# Iluka Baseline Ecological Assessments – WIM100 Ecology Report

Murray Basin Fine Mineral Deposits

Prepared for Iluka

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### Cardno<sup>®</sup>

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### **Executive Summary**

Cardno (Vic) Pty Ltd (Cardno) was commissioned by Iluka Resources Limited to complete a baseline environmental assessment for the WIM100 deposit area within exploration licence tenement EL4282 (the study area). The aim of this assessment was to establish the baseline ecological conditions of the study area in order to inform design of the mining plan and future detailed surveys should the project progress to environmental planning and approvals stage. This was achieved by completing a desktop assessment followed by a 14-day field assessment (6 to 19 November 2018). The field assessment utilised a range of survey techniques to establish species diversity and ecological features of the study area, improve the Government native vegetation mapping from a scale of 1: 100,000 to 1: 10,000, and identify potential locations for threatened species and ecological communities.

The results of the desktop and field assessments are summarised below in relation to relevant environmental legislation and policy, and recommendations made for future surveys. The study area was found to be heavily cleared as a result of agriculture with many large scattered trees. The main ecological values pertain to patches of woodland, natural wetlands and swamps that predominantly occurred on Crown land (i.e. road-reserves and nature reserves), with smaller, more disturbed patches found on private land. These habitats have potential to support National and State-significant ecological communities and species. Cropped paddocks and the extensive system of water distribution channels that dissect the study area are of limited ecological value.

Any future development of the study area will consider both direct and indirect impacts of mining on ecological values in the local area. Indirect impacts that would be relevant to the project include changes to the hydrological regime, such as surface water-flow, groundwater levels, and water quality, which may impact on wetlands, swamps and groundwater dependent ecosystems in the surrounding area.

Legislation	Findings	Further Surveys
Commonwealth Environment Protection and Biodiversity Conservation Act 1999 <sup>1</sup>	One category of Matter of National Environmental Significance (MNES) present or likely to be present within the study area: listed threatened species and ecological communities. The study area has potential to support three Threatened Ecological Communities (TECs) and two threatened fauna species (Red-tailed Black-Cockatoo and Growling Grass Frog). The TECs which are likely to be present include: - Grey Box ( <i>Eucalyptus microcarpa</i> ) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia - Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions - Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Targeted surveys in spring of locations where TECs are likely to occur (see <b>Table 4-6</b> and <b>Figure 4-7</b> ). Targeted for Red-tailed Black-Cockatoo (all year round) and Growling Grass Frog (October to February one month after flooding).
Victorian Flora and Fauna Guarantee Act 1988	Confirmed presence of one listed ecological community, (Victorian Temperate Woodland Bird Community) and likely presence of two more (Semi-arid Northwest Plains Buloke Grassy Woodland Community, and Red Gum Swamp Community No. 1). Five listed species were recorded in the study area (Buloke, Magpie Goose, Diamond Firetail, Whiskered Tern and Brown Toadlet).	Targeted surveys in spring of TECs likely to be present.
Victorian Environment Effects Act 1978	In response to the Environment Effects Statement (EES) referral triggers for individual environmental effects, the study area supports more than 10 ha of an endangered Ecological Vegetation Class (EVC), and provides habitat	Detailed assessment of aquatic habitats to establish presence and condition of fish and invertebrate populations.

Table 1-1 Summary of finds and reco	mmendations for future surveys
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<sup>&</sup>lt;sup>1</sup> This study did not consider 'nuclear action' as potential controlling provision for EPBC Act assessment. A previous EPBC Act referral for a mineral sands mine in Victoria did assess the action as a 'controlled action' with 'nuclear action' one of several controlling provisions.

Legislation	Findings	Further Surveys
	for threatened species. An assessment of aquatic biodiversity was not undertaken.	Further assessment of landscape values in surrounding area required.
	In response to the EES referral triggers for a combination of potential environmental effects, the study area was predicted as supporting 448 ha of native vegetation and 942 scattered trees, supports or is likely to support ecological communities and species listed under the <i>Flora and Fauna Guarantee Act 1988</i> (FFG Act), and is covered by Environmental Significance Overlays which relate to the protection of the Natimuk Douglas Wetlands and other local values.	
Victorian Mineral Resources (Sustainable Development) Act 1990	A mining license under the <i>Mining Resources</i> ( <i>Sustainable</i> Development) <i>Act 1990</i> is likely to stipulate conditions on the removal of native vegetation and offset requirements	N/A
Victorian <i>Planning and Environment</i> <i>Act</i> 1987 – Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017)	Mapping at 1:10,000 scale identified 448 ha of native patches and 942 scattered trees within the study area. Mapped wetlands (which are classified as native vegetation under the Guidelines) are also present throughout the study area. According to Native Vegetation Information Management (NVIM) native vegetation within the study area has been assigned to Location 1 or Location 2	Habitat hectare assessment of native vegetation identified in the study area including patches (see <b>Figure 4-4</b> ) and scattered trees ( see <b>Figure 4-6</b> )
Victorian Catchment and Land Protection Act 1994	Four declared weeds (Bridal Creeper, Slender Thistle, Spear Thistle and African Boxthorn) and one declared pest (Red Fox) was recorded in the study area.	Detailed species list of all declared weeds in impacted areas.
Victorian <i>Wildlife Act 1975</i>	Study area provides a variety of habitats including mature woodland, large scattered trees and permanent and ephemeral swamps and wetlands that support, or are likely to support, wildlife protected under the Act.	N/A

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# **Terms and Abbreviations**

