1	6	1				9	1.0	
8	<i>Eucalyptus phenax ssp phenax</i>	1	7.5	34	50	1	1		6	1				9	1.0	
9	<i>Eucalyptus oleosa</i>	1	6.5	28	70				6	1				9	1.0	
10	<i>Eucalyptus oleosa</i>	1	6.5	20	60				6	1				9	1.0	
11	<i>Eucalyptus phenax ssp phenax</i>	1	6.0	22	50				6	1				9	1.0	
12	<i>Eucalyptus phenax ssp phenax</i>	1	6.0	24	50				6	1				9	1.0	
13	<i>Eucalyptus incrassata</i>	1	4.5	19	50				6	1				9	1.0	
14	<i>Eucalyptus phenax ssp phenax</i>	1	5.5	27	70	1			6	1				9	1.0	
15	<i>Melaleuca lanceolata (South East and Southern Murray Mallee)</i>	1	5.5	29	0				4	0				9	1.0	
16	<i>Eucalyptus incrassata</i>	1	3.8	18	15				6	1				9	1.0	
17	<i>Eucalyptus incrassata</i>	1	5.0	28	10				6	1				9	1.0	
18	<i>Melaleuca lanceolata (South East and Southern Murray Mallee)</i>	1	6.0	27	0				4					9	1.0	

Species	Fauna habitat Score	Threatened flora score	Biodiversity score (Max 15) (Score per tree)	Total biodiversity score	SEB Points Req.	Total SEB Payment \$	Optional Unique tree ID	Optional Photo No.
Eucalyptus incrassata	1	0	1.18	1.18	1.23	\$358.18	ST1	
Eucalyptus incrassata	1	0	1.98	1.98	2.08	\$603.70	ST2	
Eucalyptus phenax ssp phenax	1	0	4.02	4.02	4.22	\$1,225.28	ST2	
Eucalyptus incrassata	1	0	2.22	2.22	2.33	\$677.20	ST2	
Eucalyptus incrassata	1	0	2.29	2.29	2.41	\$699.06	ST3	
Eucalyptus incrassata	1	0	0.55	0.55	0.58	\$167.61	ST4	
Eucalyptus incrassata	1	0	2.42	2.42	2.54	\$736.39	ST5	
Eucalyptus phenax ssp phenax	1	0	2.46	2.46	2.58	\$750.29	ST6	
Eucalyptus oleosa	1	0	0.30	0.30	0.31	\$91.11	ST7	
Eucalyptus oleosa	1	0	0.26	0.26	0.28	\$80.03	ST7	
Eucalyptus phenax ssp phenax	1	0	1.06	1.06	1.12	\$324.37	ST7	
Eucalyptus phenax ssp phenax	1	0	1.11	1.11	1.17	\$339.12	ST7	
Eucalyptus incrassata	1	0	0.53	0.53	0.55	\$160.13	ST7	
Eucalyptus phenax ssp phenax	1	0	1.19	1.19	1.25	\$362.07	ST8	
Melaleuca lanceolata	1	0	1.22	1.22	1.28	\$371.68	ST9	
Eucalyptus incrassata	1	0	0.58	0.58	0.61	\$176.18	ST10	
Eucalyptus incrassata	1	0	2.03	2.03	2.14	\$620.11	ST10	
Melaleuca lanceolata	1	0	1.27	1.27	1.33	\$387.05	ST11	

Height formula	
2	4
2	4
2	4
2	4
2	4
2	4
2	4
2	4
5	10
5	10
2	4
2	4
2	4
2	4
3	6
2	4
2	4
3	6

## Appendix 8: Bushland Assessment Scoresheets for MPL 77 – Block R





**ECOSPHERE**  
Ecological Solutions

# Mercunda Project Block 'R' Ecological Assessment

5 August 2022



# Document information and distribution

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Client	JBS&G Australia Pty Ltd
Prepared by	Andrew Sinel
Document status	Draft
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Authors	Document status	Version number	Date of issue	Issued to
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# 1 Introduction

Ecosphere was engaged by JBS&G on behalf of Murray Zircon to undertake an assessment as part of the Mercunda Strandline Project, located approximately 150 km east of Adelaide in the Murray Mallee Region of South Australia (Figure 1). This assessment was specifically targeted to Block 'R' within the Miscellaneous Purposes Licence (MPL) 77area (Figure 2).

A broader Ecological assessment and native vegetation management plan for the overall Mercunda Strandline Project was undertaken by GBS Consulting (Smith 2022). Please refer to that document for all background information related to the overall project.

## 1.1 Objectives

The purpose of the Block R ecological assessment was to determine the potential impacts to flora and fauna within the Block R development footprint. The specific objectives of the assessment were to:

- review any existing mapping data and existing information (e.g., vegetation communities, vegetation condition and aerial photographs)
- collect vegetation data to inform impacts as part of the development footprint within Block R
- identify any flora species of Commonwealth or state conservation significance known to, or likely to, occur in the area
- identify any declared plants under the *Landscape South Australia Act 2019* (LSA Act) that may be significant
- conduct an opportunistic fauna assessment to determine if any native fauna species, or fauna habitat, of Commonwealth or state significance may be impacted upon by the Project not identified in previous studies.

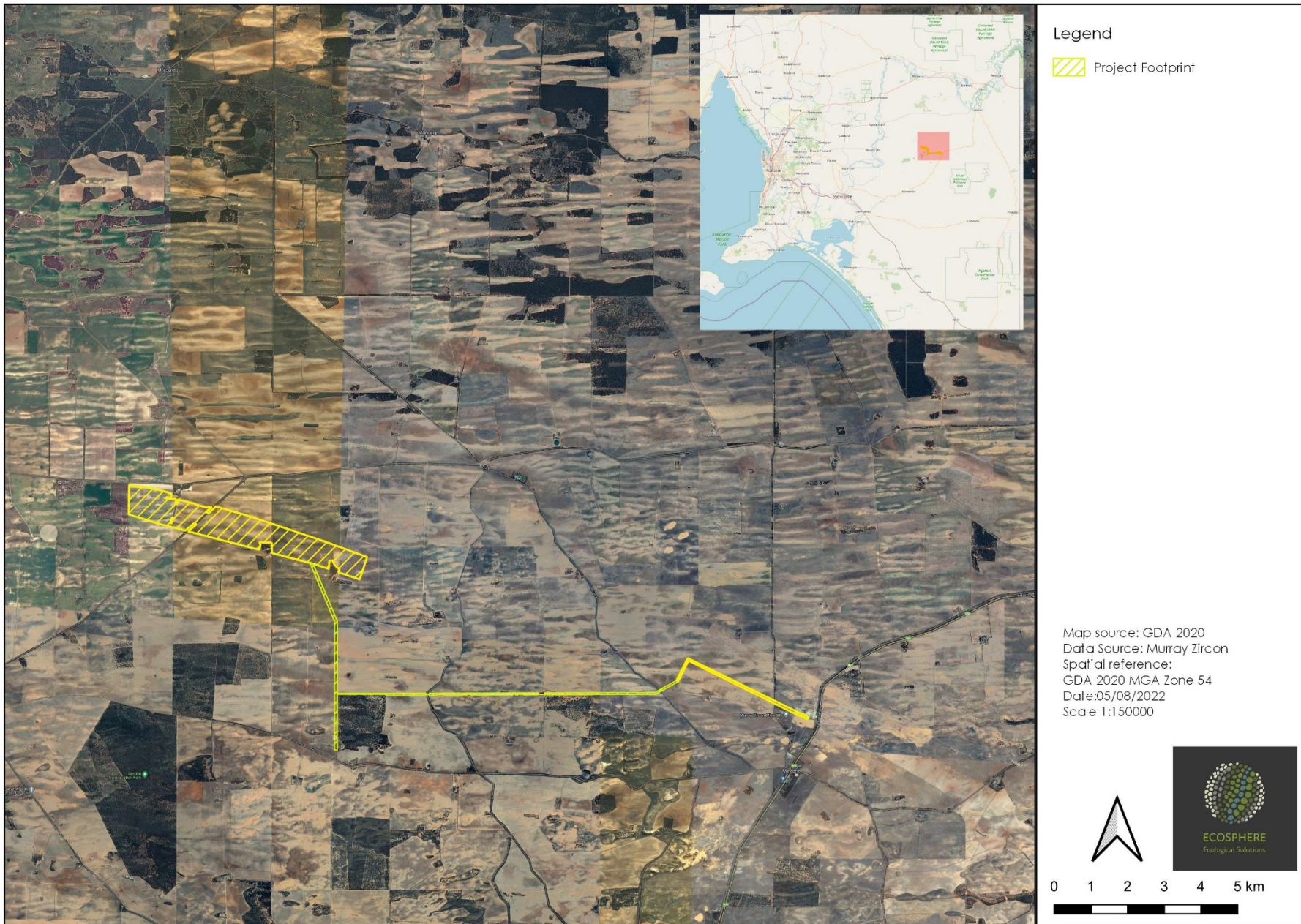


Figure 1. Location of the overall Murray Zircon ML and MPL area.