Abbreviation	Description
asl	Above sea level
BIM	VIC Biodiversity Interactive Map
Buloke TEC	Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions
Cardno	Cardno (VIC) Pty Ltd
DBH	Diameter at Breast Height
DELWP	Victorian Department of Environment, Land, Water and Planning
DoEE	Commonwealth Department of the Environment and Energy
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EL	Exploration Licence
EVC	Ecological Vegetation Class
FFG Act	Victorian Flora and Fauna Guarantee Act 1988
FIS	Victorian Flora Information System
GDE	Groundwater Dependent Ecosystem
Grey Box TEC	Grey Box ( <i>Eucalyptus microcarpa</i> ) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
ha	Hectare
km	Kilometre
mm	millimetre
MNES	Matters of National Environmental Significance
Nationally significant	Species or ecological community listed under the EPBC Act
NVIM	Native Vegetation Information Management
PMST	Protected Matters Search Tool
TEC	Threatened Ecological Community
The Guidelines	Guidelines for the Removal, Destruction or lopping of native vegetation (DELWP 2017)
PFS	Pre-Feasibility Study
PMST	Protected Matters Search Tool
State significant	Species or community listed under the FFG Act or Victorian Advisory Lists.
VBA	Victorian Biodiversity Atlas
VPP	Victorian Planning Provisions
VQA	Vegetation Quality Assessment



Wetlands TEC Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains

# 1 Background

The Murray Basin Operations undertaken by Iluka Resources Limited (Iluka) included mining, processing, transport, storage and shipping of mineral sand products at a number of operational sites.

Conventional coarse-grain mineral sand deposits were mined at the Douglas and Echo mine sites near Balmoral in south-west Victoria, and at the Kulwin and WRP mine sites near Ouyen in the north-west of the State.

Western Victoria also hosts a number of fine-grained mineral sand deposits that are undeveloped. Iluka currently holds exploration licence EL4282 over in-ground fine grained resources located between Horsham and Hamilton, which includes the WIM100 deposit.

Following significant technical development work undertaken in the last two to three years, Iluka now seeks to progress the WIM100 deposit into the Pre-feasibility Study stage.

This baseline ecological assessment assesses the ecological values and constraints within the designated WIM100 study area within EL4282. The findings of the assessment will inform the design of the mining plan, as well as detailed ecological surveys should the project progress into the environmental planning and approvals stages.

The study area is located in western Victoria, approximately 325 kilometres (km) west of Melbourne's CBD, 35km south-west of Horsham and 25 km north-east of Balmoral. It is located immediately north of the Toolondo Reservoir. The Iluka Echo and Douglas mines are approximately 5 km to the east and 20 km to the south-west respectively.

The study area is located in the Wimmera Bioregion, the Wimmera Catchment Management Authority and the Horsham Rural City local government area. It is approximately 5,560 ha in size, bound by Quick Sinclair Russells Road to the east, in part by Mitchells Road to the south, Clarkes Road to the west and farming land to the north (**Figure 3-1**). It is relatively flat with the middle of the study area located at approximately 160 m above sea level (asl)

Being generally flat, the study area features a number of perennial or ephemeral wetlands including several wildlife and conservation reserves such as the Jallumba Marsh Flora Reserve, Red Gum Swamp (Jallumba Wildlife Reserve), Darragan Swamp Wildlife Reserve and Cookes Wildlife Reserve (**Figure 3-1**). The predominant land use within the study area is agriculture (mixed cropping and sheep) and is dissected by a series of constructed open channels including the Toolondo, Rocklands, Natimuk and Darragan Channels. Remnant native vegetation exists mainly as scattered trees within paddocks and along road reserves; however, larger patches do exist both on private and Crown land.

The study area experiences a semi-arid climate with maximum daily temperatures varying between 13.4 °C in July and 29.8 °C in January and February. Mean annual rainfall is 448 millimetres (mm).

# 2 Study Objectives

The aim of this assessment was to establish the baseline ecological conditions of the study area in order to inform design of the mining plan and future detailed surveys should the project progress to environmental planning and approvals stage. The following tasks were undertaken to achieve these objectives:

- > Review available biodiversity databases, planning scheme information, GIS mapping datasets and any other relevant and available information
- > Description of the vascular flora, terrestrial vertebrate fauna and habitat values of the study area
- > Mapping any remnant and ecologically significant flora and terrestrial fauna habitats
- > Identify flora and fauna of National, State and regional significance present or likely to occur in the study area
- > Undertaking habitat quality assessments of various woodlands and habitat patches within the delineated study area in accordance with the relevant State and National native vegetation assessment frameworks
- > Recommend any further assessments of the study area that may be required such as particular habitat patches requiring targeted searches for significant species.

# 3 Methodology

This section describes the methods implemented to meet the study objectives described in Section 2. The scope of works consisted of a desktop phase to review available information and datasets, followed by a field assessment to verify the accuracy of the desktop information and collect additional information to characterise the ecological condition of the study area.

### 3.1 Desktop

#### 3.1.1 Database

The following databases reviewed prior to fieldwork provided a high-level characterisation of the ecology of the area:

- > Victorian Biodiversity Atlas (VBA), maintained by the Victorian Department of Environment, Land, Water and Planning (DELWP) for records of significant species within the study area or surrounding 10 km radius
- > EPBC Act Protected Matters Search Tool (PMST), maintained by the Commonwealth Department of the Environment and Energy (DoEE), for Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), that occur or are likely to occur within the study area or surrounding 10 km radius
- Nature Kit and Native Vegetation Information Management (NVIM) tools maintained by DELWP, for the predicted type and condition of Ecological Vegetation Classes (EVCs) currently present within the study area (EVC 2005), and prior to European Settlement (EVC 1750)
- > Current Wetland layer, maintained by DELWP, for the presence of listed wetlands within or in close proximity to the study area
- > Flora of Victoria online tool, maintained by the Royal Botanic Gardens of Victoria, for flora species associated with the Jallumba Marsh Flora Reserve and Red Gum Swamp (Jallumba Wildlife Reserve)
- > Groundwater Dependent Ecosystems (GDE) Atlas maintained by the Commonwealth Bureau of Meteorology, for the predicted occurrence of aquatic, terrestrial and sub-terrestrial GDEs within the study area
- > Publically available aerial imagery.

#### 3.1.2 **Preliminary vegetation mapping**

Prior to commencing fieldwork, vegetation patches were delineated by cross-referencing modelled native vegetation data from Naturekit (i.e. EVC 2005) against current BING aerial imagery. Preliminary mapping was delineated at a scale of approximately 1:10,000, and each patch of native vegetation assigned an EVC consistent with EVC 1750 data.

Scattered trees outside of patches were identified by aerial imagery and delineated with a point.

#### 3.1.3 Likelihood of presence

A likelihood of presence assessment was undertaken for all threatened species<sup>2</sup> identified via the VBA and PMST search. Each species was assigned one of the following likelihood of presence ratings, based on the location, date and number of records, as well as modelled EVC data:

- > Known: species has been recorded in the study area by a qualified ecologist in the past 20 years
- > Likely: suitable habitat for the species occurs in the study area and species has been recorded proximate to the study area

<sup>&</sup>lt;sup>2</sup> Threatened is defined as any species or ecological community listed as threatened under the EPBC Act, FFG Act or Victorian Advisory Lists.

- Possible: suitable habitat for the species occurs in the study area but no recent records from the study area or proximate areas, OR, suitable habitat for the species may occur in the study area and there are recent records for the species proximate to the study area
- > **Unlikely:** suitable habitat for the species does not occur in the study area and no recent records from the study area or proximate areas.

### 3.2 Field assessment

#### 3.2.1 General

Field surveys were undertaken between 6 and 19 November 2018 by four ecologists to verify the accuracy of the databases and preliminary vegetation mapping. A summary of the methods implemented during the field assessment is provided in Table 3-1, with further information in the following sub-sections. **Figure 3-1** illustrates the location of survey sites.

Survey	Objective	Techniques	Quantity
Native Vegetation	Map significant native vegetation protected under Commonwealth, State or Local legislation.	<ul> <li>Habitat hectares</li> <li>Quaternary (rapid) assessment</li> <li>Scattered tree counts</li> </ul>	<ul> <li>&gt; 30 sites</li> <li>&gt; 80 sites</li> <li>&gt; 76 sites</li> </ul>
Wetlands	Map the presence and describe the condition of listed wetland	> Habitat hectares	> 7 sites
Flora species	Preliminary search of locations likely to support threatened flora	> Random meander and transects	> 110 sites
Fauna species	Preliminary search of locations likely to support threatened fauna	<ul> <li>Random meander</li> <li>Targeted searches</li> <li>Camera traps</li> </ul>	> 20 camera traps logging for 12 nights (240 trap nights)

Table 3-1 Summary of field assessment methods



#### 3.2.2 Native Vegetation

The objective of the native vegetation assessment was to improve the accuracy of current native vegetation mapping information and identify where in the study area future detailed vegetation assessments should concentrate. Native vegetation modelling by DELWP (EVC 2005) is prepared at a scale of 1:100,000 and the assessment approach attempted to improve the accuracy of native vegetation information to a scale of 1: 10,000 by surveying at 110 ground locations.

In Victoria, native vegetation is defined under the Victorian Planning Provisions (VPP) as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. The Victorian Guidelines for the removal, destruction or lopping of native vegetation 'the Guidelines' (DELWP 2017) further classify native vegetation as either a patch or scattered tree as per definitions in **Table 3-2**. The field assessment only considered native vegetation that met the definition of a patch or scattered tree. Planted vegetation was not mapped given the planning permit exemptions under Clause 52.17-7 of the VPP.

	Classification of hative vegetation in victoria (DEEWF 2017)
Native Vegetation	Definition
Patch	<ul> <li>An area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native, or</li> <li>Any area with three or more native canopy trees<sup>3</sup> where the drip line of each tree touches the drip lone of at least one other tree, forming a continuous canopy, or</li> <li>Any mapped wetland included in the <i>Current wetland map</i>, available in DELWP systems and tools.</li> </ul>
Scattered Tre	A native canopy tree that does not form part of a patch.

#### Table 3-2 Classification of native vegetation in Victoria (DELWP 2017)

#### 3.2.2.2 Patch

Field assessments of native patches were undertaken at 110 locations including 80 Quaternary (rapid) sites and 30 habitat hectare sites (**Figure 3-1**). The purpose of the Quaternary sites was to collect rapid information on vegetation characteristics, such as dominant canopy species and ground-layer flora, to determine the EVC. Vegetation condition was assigned to one of three classes in accordance with the Qualitative Index described in **Table 3-3** below.

Detailed information was collected at the 30 habitat hectare sites in accordance with the Vegetation Quality Assessment (VQA) manual (DSE 2004). Habitat hectare assessments were undertaken on a representative 20 x 100 meter (m) plot at each site.