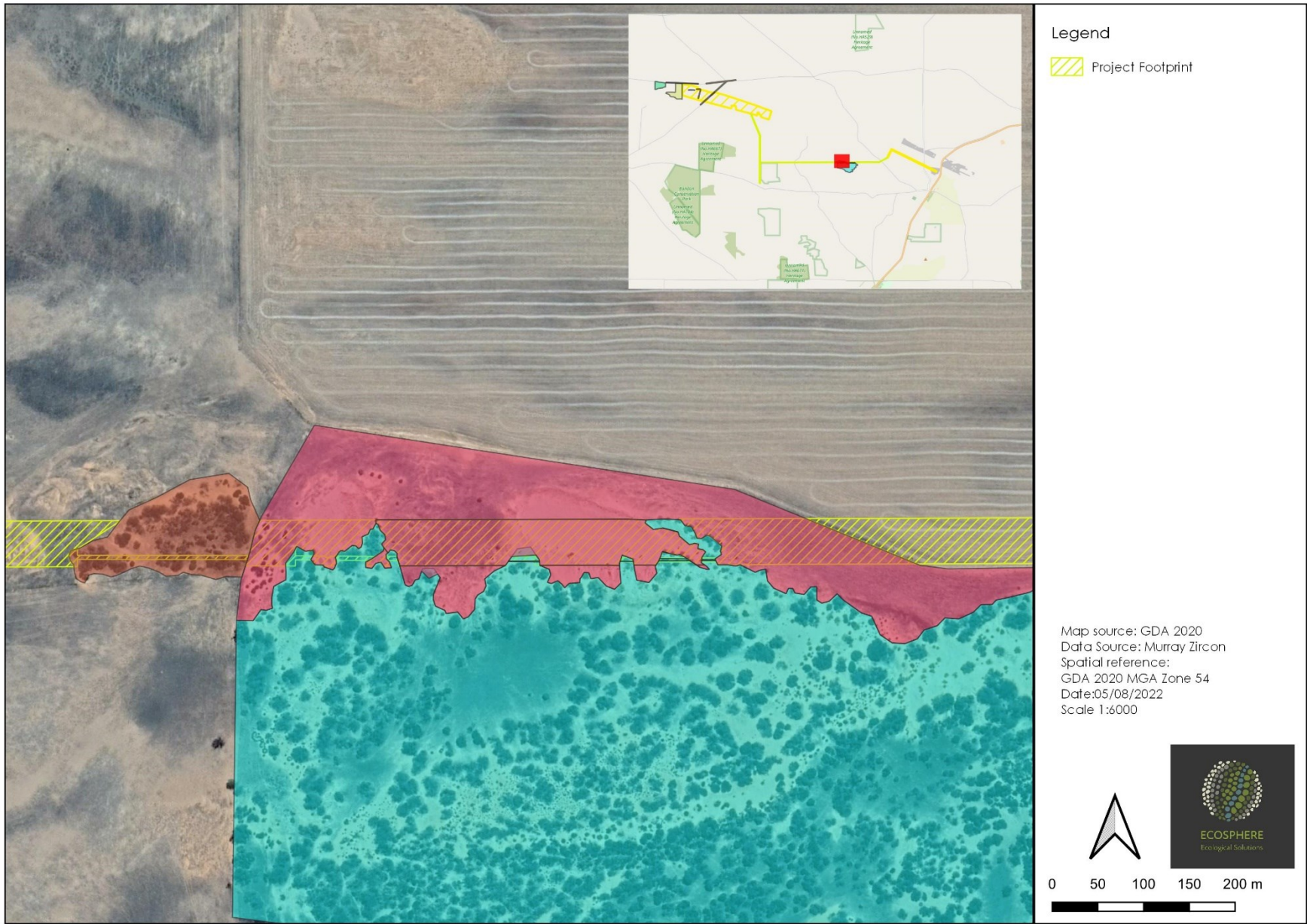


Figure 2. Location of specific Block R development footprint.

# 2 Methods

## 2.1 Bushland assessment sheets

The standard fauna species conservation significance score is based partly on historical BDBSA records for all fauna species observations within 5km of the area since 1995 and with a less than 1km spatial reliability. In this instance, no records were available within 5 km. As a result, the search area was widened to 10 km to get a suitable sample of the species richness expected within similar habitats.

## 2.2 Field survey

The field survey was conducted on 27th July 2022 by NVC accredited ecologist Andrew Sinel. The field survey included a vegetation survey and passive fauna assessment.

### 2.2.1 Vegetation survey

All Block R sites were assessed using the Bushland Assessment Methodology (BAM). The NVC BAM was designed for assessing vegetation that is located within the agricultural region of South Australia. The BAM uses biodiversity 'surrogates' or 'indicators' to measure biodiversity value against benchmark communities. Each area to be assessed is termed an application area ('Block'), within which different vegetation associations ('Sites') are identified. The survey was a targeted assessment and focussed on the Miscellaneous Purpose Licence 77 area associated the Mercunda strandline and continued from the GBS consulting document Blocks M to Q and was allocated Block R.

### 2.2.2 Fauna

A focus of the on-ground fauna assessment was on avian species due to the availability of passive observations and low interference required. For more inconspicuous fauna species, opportunistic observations were recorded, or alternatively, the native vegetation within the Project area buffer was assessed for fauna habitat value. The likelihood of species occurring within the project footprint buffer was made based on the presence of suitable habitat and included:

- reviewing previous field survey results and database records;
- assessing the habitat value of the vegetation during the field survey to determine the fauna species likely to occur within the Project area; and
- highlighting any areas of significant fauna value.



# 3 Results

## 3.1 Field Assessment

The vegetation was assessed within the proposed Block R disturbance footprint. Each site was recorded as a hectare site within a linear configuration consistent with the development footprint.

### 3.1.1 Vegetation associations

Three vegetation associations (sites) were present within the disturbance footprint and are summarised below in Table 1 and shown below in Figure 3. Unit Biodiversity Scores (UBS) ranged between 5.08 and 76.54. Vegetation associated with the dune crest was recorded in the best condition however remained relatively degraded due to factors such as pastoral use, rabbits and clearance of surrounding areas. Generally, condition was poor and biodiversity value low. Each vegetation site and associated scores are summarised below in Table 2 to Table 4.

Table 1. Vegetation association summary.

Asso c #	Description	UBS
1	<i>Eucalyptus incrassata</i> (Ridge Fruited Mallee) Mixed Mallee over <i>Triodia</i> spp. (Spinifex)	76.54
2	Exotic grass/herb land +/- emergent <i>Acacia ligulata</i> (Sandhill Wattle) and <i>Beyeria opaca</i> (Dark Turpentine Bush)	5.08
3	<i>Eucalyptus incrassata</i> (Ridge Fruited Mallee) +/- <i>Melaleuca lanceolata</i> (Dryland Teatree) and <i>Leptospermum coriaceum</i> (Mallee Teatree) Mixed Mallee over sparsely scattered chenopod shrubs and exotic herbaceous and grass spp.	17.81


Table 2. Vegetation association 1 summary.