Using the information collected during the Quaternary and habitat hectare site assessments, the preliminary vegetation mapped prepared during the desktop phase (see **Section 3.1.2**) was updated to provide a more accurate assessment of native patch distribution and EVC type. Each patch of native vegetation was assigned a site condition score by extrapolating the site condition scores from the habitat hectares assessment, and the vegetation condition class information collected at the Quaternary sites.

Table 3-3	Qualitative	index for	patches	from	Quaternary s	ites.

Condition class	Qualitative criteria
High	<ul> <li>Areas managed for conservation (e.g. Jallumba Marsh Flora Reserve); and/or</li> <li>Broad areas of vegetation where most structural elements are present.</li> </ul>
Medium	> Most canopy elements remain intact with relictual canopy elements common to abundant.
Low	> Small patches of vegetation where relictual canopy elements are uncommon or absent.

#### 3.2.2.3 Scattered trees

To gain a high-level estimation of the number and location of scattered trees within the study area, subsampling was undertaken in areas selected from aerial photography considered representative of the typical spread of scattered trees across the study area. The sub-sampling process involved dividing the study area

<sup>&</sup>lt;sup>3</sup> A native canopy tree is a mature tree (i.e. it is able to flower) that is greater than 3 metres in height and is normally found in the upper layer of the relevant vegetation type.

into 250 m x 250 m square cells (total of 959 squares) and surveying 76 of these cells for scattered trees in the field. For each scattered tree, the following information was recorded:

- > Species
- > Diameter at Breast Height (DBH)
- > Size class (large or small).

The size class of each scattered tree was determined in accordance with the Guidelines (DELWP 2017) as such:

- > A large tree is a native canopy tree with a DBH greater than or equal to the large tree benchmark for the relevant bioregional EVC
- > A small tree is a native canopy tree greater than 3 m and with a DBH less than the large tree benchmark for the relevant bioregional EVC.

The large tree benchmarks for the EVCs typically associated with scattered tree locations is in Table 3-4.

Data collected on scattered trees was then extrapolated across each 250 m x 250 m cell in ArcGIS 10.0  $^{\circ}$  using the 'nearest-neighbour' method to map the distribution and density of scattered trees across the study area.

Table 3-4	Benchmark	DBH for	Large	Scattered	Trees

EVC	Canopy Species	Large Tree DBH (cm)
Plains Woodland EV/C 803	Eucalyptus spp.	70
	Allocasuarina luehmannii	40
Red Gum Swamp – EVC 292	Eucalyptus spp.	60

#### 3.2.3 Threatened Ecological Communities

A threatened ecological community (TEC) is considered any ecological community listed as threatened under the EPBC Act or Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). As part of the native vegetation assessment (see **Section 3.2.2**), information was collected to determine the likely presence of TECs within the study area.

The PMST identified the following EPBC Act-listed TECs as likely to be present within the study area or a surrounding 10 km radius:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions (hereinafter referred to as the Buloke TEC)
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (hereinafter referred to as the Grey Box TEC)
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (hereinafter referred to as the Wetlands TEC).

The following listing advice and assessment guides were used to identify EPBC Act TECs in the field:

- > Commonwealth Listing Advice on Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions (ESS, 2000)<sup>4</sup>
- > Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia listing advice (CoA, 2010)

<sup>&</sup>lt;sup>4</sup> Information to confidently define the Buloke Woodland TEC is scant, with no information available regarding minimum patch size. Consultation with the DoEE regarding the Buloke TEC listing identified that this listing advice is old, lacks substantive information that is otherwise available for listing advice for other TECs and that the Department cannot provide further guiding at present. Conversely to accurately validate the Grey Box TEC additional structural information is required for individual patches.

- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains Listing advice (CoA, 2012a)
- > Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia: A guide to the identification, assessment and management of a nationally threatened ecological community *Environment Protection and Biodiversity Conservation Act 1999* (CoA, 2012b).
- > National Recovery Plan for Buloke Woodlands of the Riverina and Murray Darling Depression Bioregions (Cheal et al., 2011).

The decision tree shows how information from the sources above was combined with EVC data to identify the potential location of TECs (Figure 3-2).

Not every patch of native vegetation could be assessed in detail, therefore the likely presence of a TEC was identified on the basis of the available field and/or supporting desktop information.



Figure 3-2 EPBC Act TEC decision tree

The presence of FFG Act TECs was inferred from EVC data and bird surveys. There are three FFG Act TECs with potential to occur in the study area (**Table 3-5**).