Vegetation Association R1	<i>Eucalyptus incrassata</i> (Ridge Fruited Mallee) Mixed Mallee over <i>Triodia</i> spp. (Spinifex)				
					
General description	Degraded Mallee community on dune however recorded 24 indigenous flora species were recorded which was higher than expected for a community as degraded as this and with low cover comparatively with intact benchmark communities. Limited regeneration was observed from disturbance resistant and unpalatable species such as <i>Acacia ligulata</i> (Sandhill Wattle) and <i>Pittosporum angustifolium</i> (Native Apricot). Generally, the site had low ecological value due to the lack of ground cover species present however there were features such as hollow bearing limbs.				
Threatened species or community	Fulfills requirements under the Mallee Bird Community of the Murray Darling Depression Bioregion Threatened Ecological Community listed as Endangered under the EPBC Act.				
Landscape context score	1.12	Vegetation Condition Score	50.25	Conservation significance score	1.36
Unit biodiversity Score	76.54	Area (ha)	0.09	Total biodiversity Score	6.89

Table 3. Vegetation association 2 summary.

Vegetation Association R2	Exotic grass/herb land +/- emergent <i>Acacia ligulata</i> (Sandhill Wattle) and <i>Beyeria opaca</i> (Dark Turpentine Bush)				
DIRECTION NW (T)		54s 421865 6149649		ACCURACY 777 m DATUM GDA2020	
					
General description	Highly degraded open dune blowout area where colonisation by exotic weeds has dominated the cover however the lack of topsoil in some areas has allowed indigenous species to regenerate in the absence of significant exotic cover. Scattered shrubs very sparsely present and all consisting of one of three species including <i>Acacia ligulata</i> (Sandhill Wattle), <i>Beyeria opaca</i> (Turpentine Bush) and <i>Leptospermum coriaceum</i> (Mallee Teatree). Few other grass and herbaceous species present however <i>Aristida holathera</i> (Kerosene Grass) was providing good cover in some areas and was at the southern extent of the species range here.				
Threatened species or community	Not a threatened community				
Landscape context score	1.12	Vegetation Condition Score	4.28	Conservation significance score	1.06
Unit biodiversity Score	5.08	Area (ha)	2.92	Total biodiversity Score	14.82

Table 4. Vegetation association 3 summary.

Vegetation Association R3	<i>Eucalyptus incrassata</i> (Ridge Fruited Mallee) +/- <i>Melaleuca lanceolata</i> (Dryland Teatree) and <i>Leptospermum coriaceum</i> (Mallee Teatree) Mixed Mallee over sparsely scattered chenopod shrubs and exotic herbaceous and grass spp.				
DIRECTION S (T)		54s 421744 6149655		ACCURACY 6 m DATUM GDA2020	
					
27/7/2022					
General description	Highly degraded community where management has altered the understorey structure to be almost completely dominated by exotic species with only a few chenopod shrubs and sparsely present native grass tussocks present as understorey. Rabbits were also highly prevalent in this area.				
Threatened species or community	Not a threatened community				
Landscape context score	1.12	Vegetation Condition Score	15.00	Conservation significance score	1.06
Unit biodiversity Score	17.81	Area (ha)	0.1	Total biodiversity Score	1.69

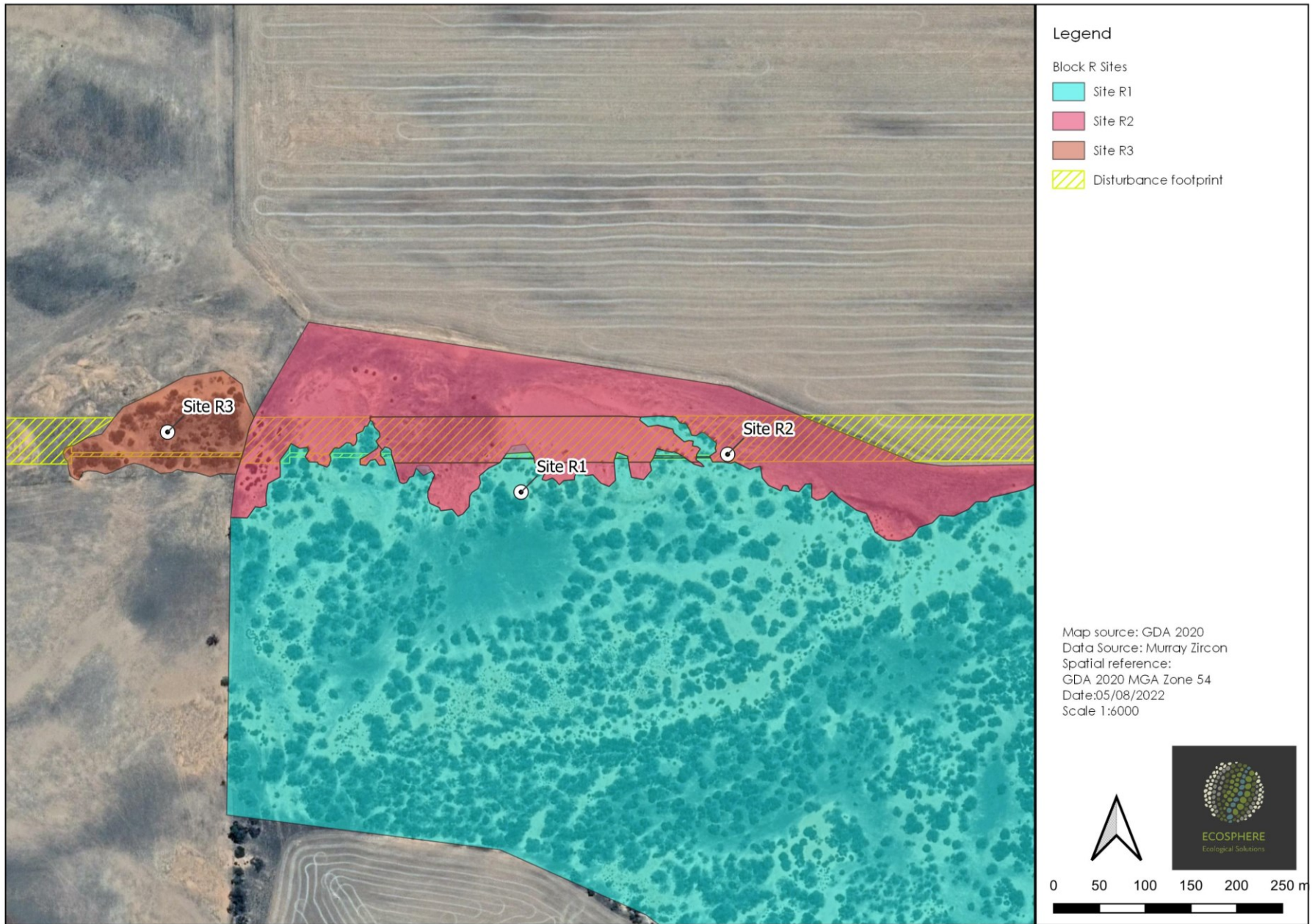


Figure 3. Vegetation associations overview and Bushland Assessment Method sites.

### 3.1.2 Flora species

A total of 27 indigenous flora species were recorded within the development footprint areas (Table 5). Site R2 had the highest species richness with 23 species recorded. Other sites had very low species richness. No species of conservation significance were recorded within the development footprints. See Appendix 2 for Bushland assessment sheets.

Table 5. Flora species observations within development footprint.

Scientific Name	Common Name	EPBC Act	NPW Act	Association (site)		
				1	2	3
<i>Acacia brachybotrya</i>	Grey Mulga-bush				✓	
<i>Acacia ligulata</i>	Umbrella Bush			✓	✓	
<i>Acacia rigens</i>	Nealie					
<i>Aristida holathera</i> var. <i>holathera</i>	Tall Kerosene Grass			✓	✓	
<i>Austrostipa elegantissima</i>	Feather Spear-grass				✓	
<i>Austrostipa</i> sp.	Spear-grass			✓		
<i>Beyeria opaca</i>	Dark Turpentine Bush			✓	✓	
<i>Billardiera</i> sp.	Apple-berry				✓	
<i>Calotis lappulacea</i>	Yellow Burr-daisy				✓	✓
<i>Chrysocephalum apiculatum</i>	Common Everlasting				✓	
<i>Enchylaena tomentosa</i> var.	Ruby Saltbush			✓	✓	
<i>Eucalyptus incrassata</i>	Ridge-fruited Mallee				✓	✓
<i>Exocarpos sparteus</i>	Slender Cherry				✓	
<i>Grevillea pterosperma</i>	Dune Grevillea				✓	
<i>Hysterobaeckea behrii</i>	Silver Broombush				✓	
<i>Lasiopetalum behrii</i>	Pink Velvet-bush				✓	
<i>Leptospermum coriaceum</i>	Dune Tea-tree				✓	
<i>Maireana brevifolia</i>	Short-leaf Bluebush			✓		
<i>Melaleuca lanceolata</i>	Dryland Tea-tree				✓	✓
<i>Pittosporum angustifolium</i>	Native Apricot				✓	
<i>Podolepis</i> sp.	Copper-wire Daisy				✓	
<i>Rhagodia crassifolia</i>	Fleshy Saltbush				✓	✓
<i>Rhagodia preissii</i> ssp. <i>preissii</i>	Mallee Saltbush				✓	
<i>Rytidosperma</i> sp.	Wallaby-grass				✓	
<i>Salsola australis</i>	Buckbush				✓	
<i>Triodia scariosa</i>	Spinifex				✓	
<i>Vittadinia cuneata</i> var.	Fuzzy New Holland Daisy			✓		
Total				7	23	4

### 3.1.3 Exotic flora species

Fifteen exotic flora species were recorded within the development footprint. Of these, four were declared species under the *Landscape South Australia Act 2016* (LSA Act) (Table 6). All declared species recorded were naturalised and control of these species at the local scale is

not considered feasible. Exotic species richness was highest for site 1 which also had the lowest UBS.

Table 6. Exotic flora species recorded within development footprint.

Scientific Name	Common Name	NRM Act Weed Status	Association (site)		
			1	2	3
<i>Arctotheca calendula</i>	Cape Weed		✓		✓
<i>Asparagus asparagoides f.</i>	Bridal Creeper	Declared NRM Act - Not For Sale		✓	
<i>Asphodelus fistulosus</i>	Onion Weed		✓		✓
<i>Avena barbata</i>	Bearded Oat				
<i>Brassica tournefortii</i>	Wild Turnip		✓		✓
<i>Echium plantagineum</i>	Salvation Jane	Declared NRM Act - Not For Sale	✓		
<i>Euphorbia terracina</i>	False Caper	Declared NRM Act - Not For Sale	✓		✓
<i>Gomphocarpus cancellatus</i>	Broad-leaf Cotton-bush		✓	✓	
<i>Marrubium vulgare</i>	Horehound	Declared NRM Act - Not For Sale			✓
<i>Oenothera stricta ssp. stricta</i>	Common Evening Primrose		✓		
<i>Reichardia tingitana</i>	False Sowthistle		✓		
<i>Romulea sp.</i>	Onion-grass				
<i>Salvia verbenaca var.</i>	Wild Sage		✓		
<i>Sonchus oleraceus</i>	Common Sow-thistle				
<i>Symphotrichum subulatum</i>	Aster-weed		✓		
Total			10	2	5

### 3.1.4 Clearance footprints

Based on the findings of the vegetation site results, clearance footprints were reduced to impact on the areas of lowest condition (Figure 4 & Figure 5). Given site R1 was of exceptionally low quality, the disturbance will be largely contained within those areas in the construction phase and through location of conductor towers. Emergent shrubs within this site would also be banded off to reduce any impact.

Impacts within sites R2 and R3 would be limited to stringing requirements during construction and no permanent impact is anticipated during this period and careful management incorporated into a Construction Environment Management Plan (CEMP) would be undertaken.

### 3.1.5 Fauna species

No fauna species of conservation significance were recorded or deemed likely to occur within the development footprint. Seventeen indigenous avian species were recorded in total, and all were relatively common species for the mallee region.

Table 7. Fauna species recorded within Block R development footprint during field assessment.

Scientific Name	Common Name	EPBC Act Status	NPW Act Status
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill		
<i>Acanthiza pusilla</i>	Brown Thornbill		
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill		
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill		
<i>Colluricincla harmonica</i>	Grey Shrikethrush		
<i>Corvus mellori</i>	Little Raven		
<i>Eolophus roseicapilla</i>	Galah		
<i>Falco cenchroides</i>	Nankeen Kestrel		
<i>Gavicalis virescens</i>	Singing Honeyeater		
<i>Geopelia placida</i>	Peaceful Dove		
<i>Gymnorhina tibicen</i>	Australian Magpie		
<i>Malurus cyaneus</i>	Superb Fairywren		
<i>Ocyphaps lophotes</i>	Crested Pigeon		
<i>Petroica goodenovii</i>	Red-capped Robin		
<i>Pomatostomus superciliosus</i>	White-browed Babbler		
<i>Rhipidura leucophrys</i>	Willie Wagtail		
<i>Smicrornis brevirostris</i>	Weebill		



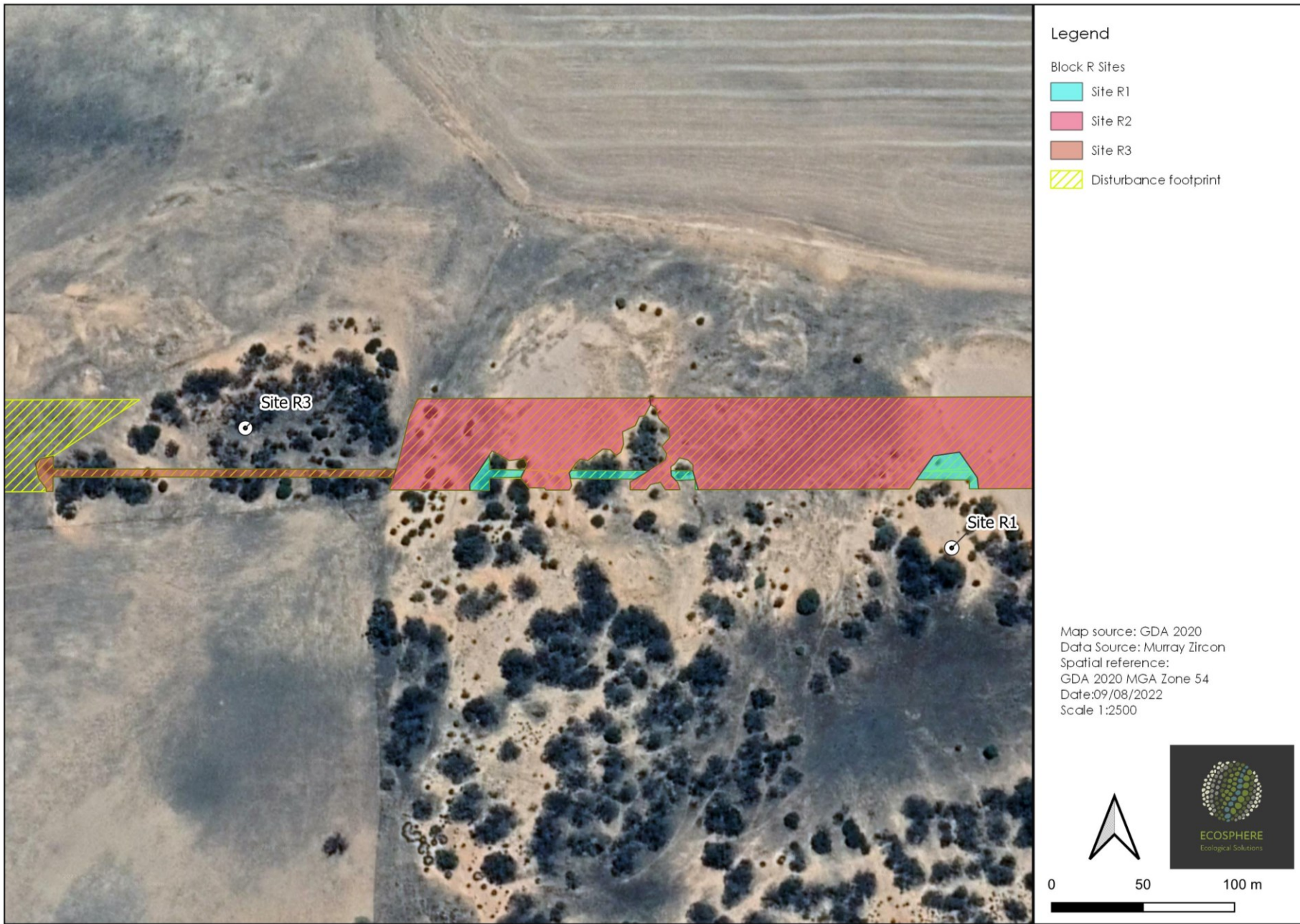


Figure 4. Proposed clearance footprint map 1 of 2.