Table 3-5	FFG Act TEC descriptions
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FFG Act TEC	EVC	Key diagnostic characteristics (DELWP 2018)
Semi-arid Northwest Plains Buloke Grassy Woodland Community	803	Open woodland in which Buloke <i>Allocasuarina luehmannii</i> is the dominant tree, sometimes in association with Black Box <i>Eucalyptus largiflorens</i> and/or Yellow Gum <i>Eucalyptus leucoxylon</i> Once widespread across the plains of north-western Victoria and the Wimmera on sites where soils are relatively fertile and subject to seasonal water-logging.
Victorian Temperate Woodland Bird Community	n/a	Defined as a suite of bird species, mainly associated with drier woodlands on the slopes and plains north of the Great Dividing Range. Species include Painted Button-quail <i>Turnix varia</i> , Bush Stone- curlew <i>Burhinus grallarius</i> , Red-tailed Black-Cockatoo <i>Calyptorhynchis banksia graptogyne</i> , Little Lorikeet <i>Glossopsitta pusilla</i> , Superb Parrot <i>Polytelis swainsonii</i> , Swift Parrot <i>Lathamus discolor</i> , Turquoise Parrot <i>Neophema pulchella</i> , Barking Owl <i>Ninox connivens</i> , Brown Treecreeper <i>Climacteris picumnus victoriae</i> , Speckled Warbler <i>Chthonicola sagittata</i> , Western Gerygone <i>fusca</i> , Regent Honeyeater <i>Anthochaera Phrygia</i> , Yellow-tufted Honeyeater <i>Lichenostomus melanops meltoni</i> , Fuscous Honeyeater <i>Lichenostomus fuscus</i> , Black-chinned Honeyeater <i>Grantiella picta</i> , Jacky Winter <i>Microeca fascinans</i> , Red-capped Robin <i>Petroica goodenovii</i> , Hooded Robin <i>Melanodryas cucullata</i> , Grey-crowned Babbler <i>Pomatostomus temporalis</i> , Ground Cuckoo-shrike <i>Coracina maxima</i> , Apostlebird <i>Struthidea cinerea</i> and Diamond Firetail <i>Stagonopleura guttata</i> .
Red Gum Swamp Community No. 1	292	Dominated by River Red Gum <i>Eucalyptus camaldulensis</i> with seasonal or intermittent surface water up to 40 cm depth that can inundate for up to four months of the year. Currently known to occur in parts of the Wimmera CMA.

#### 3.2.4 Wetlands

Mapped wetlands were investigated to confirm they meet the definition of a patch in accordance with the Guidelines:

"A location that is mapped as a wetland in the Current wetlands map, available in DELWP systems and tools, is included when measuring the extent of native vegetation to be removed...Mapped wetlands are treated as a patch of native vegetation. The modelled condition score is used for mapped wetland unless a site assessment is carried out soon after inundation...A part of mapped wetland may be excluded if it is covered by a hardened, man-made surface, for example, a roadway (DELWP 2017 pg 8).

Additional observations regarding the dominance of native flora species at each wetland was made during field investigation to inform habitat suitability for threatened flora and fauna, and assessment of Wetland TEC.

#### 3.2.5 Flora

A full list of flora species recorded during the surveys of the Quaternary and habitat hectare sites, as well as incidental records. Surveys within reserves was conducted in accordance with Cardno's FFG Act Permit conditions (#10008807).

Targeted surveys were completed for threatened flora species regarded as having a likely or possible occurrence in the study area based on the desktop results (see **Appendix A** for species list). Targeted surveys involved surveying highly probable habitat of threatened flora species including road reserves and conservation estate.

A full sweep of the Jallumba Marsh Flora Reserve was undertaken as part of the targeted search for Small Milkwort *Comesperma polygaloides*.

The likelihood of presence ratings assigned as part of the desktop assessment (see **Section 3.1.3**) were updated following the field assessment, to provide a more accurate assessment of the likelihood of presence.

#### 3.2.6 **Fauna**

Fauna surveys were conducted concurrently with flora assessments. All species of fauna observed during the assessment were recorded.

Fauna assessments relied on non-invasive habitat assessments and incidental observations (i.e. no trapping). Fauna searches included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. Particular attention was given to searching for likely significant species, such as the Growling Grass Frog *Litoria raniformis*.

 Table 3-6 presents targeted techniques adopted during fieldwork.

Significant habitat features for threatened species were targeted for additional survey effort. This included inspection of known Red-tailed Black Cockatoo foraging trees for orts and aural surveys for Growling Grass Frog at waterbodies.

The likelihood of presence ratings assigned as part of the desktop assessment (see **Section 3.1.3**) were updated following the field assessment, to provide a more accurate assessment of the likelihood of presence

	,		, ,				
Group	Species	Direct searches o signs	Call playback	Dawn survey	Spot lighting	Camera trap (20 traps)	Dedicated wetland bird surveys
Amphibians	General/ Growling Grass Frog	✓	1		√		
Reptiles	General	✓					
Birds	General	✓		1	1		✓
Mammals	General	✓			1	✓	
SITES		All	Cam 12a (see Figure 3-1)	Jallumba Marsh Flora Reserve	Roads / tracks in <b>Figure 3-1</b>	See Figure 3- 1	Jallumba Marsh Flora Reserve, Red Gum Swamp, Darragan Swamp

 Table 3-6
 Summary of Proposed Fauna Survey Techniques

### 3.3 Limitations

Despite the field survey scheduled for spring to optimise flora and fauna identification, not all potentially occurring species would have been observed if present due to the transient and ephemeral nature of some species.

The flora and fauna survey effort was focussed on capturing as many species as possible, as well as habitats likely to support threatened species to maximize the potential for observing such species. Targeted surveys for threatened species were not completed but recommendations have been made as to which species to target and appropriate survey timing.

The purpose of the native vegetation assessment was to only improve the accuracy from a scale of 1:100,000 to 1: 10,000. This resulted in more detailed native vegetation information that can inform development of the mine plan. Prior to any native vegetation removal, a habitat hectare assessment must be completed in accordance with the Guidelines (DELWP 2017).

### 4 Results

### 4.1 Desktop Assessment

#### 4.1.1 Native Vegetation

According to NVIM, the study area is predicted to support three EVCs covering 528 ha or 9.5% of the study area (**Table 4-1**). The predicted occurrence of EVCs across the study area is illustrated in **Figure 4-1**.