Figure 5. Proposed clearance footprint map 2 of 2.

## 4 SEB calculations

The development footprint clearance summary resulted in an area of 3.11 hectares and a total biodiversity score of 23.5points. The offset payment required to satisfy the offset (including admin fee) is \$2,983.47.

Block	Site	Native species diversity score	Threatened Ecological community Score	Threatened plant score	Threatened fauna score	UBS	Area (ha)	Total Biodiversity score	Loss factor	Loadings	Reductions	SEB Points required	SEB payment	Admin Fee
R	1	26	1.3	0	0.06	76.54	0.09	6.89	0.8		0.5	2.89	\$828.84	\$45.59
R	2	8	1	0	0.06	5.08	2.92	14.83	0.8		0.5	6.23	\$1,784.80	\$98.16
R	3	6	1	0	0.06	17.81	0.1	1.78	0.8		0.5	0.75	\$214.29	\$11.79
						<b>Total</b>	<b>3.11</b>	<b>23.50</b>				<b>9.87</b>	<b>\$2,827.93</b>	<b>\$155.54</b>

IBRA Association percent vegetation remnancy (%)	9
IBRA Subregion percent vegetation remnancy (%)	21
Is the vegetation associated with a Wetland	No
Economies of Scale Factor	0.35
Rainfall (mm)	306

	Total Biodiversity score	Total SEB points required	SEB Payment	Admin Fee	Total Payment
<b>Application</b>	23.50	9.87	\$2,827.93	\$155.54	\$2,983.47

# 5 Appendices

Appendix 1. Fauna BDBSA records within 10km of Study area

Species Name	Common Name	AUS	SA	Most recent record
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater			23/09/2014
<i>Acanthiza apicalis</i>	Inland Thornbill			25/09/2014
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill			25/10/2009
<i>Acanthiza nana</i>	Yellow Thornbill			25/09/2014
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill			25/09/2014
<i>Aegotheles cristatus cristatus</i>	Australian Owlet-nightjar			22/01/2002
<i>Alauda arvensis arvensis</i>	Eurasian Skylark			8/10/2009
<i>Anthochaera carunculata</i>	Red Wattlebird			25/09/2014
<i>Aquila audax audax</i>	Wedge-tailed Eagle			25/10/2009
<i>Artamus cyanopterus</i>	Dusky Woodswallow			12/12/2007
<i>Artamus personatus</i>	Masked Woodswallow			25/10/2009
<i>Artamus superciliosus</i>	White-browed Woodswallow			26/11/2007
<i>Barnardius zonarius</i>	Australian Ringneck			23/09/2014
<i>Cheramoeca leucosterna</i>	White-backed Swallow			12/12/2007
<i>Cincloramphus cruralis</i>	Brown Songlark			25/09/2014
<i>Cinclosoma castanotum (NC)</i>	Chestnut-backed Quailthrush (Chestnut Quailthrush)		ssp	12/10/2009
<i>Climacteris picumnus picumnus</i>	Brown Treecreeper			22/01/2002
<i>Colluricincla harmonica</i>	Grey Shrikethrush			25/09/2014
<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike			22/01/2002
<i>Corcorax melanorhamphos</i>	White-winged Chough		R	25/10/2009
<i>Corvus bennetti</i>	Little Crow			23/09/2014
<i>Corvus mellori</i>	Little Raven			25/09/2014
<i>Cracticus torquatus leucopterus</i>	Grey Butcherbird			25/09/2014
<i>Dromaius novaehollandiae</i>	Emu	ssp	ssp	26/11/2007
<i>Drymodes brunneopygia</i>	Southern Scrub Robin			12/10/2009
<i>Eolophus roseicapilla</i>	Galah			25/10/2009
<i>Falco berigora berigora</i>	Brown Falcon			25/10/2009
<i>Falco cenchroides cenchroides</i>	Nankeen Kestrel			8/10/2009
<i>Gavicalis virescens</i>	Singing Honeyeater			23/09/2014
<i>Geopelia placida placida</i>	Peaceful Dove			23/09/2014
<i>Gymnorhina tibicen</i>	Australian Magpie			25/09/2014
<i>Hieraetus morphnoides</i>	Little Eagle		V	22/01/2002
<i>Lalage tricolor</i>	White-winged Triller			25/10/2009
<i>Lepus europaeus</i>	European Brown Hare			19/09/2014
<i>Lichenostomus cratitius occidentalis</i>	Purple-gaped Honeyeater (mainland SA)		R	25/10/2009
<i>Lophochroa leadbeateri leadbeateri</i>	Major Mitchell's Cockatoo (LNE, MM)		SP	23/09/2014
<i>Macropus fuliginosus</i>	Western Grey Kangaroo			25/09/2014

Species Name	Common Name	AUS	SA	Most recent record
<i>Malurus assimilis assimilis</i>	Purple-backed Fairywren			15/10/2009
<i>Malurus splendens melanotus</i>	Black-backed Fairywren (MM)			25/10/2009
<i>Manorina flavigula</i>	Yellow-throated Miner	ssp	ssp	25/10/2009
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (YP, MN, AP, MLR, MM, SE)		R	17/10/2009
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	ssp		25/09/2014
<i>Merops ornatus</i>	Rainbow Bee-eater			25/10/2009
<i>Microeca fascinans</i>	Jacky Winter		ssp	25/09/2014
<i>Myiagra inquieta</i>	Restless Flycatcher		R	12/12/2007
<i>Neophema sp.</i>	Neophema parrots			26/11/2007
<i>Nesoptilotis leucotis leucotis</i>	White-eared Honeyeater (SE)			25/09/2014
<i>Northiella haematogaster (NC)</i>	Bluebonnet (Eastern and Naretha)		ssp	15/10/2009
<i>Ocyphaps lophotes lophotes</i>	Crested Pigeon			25/10/2009
<i>Oreoica gutturalis</i>	Crested Bellbird			17/10/2009
<i>Oryctolagus cuniculus</i>	Rabbit (European Rabbit)			14/11/2011
<i>Pachycephala fuliginosa fuliginosa</i>	Western Whistler			25/09/2014
<i>Pardalotus punctatus</i>	Spotted Pardalote			25/09/2014
<i>Pardalotus striatus substriatus</i>	Striated Pardalote			25/10/2009
<i>Passer domesticus domesticus</i>	House Sparrow			22/01/2002
<i>Petrochelidon nigricans</i>	Tree Martin			12/12/2007
<i>Petroica goodenovii</i>	Red-capped Robin			17/10/2009
<i>Phaps chalcoptera</i>	Common Bronzewing			25/09/2014
<i>Pomatostomus superciliosus</i>	White-browed Babbler			25/10/2009
<i>Psephotellus varius</i>	Mulga Parrot			25/10/2009
<i>Ptilotula ornata</i>	Yellow-plumed Honeyeater			23/09/2014
<i>Ptilotula plumula</i>	Grey-fronted Honeyeater			22/01/2002
<i>Rhipidura leucophrys leucophrys</i>	Willie Wagtail			19/09/2014
<i>Smicronis brevirostris</i>	Weebill			25/09/2014
<i>Strepera versicolor melanoptera</i>	Black-winged Currawong (MLR, MM, SE)			25/09/2014
<i>Sturnus vulgaris vulgaris</i>	Common Starling			8/10/2009
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	ssp	ssp	25/10/2009
<i>Vulpes vulpes</i>	Fox (Red Fox)			1/06/2011