#### Table 4-1 EVCs mapped in the study area

Bioregion	Vegetation Code	Name	Bioregional Status	Conservation	Area (ha)	Area (% study area)
	Wim_0022	Grassy Dry Forest	Depleted		11	0.2
Wimmera	Wim_0292	Red Gum Swamp / Wetlands	Vulnerable		245	4.4
	Wim_0803	Plains Woodlands	Endangered		272	4.9
			TOTAL		528	9.5



#### 4.1.2 Wetlands

Despite the Wimmera experiencing considerable disturbance to its hydrology since agricultural development began in the 1860s, it still retains significant wetland features and is home to over 20% of Victoria's non-flowing wetlands. The wetlands in the study area are part of the South West Wimmera wetland system known for their high biodiversity and connectivity (Wimmera CMA, 2011).

The PMST search identified one Wetland of International Significance (Ramsar Site) – Lake Albacutya. The study area is 100 – 150 km upstream of the Ramsar Site and therefore unlikely to have any impacts.

According to DELWP's Current Wetland layer, there are thirteen wetlands registered under the Victorian Wetland Inventory List occurring within or in proximity to the study area (**Figure 4-2**). The Current Wetland layer also specifies that all thirteen wetlands have a freshwater salinity regime and low groundwater influence. Furthermore, none are listed as permanently inundated. They vary in size from less than 5 ha to greater than 180 ha for Red Gum Swamp (i.e. Weltand ID 18280 in **Figure 4-2**).

#### 4.1.3 Groundwater Dependent Ecosystems

The GDE Atlas (BoM 2018) identifies wetlands mapped within the study area as unlikely to be groundwater dependent, although several of the wetlands directly adjoining the study area are. Native woodland within the study area, with large, deep-rooted canopy trees, may also be groundwater dependent.

Groundwater dependent wetlands rely on the surface expression of groundwater, and therefore are typically found above shallow groundwater profiles. In contrast, woodlands and other terrestrial vegetation that is groundwater dependent, are commonly reliant on the sub-surface expression of groundwater which is accessed via deep tap-roots.

Further hydrogeological and eco-physiological investigations are required to determine the groundwater dependency of ecosystems that could potentially be impacted by any mining development.



#### 4.1.4 Threatened Fauna and Flora

**Table 4-2** and **Table 4-3** presents the threatened species records from VBA within the study areas and surrounding 10 km radius. **Figure 4-3** shows the location of records within and directly adjoining the study area.

The likelihood of threatened species raised via the VBA and PMST occurring within the study area was assessed based on desktop information, with the detailed results (including habitat preferences for each species) provided in **Appendix A**.

Four threatened fauna species were considered 'likely' to occur in the study area:

- > Red-tailed Black-Cockatoo
- > Diamond Firetail
- > Growling Grass Frog
- > Brown Toadlet.

Red-tailed Black-Cockatoo, Growling Grass Frog and Diamond Firetail are nationally significant, and Diamond Firetail and Brown Toadlet are of State-significance only. There are several records for Red-tailed Black-Cockatoo from within the study area (**Figure 4-9**), and the species utilises large River Red-gum *Eucalyptus camaldulensis* trees for nesting and typically feeds in heathy and Buloke woodlands. Diamond Firetail is associated with similar habitat. There are no records for Diamond Firetail within the study area, but the species has been recorded within proximity (**able 4-2**).

Growling Grass Frog and Brown Toadlet are associated with wet, low-lying areas, including permanent and ephemeral wetlands surrounded by aquatic and emergent vegetation. Wetlands within the study area (including highly modified wetlands) could provide habitat for both species. The system of channels is not optimal habitat for either species due to infrequency of water availability and the lack of vegetation. The channels could potentially be utilised by both species opportunistically to disperse through the landscape when in flood.

The likelihood of 32 additional fauna species was considered 'possible' based on desktop information, including 27 birds, 3 mammals and 2 reptiles. Full results are provided in **Appendix A** 

For threatened flora, four species raised via the VBA were considered likely to occur in the study area, both of which are State-significant:

- > Buloke
- > Buloke Mistletoe Amyema linophylla subsp. orientalis
- > Wimmera Woodruff Asperula wimmerana
- > Small Milkwort Compesperma polygaloides.

Buloke can be found as an isolated paddock tree or in patches of native woodland. Buloke Mistletoe is a parasitic species of the tree, while Wimmera Woodruff and Small Milkwort are associated with heavier soils support woodland vegetation. All four species have been recently recorded within or in proximity to the study area (**Figure 4-9**).

Scientific Name	Common Name	EPBC Act^	FFG Act*	Victorian Advisory List#	Latest Date	No of records
Birds						
Anas rhynchotis	Australasian Shoveler			Vulnerable	27/12/1998	4056
Calyptorhynchus banksii graptogyne	Red-tailed Black- Cockatoo	EN	Listed	Endangered	4/05/2014	1230
Grus rubicunda	Brolga		Listed	Vulnerable	1/10/2012	84
Biziura lobata	Musk Duck			Vulnerable	20/05/2001	559
Melanodryas cucullata	Hooded Robin		Listed	Near threatened	12/06/2010	26
Oxyura australis	Blue-billed Duck		Listed	Endangered	1/03/1994	3513

Table 4-2 VBA threatened fauna records within the study area and surrounding 10 km radius.