## Appendix 2. Bushland Assessment Sheets

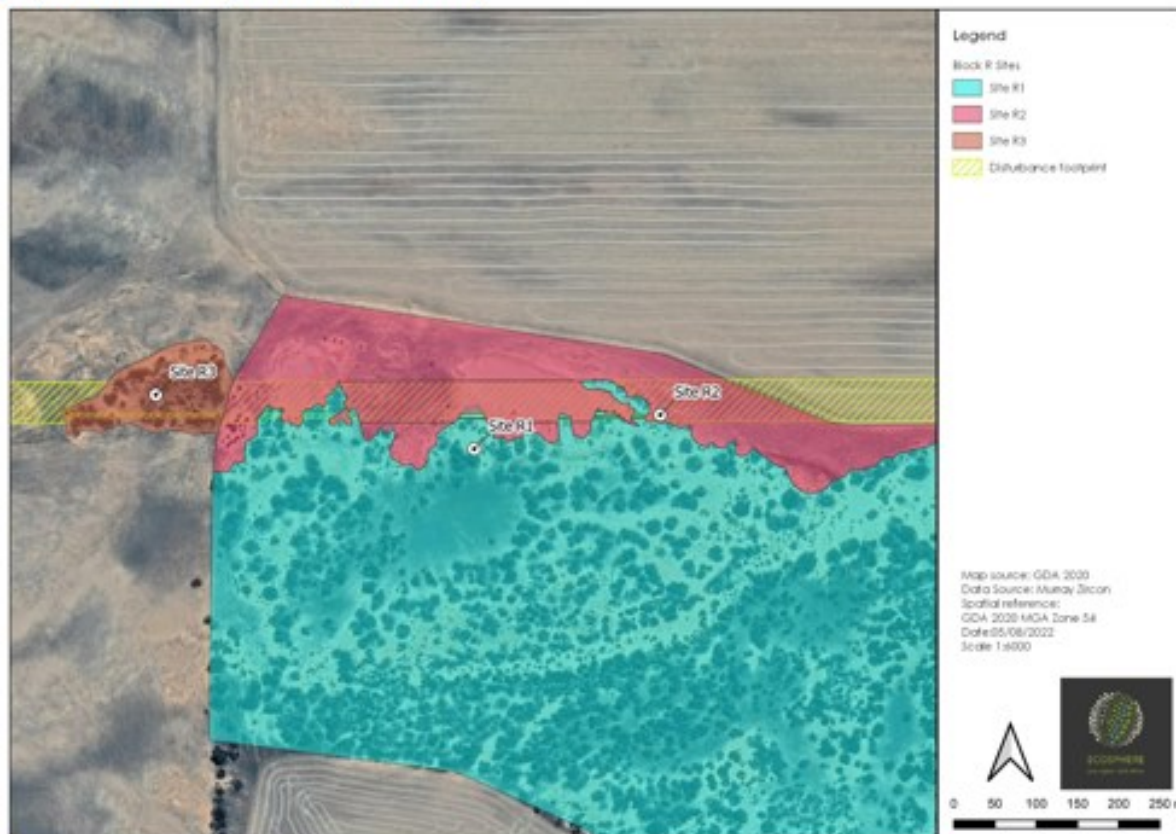
## Bushland Assessment Scoresheets

(Version - 22 Oct 2021)

<b>Block</b>	Mindarie Block R
<b>Size of Block (Ha)</b>	80.060
<b>Landscapes Region</b>	Murraylands and Riverland
<b>BCM Region</b>	Murray Darling Basin
<b>IBRA Association</b>	Kunlara
<b>IBRA Subregion</b>	Murray Mallee

<b>ASSESSOR(S)</b>	Andrew Sinel
<b>DATE OF ASSESSM</b>	27.07.22

### Map of the Block (Including the Sites)



### Landscape Context Scores

<b>% native veg. remaining in IBRA Assoc.</b>	9
<b>% native veg. remaining in IBRA subregion</b>	21
0 - 10% = 0.05 pts; >10-20% = 0.04 pts; >20-30% = 0.03 pts; >30-60% = 0.02 pts; > 60 = 0 pts	<b>Score</b> 0.08
Score received for both IBRA assoc. and subregion then summed	
<b>Percent Vegetation Cover (5km radius) (%)</b>	1
0-5% = 0 pts; >5-10% = 0.02 pts; >10-25% = 0.04 pts; >25-50% = 0.06 pts; >50-75% = 0.03 pt; >75-100% = 0 pts	<b>Score</b> 0
<b>% native veg. protected IBRA Assoc.</b>	37
0-10% = 0.03 pts; >10-20% = 0.02 pts; >20-40% = 0.01 pt; >40% = 0	<b>Score</b> 0.01
<b>Block Shape</b> Cleared perimeter:Area (km/km <sup>2</sup> )	
<b>Cleared Perimeter (m) =</b>	2800
<b>Cleared Perimeter to area ratio</b>	3.50
<6 = 0.03 pts; 6 to <12 = 0.02 pts; 12 to <18 = 0.01 pt	<b>Score</b> 0.03
<b>Wetland or Riparian Habitat present</b>	
Riparian zone present (Yes/No) = 0.02 pt	No
Swamp/wetland present (Yes/No) = 0.03 pts	No
(Swamp/wetland may be +/- riparian zone)	
<b>Score</b>	0
<b>LANDSCAPE CONTEXT SCORE (max)</b>	<b>1.12</b>

*Note: Blocks will score a minimum Landscape Context Score of 1*







Vegetation Condition Scores																									
<b>SITE:</b>	R1																								
<b>BCM COMMUNITY</b>	MDBSA 3.2 Mallee with Open Sclerophyll / Chenopod Shrub Understorey																								
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	<i>Eucalyptus incrassata</i> (Ridge Fruited Mallee) Mixed Mallee over <i>Triclis</i>																								
<b>SIZE OF SITE (Ha)</b>	0.09																								
<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)																									
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)	24		<b>Native Plant Life Forms</b>																						
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>	26.0		Trees > 15m																						
<b>Number of regenerating native species</b>	3		Trees 5 - 15 m																						
<b>Regeneration Score (max 12) from benchmark community</b> <i>weighted by a factor of 1.5</i>	9		Trees < 5m																						
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6)	Weed Threat Rating (max 5)	C x I																						
Gomphocarpus cancellatus	2	2	4																						
Brassica spp.	2	2	4																						
Asphodelus fistulosus	2	2	4																						
Avena spp.	2	2	4																						
Romulea sp.	2	2	4																						
	<b>Cover x Threat</b>	20																							
<b>Weed Score (max 15) from benchmark community</b>	4																								
<b>Native Plant Life Forms (max 20) from benchmark score</b> <i>weighted by a factor of 2</i>			<b>rating</b>																						
			Mallee > 5m																						
			Mallee < 5m																						
			3																						
			Shrubs > 2m																						
			2																						
			Shrubs 0.5 - 2m																						
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			2																						
			Forbs																						
			2																						
			Mat Plants																						
			Grasses > 0.2m																						
			Grasses < 0.2m																						
			2																						
			Sedges > 1m																						
			Sedges < 1m																						
			Hummock grasses																						
			Vines, scramblers																						
			1																						
			Mistletoe																						
			Ferns																						
			Grass-tree																						
			<b>Total</b>																						
			14																						
			<b>16.0</b>																						
<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)																									
<b>Native:exotic Understorey biomass Score</b>	4		<i>Is the community naturally treeless?*</i>																						
			<input type="checkbox"/>																						
			<b>Fallen Timber/Debris (max 5)</b>																						
			3																						
			<b>Hollow-bearing trees Score (max 5)</b>																						
			2																						
			<b>Mature Tree Score (max 8)</b>																						
			4																						
			<b>Tree Canopy Cover Score (max 5)</b>																						
			4																						
<b>Vegetation Condition Score calculation</b>																									
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees																									
- <i>If the community Score is Not Benchmarked (SNE) for regeneration this score is multiplied 1.24</i>																									
- <i>If the community is naturally treeless this score is multiplied by 1.25</i>			60.00																						
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score) x 2/2)			13.00																						
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))			<b>50.25</b>																						
<table border="1"> <thead> <tr> <th>Attribute</th> <th>Score</th> </tr> </thead> <tbody> <tr> <td>Native Plant Species Diversity</td> <td>26.0</td> </tr> <tr> <td>Weed Score</td> <td>4</td> </tr> <tr> <td>Native Plant Life Forms</td> <td>16.0</td> </tr> <tr> <td>Regeneration</td> <td>9</td> </tr> <tr> <td>Native:exotic Understorey Biomass</td> <td>4</td> </tr> <tr> <td>Mature Trees</td> <td>4</td> </tr> <tr> <td>Tree Canopy Cover</td> <td>4</td> </tr> <tr> <td>Tree Hollows</td> <td>3</td> </tr> <tr> <td>Fallen timber</td> <td>3</td> </tr> <tr> <td><b>Vegetation Condition Score</b></td> <td><b>50.25</b></td> </tr> </tbody> </table>				Attribute	Score	Native Plant Species Diversity	26.0	Weed Score	4	Native Plant Life Forms	16.0	Regeneration	9	Native:exotic Understorey Biomass	4	Mature Trees	4	Tree Canopy Cover	4	Tree Hollows	3	Fallen timber	3	<b>Vegetation Condition Score</b>	<b>50.25</b>
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<b>Vegetation Condition Score</b>	<b>50.25</b>																								

## Conservation Significance Score


Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input checked="" type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	
<b>Threatened Community Score</b>	<b>1.3</b>

Number of Threatened Flora Species recorded for the site (within the site)	Number
<i>If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>0</b>
<b>Threatened Flora Score</b>	<b>0</b>

Potential habitat for Threatened Fauna Species (number observed or previously recorded)	Number
<i>If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	5
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	1
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>7.5</b>
<b>Threatened Fauna Score</b>	<b>0.06</b>

**CONSERVATION SIGNIFICANCE SCORE** **1.36**

Total Scores for the Site		Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>1.12</b>	<b>UNIT BIODIVERSITY SCORE</b>	<b>76.54</b>
<b>VEGETATION CONDITION SCORE</b>	<b>50.25</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE</b>	<b>1.36</b>	<b>(Biodiversity Score x hectares)</b>	<b>6.89</b>

Photo Point and Vegetation Survey Location	Direction of the Photo
	west
	<b>GPS Reference</b>
	Datum GDA94
	Zone (52, 53 or 54) 54
	Easting (6 digits) 422275
Northing (7 digits) 6149646	
	<b>Description</b>
	Open Ridge fruited Mallee on dune crest over Triodia and emergent mixed mallee shrubs. Semi degraded and has stock impacts however a moderate to high suite of species remains.

What is the purpose of Assessment?

Assessment for Clearance		Approximate hectares required	
Loss Factor	0.8		0.36
Loadings for clearance of protected areas		<b>Economies of Scale Factor</b>	0.35
Reductions for rehabilitation of impact site	0.5	<b>Mean Annual rainfall for the site (mm)</b>	306
<b>SEB Points required</b>	<b>2.89</b>	<b>Payment into the fund (GST Excl)</b>	<b>\$828.85</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$45.59</b>



## Vegetation Condition Scores

<b>SITE:</b>	R2
<b>BCM COMMUNITY</b>	MDBSA 3.2 Mallee with Open Sclerophyll / Chenopod Shrub Understorey
<b>VEGETATION ASSOCIATION DESCRIPTION</b>	Exotic grass/herbland +/- emergent Acacia ligulata (Sandhill Wattle) an
<b>SIZE OF SITE (Ha)</b>	2.92

### Benchmarked attributes

(Scores determined by comparing to a Benchmark community)

		<b>Native Plant Life Forms</b>	<b>r rating</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)	7	Trees > 15m	
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>	<b>8.0</b>	Trees 5 - 15 m	
		Trees < 5m	
		Mallee > 5m	
		Mallee < 5m	
<b>Number of regenerating native species</b>	0	Shrubs > 2m	1
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5	<b>0</b>	Shrubs 0.5 - 2m	1
		Shrubs < 0.5	
		Forbs	1
<b>Weed species</b> (Top 5 Cover x Invasiveness)	Cover (max 6) Weed Threat Rating (max 5) C x I	Mat Plants	
Euphorbia terracina	2 3 6	Grasses > 0.2m	1
Arctotheca calendula	2 2 4	Grasses < 0.2m	
Brassica spp.	2 2 4	Sedges > 1m	
Asphodelus fistulosus	2 2 4	Sedges < 1m	
Gomphocarpus cancellatus	2 2 4	Hummock grasses	
	<b>Cover x Threat</b> 22	Vines, scramblers	
<b>Weed Score (max 15) from benchmark community</b>	<b>4</b>	Mistletoe	
		Ferns	
		Grass-tree	
		<b>Total</b>	<b>4</b>
<b>Native Plant Life Forms (max 20) from benchmark score</b> weighted by a factor of 2			<b>4.0</b>

### Non-Benchmarked Attributes

(Scores determined from direct field observations)

<b>Native:exotic Understorey biomass Score</b>	1	<i>Is the community naturally treeless?</i>	<input type="checkbox"/>
		<b>Fallen Timber/Debris (max 5)</b>	<b>0</b>
		<b>Hollow-bearing trees Score (max 5)</b>	<b>0</b>
		<b>Mature Tree Score (max 8)</b>	<b>0</b>
		<b>Tree Canopy Cover Score (max 5)</b>	<b>0</b>

### Vegetation Condition Score calculation

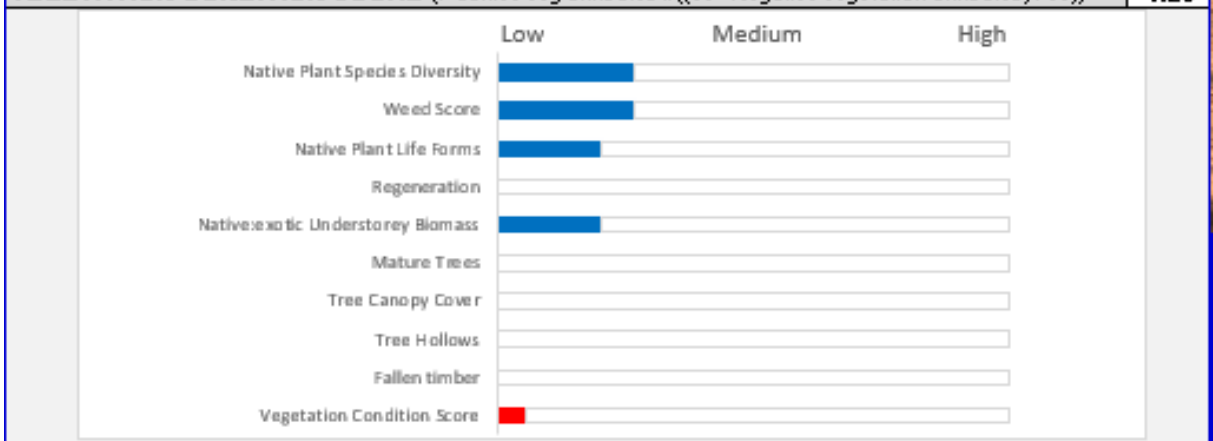
**Positive Vegetation Attributes Score** = Native species diversity + Regeneration + Native Plant Life Forms

Fallen timber/debris + Hollow-bearing trees

- If the community Score is Not Benchmarked (SNE) for regeneration this score is multiplied 1.24

- If the community is naturally treeless this score is multiplied by 1.25

Positive Vegetation Attributes Score	12.00
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score)exp2/2)	51.50
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))	<b>4.28</b>



## Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	
<b>Threatened Community Score</b>	<b>1</b>

Number of Threatened Flora Species recorded for the site (within the site)	Number
<i>If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>0</b>
<b>Threatened Flora Score</b>	<b>0</b>

Potential habitat for Threatened Fauna Species (number observed or previously recorded)	Number
<i>If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	5
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	1
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>7.5</b>
<b>Threatened Fauna Score</b>	<b>0.06</b>

**CONSERVATION SIGNIFICANCE SCORE** **1.06**

### Total Scores for the Site

Score	Vegetation Condition x Landscape Context x Conservation Significance =
<b>LANDSCAPE CONTEXT SCORE</b> 1.12	<b>UNIT BIODIVERSITY SCORE</b> 5.08
<b>VEGETATION CONDITION SCORE</b> 4.28	<b>Total Biodiversity Score</b>
<b>CONSERVATION SIGNIFICANCE</b> 1.06	<b>(Biodiversity Score x hectares)</b> 14.82

### Photo Point and Vegetation Survey Location



### Direction of the Photo

Direction	West
<b>GPS Reference</b>	
Datum	GDA94
Zone (52, 53 or 54)	54
Easting (6 digits)	422505
Northing (7 digits)	6149635
<b>Description</b>	
Very degraded landscape and is largely exotic however does have sparsely scattered indigneous vegetation present in varying densities throughout the area.	