### Cardno<sup>®</sup>

Scientific Name	Common Name	EPBC Act <sup>^</sup>	FFG Act*	Victorian Advisory List#	Latest Date	No of records
Lichenostomus cratitius	Purple-gaped Honeyeater			Vulnerable	9/11/1981	9
Leipoa ocellata	Malleefowl	VU	Listed	Endangered	19/10/1978	9
Stagonopleura guttata	Diamond Firetail		Listed	Near threatened	2/01/2011	131
Ardea modesta	Eastern Great Egret		Listed	Vulnerable	31/03/2003	70
Aythya australis	Hardhead			Vulnerable	31/03/2004	354
Oreoica gutturalis	Crested Bellbird		Listed	Near threatened	19/10/1978	5
Stictonetta naevosa	Freckled Duck		Listed	Endangered	3/03/2000	1205
Lophocroa leadbeateri	Major Mitchell's Cockatoo		Listed	Vulnerable	13/08/1974	3
Anthochaera phrygia	Regent Honeyeater	CR	Listed	Critically endangered	1/01/1928	1
Neophema elegans	Elegant Parrot			Vulnerable	1/01/1951	1
Burhinus grallarius	Bush Stone-curlew		Listed	Endangered	11/08/2008	19
Pachycephala rufogularis	Red-lored Whistler	VU	Listed	Endangered	26/04/1975	1
Hirundapus caudacutus	White-throated Needletail			Vulnerable	25/12/1970	9
Egretta garzetta nigripes	Little Egret		Listed	Endangered	1/01/1951	1
Pedionomus torquatus	Plains-wanderer	CR	Listed	Critically endangered	1/01/1951	1
Pomatostomus temporalis	Grey-crowned Babbler		Listed	Endangered	28/03/1975	3
Acanthiza iredalei hedleyi	Slender-billed Thornbill		Listed	Near threatened	1/01/1951	3
Polytelis anthopeplus monarchoides	Regent Parrot	VU	Listed	Vulnerable	1/01/1967	1
Ninox connivens	Barking Owl		Listed	Endangered	13/08/1974	2
Ixobrychus minutus dubius	Little Bittern		Listed	Endangered	1/09/1957	1
Hydroprogne caspia	Caspian Tern		Listed	Near threatened	1/12/1978	4
Haliaeetus leucogaster	White-bellied Sea- Eagle		Listed	Vulnerable	25/02/2003	21
Anseranas semipalmata	Magpie Goose		Listed	Near threatened	21/08/1991	1
Pyrrholaemus sagittatus	Speckled Warbler		Listed	Vulnerable	30/01/1978	1
Ardeotis australis	Australian Bustard		Listed	Critically endangered	1/12/1970	11
Falco subniger	Black Falcon		Nominated	Vulnerable	28/01/2005	6
Calamanthus pyrrhopygius	Chestnut-rumped Heathwren		Listed	Vulnerable	18/10/1979	1
Calidris ferruginea	Curlew Sandpiper	CR		Endangered	28/09/2003	4
Botaurus poiciloptilus	Australasian Bittern	EN	Listed	Endangered	4/10/1991	1
Lathamus discolor	Switt Parrot Painted	CR	LISTED	⊢ndangered	12/06/1978	2
Grantiella picta	Honeyeater	VU	Listed	Vulnerable	23/10/1977	6
Lewinia pectoralis	Lewin's Rail		Listed	Vulnerable	25/09/1991	2
madagascariensis	Eastern Curlew	CR		Vulnerable	29/08/2004	8
palustris	Baillon's Crake		Listed	Vulnerable	1/12/1985	5

### Cardno<sup>®</sup>

Scientific Name	Common Name	EPBC Act^	FFG Act*	Victorian Advisory List#	Latest Date	No of records
Lophoictinia isura	Square-tailed Kite		Listed	Vulnerable	3/01/2008	1
Ardea intermedia	Intermediate Egret		Listed	Endangered	6/08/1991	3
Ardeotis australis	Australian Bustard		Listed	Critically Endangered	1/12/1970	6
Calidris melanotos	Pectoral Sandpiper	CR		Endangered	13/02/1983	1
Chrysococcyx	Black-eared			Near	3/09/1979	1
osculans	Cuckoo			threatened		
Cinclosoma	Chestnut Quail-			Near	26/04/1975	1
castanotus	thrush			threatened		
Dromaius	Fmu			Near	6/06/1979	6
novaehollandiae	2			threatened		
Nycticorax	Nankeen Night			Near	18/11/2003	12
caledonicus hillii	Heron			threatened		
Phalacrocorax varius	Pied Cormorant			Near	7/04/2001	4
				threatened	0/40/0004	
Platalea regia	Roval Spoonbill			Near	3/12/2004	6
				threatened	00/40/4005	•
Plegadis falcinellus	Glossy Ibis			Near	30/10/1985	6
-				threatened	0/40/0000	0
Turnix velox	Little Button-quail			Near	3/12/2000	3
Fraga				threatened		
Flogs	Crowling Cross	1/11	Listed	Endangorod	01/01/17002	1
Litoria raniformis	Frog	VU	Listeu		01/01/1700-	4
Pseudophryne bibronii	Brown Toadlet		Listed	Endangered	30/09/1960	5
Mammals						
Petrogale penicillata	Brush-tailed Rock- wallaby	VU	Listed	Critically endangered	15/02/2016	1
Phascogale tapoatafa	Brush-tailed Phascogale		Listed	Vulnerable	1/05/1964	1
Cercartetus concinnus minor	Western Pygmy- possum			Near threatened	1/12/1957	1
Pseudomys apodemoides	Silky Mouse			Near threatened	4/01/1974	1
Śminthopsis crassicaudata	Fat-tailed Dunnart			Near	6/01/1964	1
Fish						
Tandanus tandanus	Freshwater Catfish		Listed	Endangered	4/03/2002	30
Reptiles						
Varanus varius	Lace Monitor			Endangered	20/02/1992	1
Pogona barbata	Bearded Dragon			Vulnerable	1/10/1974	1

<sup>^</sup>EPBC Act: VU = vulnerable, CR = critically endangered, EN = endangered Victorian Advisory# - Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014).