What is the purpose of Assessment?

Clearance

SEB Area

Other

### Assessment for Clearance

Loss Factor	0.8	Approximate hectares required	0.78
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	306
<b>SEB Points required</b>	<b>6.22</b>	<b>Payment into the fund (GST Exclussive)</b>	<b>\$1,783.14</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$98.07</b>

Vegetation Condition Scores			
SITE:		R3	
BCM COMMUNITY		MDBSA 3.3 Mallee with Open Sclerophyll / Chenopod shrub Understorey / Triodia Sandy Loam Flats/Swales	
VEGETATION ASSOCIATION DESCRIPTION		<i>Eucalyptus incrassata</i> (Ridge Fruited Mallee) +/- <i>Metaleuca lanceol</i>	
SIZE OF SITE (Ha)		0.095	
<b>Benchmarked attributes</b> (Scores determined by comparing to a Benchmark community)			<b>Native Plant Life Forms</b>
<b>Number of Native Species</b> (Minus herbaceous annuals for spring Surveys)			4
<b>Native Plant Species Diversity Score (max 30) from benchmark score</b> <i>weighted by a factor of 2</i>			<b>6.0</b>
<b>Number of regenerating native species</b>			1
<b>Regeneration Score (max 12) from benchmark community</b> weighted by a factor of 1.5			<b>4.5</b>
<b>Weed species</b> (Top 5 Cover x Invasiveness)		Cover (max 6)	Weed Threat Rating (max 5)
Brassica spp.		3	2
Arctotheca calendula		3	2
Euphorbia terracina		3	3
Marrubium vulgare		1	3
Asphodelus fistulosus		3	2
		<b>Cover x Threat</b>	<b>30</b>
<b>Weed Score (max 15) from benchmark community</b>		<b>1</b>	
<b>Native Plant Life Forms (max 20) from benchmark score</b> <i>weighted by a factor of 2</i>			<b>8.0</b>
<b>Non-Benchmarked Attributes</b> (Scores determined from direct field observations)			<i>Is the community naturally treeless?</i> <input type="checkbox"/>
<b>Native:exotic Understorey biomass Score</b> 0			<b>Fallen Timber/Debris (max 5)</b> 3.5
			<b>Hollow-bearing trees Score (max 5)</b> 0
			<b>Mature Tree Score (max 8)</b> 3
			<b>Tree Canopy Cover Score (max 5)</b> 4
<b>Vegetation Condition Score calculation</b>			
<b>Positive Vegetation Attributes Score</b> = Native species diversity + Regeneration + Native Plant Life Forms Fallen timber/debris + Hollow-bearing trees <i>- If the community Score is Not Benchmarked (SNE) for regeneration this score is multiplied 1.24</i> <i>- If the community is naturally treeless this score is multiplied by 1.25</i>			25.00
<b>Negative Vegetation Attributes Score</b> = (15 - Weeds) + ((10 - Biomass score - Tree Canopy Cover Score)exp2/2)			32.00
<b>VEGETATION CONDITION SCORE</b> (Positive veg attributes x ((80 - Negative vegetation attributes) / 80))			<b>15.00</b>

## Conservation Significance Score

Is the vegetation association considered a Threatened Ecological community or Ecosystem?	Yes/No
State (Provisional List of Threatened Ecosystems of SA) <b>Rare</b> community (0.1 pt)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Vulnerable</b> community (0.2 pts)	<input type="checkbox"/>
State (Provisional List of Threatened Ecosystems of SA) <b>Endangered</b> community (0.3 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Vulnerable</b> community (0.35 pts)	<input type="checkbox"/>
Nationally (EPBC Act) <b>Endangered</b> or <b>Critically Endangered</b> community (0.4 pts)	<input type="checkbox"/>
<i>Note: all sites will score a minimum Conservation Significance Score of 1</i>	
<b>Threatened Community Score</b>	<b>1</b>
Number of Threatened Flora Species recorded for the site (within the site)	Number
<i>If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species recorded (1 pt each)	0
State <b>Vulnerable</b> species recorded (2.5 pt each)	0
State <b>Endangered</b> recorded (5 pts each)	0
Nationally <b>Vulnerable</b> species recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species recorded (20 pts each)	0
0 = 0 pts; <2 = 0.04 pts; 2 - <5 = 0.08 pts; 5 - <10 = 0.12 pts; 10 - <20 = 0.16 pts; 20 or > = 0.2 pts	<b>0</b>
<b>Threatened Flora Score</b>	<b>0</b>
Potential habitat for Threatened Fauna Species (number observed or previously recorded)	Number
<i>If a species has both a State (NP&amp;W Act) and National (EPBC Act) rating, it's only recorded for its National rating.</i>	
State <b>Rare</b> species observed or locally recorded (1 pt each)	5
State <b>Vulnerable</b> species observed or locally recorded (2.5 pt each)	1
State <b>Endangered</b> species observed or locally recorded (5 pt each)	0
Nationally <b>Vulnerable</b> species observed or locally recorded (10 pts each)	0
Nationally <b>Endangered</b> or <b>Critically endangered</b> species observed or locally recorded (20 pts each)	0
0 = 0 pts; <2 = 0.02 pts; 2 - <5 = 0.04 pts; 5 - <10 = 0.06 pts; 10 - <20 = 0.08pts; 20 or > = 0.1 pts	<b>7.5</b>
<b>Threatened Fauna Score</b>	<b>0.06</b>
<b>CONSERVATION SIGNIFICANCE SCORE</b>	<b>1.06</b>

## Total Scores for the Site

	Score	Vegetation Condition x Landscape Context x Conservation Significance =	
<b>LANDSCAPE CONTEXT SCORE</b>	<b>1.12</b>	<b>UNIT BIODIVERSITY SCORE</b>	<b>17.81</b>
<b>VEGETATION CONDITION SCORE</b>	<b>15.00</b>	<b>Total Biodiversity Score</b>	
<b>CONSERVATION SIGNIFICANCE</b>	<b>1.06</b>	<b>(Biodiversity Score x hectares)</b>	<b>1.69</b>

## Photo Point and Vegetation Survey Location



Direction of the Photo
South
GPS Reference
Datum: GDA94
Zone (52, 53 or 54): 54
Easting (6 digits): 421665
Northing (7 digits): 6149663
Description
Mallee trees over almost entirely exotic herbaceous forbs with very sparsely present chenopod shrubs.

What is the purpose of Assessment?

Clearance

SEB Area

Other

## Assessment for Clearance

Loss Factor	0.8	Approximate hectares required	0.09
Loadings for clearance of protected areas		Economies of Scale Factor	0.35
Reductions for rehabilitation of impact site	0.5	Mean Annual rainfall for the site (mm)	306
<b>SEB Points required</b>	<b>0.71</b>	<b>Payment into the fund (GST Excl)</b>	<b>\$203.55</b>
		<b>Administration fee (GST Inclusive)</b>	<b>\$11.20</b>