Table 4-3	VBA threatened flora	records within the study	area and surrounding	10 km radius
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Scientific Name	Common Name	EPBC Act <sup>^</sup>	FFG Act*	Victorian Advisory List#	Latest Date	No of records
Flora						
Lipocarpha microcephala	Button Rush			Vulnerable	1/03/1984	3
Thelymitra azurea	Azure Sun-orchid			Vulnerable	1/01/1980	1
Acacia glandulicarpa	Hairy-pod Wattle	VU	Listed	Vulnerable	12/11/2003	5
Eucalyptus froggattii	Kamarooka Mallee		Listed	Rare	1/06/1981	3
Allocasuarina Iuehmannii	Buloke		Listed	Endangered	1/02/2012	15
Amyema linophylla subsp. orientalis	Buloke Mistletoe			Vulnerable	1/02/2012	6
Ptilotus erubescens	Hairy Tails		Listed	Vulnerable	1/02/2012	1
Senecio hypoleucus	Pale Groundsel			Vulnerable	1/09/1962	1

Scientific Name	Common Name	EPBC Act <sup>^</sup>	FFG Act*	Victorian Advisory List#	Latest Date	No of records
Davallia solida var. pyxidata	Hare's-foot Fern			Vulnerable	13/10/2015	3
Asterolasia phebalioides	Downy Star-Bush	VU	Listed	Vulnerable	12/10/1988	1
Eucalyptus hawkeri	Arapiles Peppermint-box			Vulnerable	10/04/2000	1
Melaleuca halmaturorum	Salt Paperbark		Listed	Vulnerable	1/01/1980	1
Cyperus subulatus	Pointed Flat-sedge			Vulnerable	1/03/1984	3
Comesperma polygaloides	Small Milkwort		Listed	Vulnerable	26/01/2012	5
Xerochrysum palustre	Swamp Everlasting	VU	Listed	Vulnerable	15/12/2010	1
Asperula wimmerana	Wimmera Woodruff			Rare	18/01/2012	3
Asterolasia phebalioides	Downy Star-Bush	VU	Listed	Vulnerable	12/10/1988	1
Callitriche umbonata	Winged Water- starwort			Rare	26/09/1969	1
Calotis lappulacea	Yellow Burr-daisy			Rare	21/10/1998	1
Comesperma polygaloides	Small Milkwort		Listed	Vulnerable	21/10/1998	5
Daviesia pectinata	Thorny Bitter-pea			Rare	21/10/1998	1
Eremophila gibbifolia	Coccid Emu-bush			Rare	21/10/1998	2
Eucalyptus wimmerensis	Wimmera Mallee- box			Rare	10/03/2006	5
Gnephosis drummondii	Slender Cup-flower			Rare	25/06/1969	1
Gnephosis tenuissima	Dwarf Cup-flower			Rare	21/10/1998	1
Goodenia benthamiana	Small-leaf Goodenia			Rare	16/12/1998	2
Leucopogon thymifolius	Thyme Beard- heath			Rare	1/12/1995	1
Leucopogon virgatus var. brevifolius	Common Beard- heath			Rare	19/12/1998	1
Pultenaea daltonii	Hoary Bush-pea			Rare	1/10/1927	1
Senecio hypoleucus	Pale Groundsel			Rare	1/09/1962	1
Thryptomene calycina	Grampians Thryptomene			Rare	30/09/1956	1
Xanthorrhoea caespitosa	Tufted Grass-tree			Rare	21/11/1998	1
Zieria veronicea subsp. veronicea	Pink Zieria			Rare	28/10/1891	1

Key: Key: AEPBC Act: VU = vulnerable, CR = critically endangered, EN = endangered Victorian Advisory# - Advisory List of Threatened Vertebrate Fauna in Victoria (DSE, 2013), Advisory List of Threatened Invertebrate Fauna in Victoria (DSE, 2009)



### Legend

 WIM100 Study Area (Iluka, 2018)
 Conservation Reserves
 Cadastre (VIC Lands, 2015)
 Higher Accuracy Flora and Fauna Records

ILUKA

Aythya Ardea modesta australis Biziura lobata Biziura lobata

hillii

Climacteris picumnus Lophoictinia victoriae isura Melanodryas cucullata

cucullata

Grus

rubicunda

Haliaeetus Ieucogaster

FIGURE 4-3 1:40,000 Scale at A3

30.

Known Records of Threatened Flora and Fauna Species WIM100 INDIVIDUAL STUDY SITES



### 4.2 Field Assessment

#### 4.2.1 Native Vegetation

#### 4.2.1.1 Ecological Vegetation Classes

Consistent with preliminary vegetation mapping, the study area was found to be predominantly cleared farming land subject to regular cultivation. Native vegetation present was mostly confined to roadsides and conservation reserves. Extrapolating data from the 30 habitat hectare and 80 Quartenary sites surveyed resulted in the mapping of four EVCs across 448 ha (**Table 4-4**) compared to three EVCs across 528 ha identified during the desktop assessment.

The discrepancy in number of EVCs was due to modelled patches of Grassy Dry Forest (EVC 22) found to support Plains Grassy Wetland (EVC 125), while Aquatic Herbland (EVC 653) was found in swamps where no EVC was predicted. Some of the modelled patches of Red Gum Swamp (EVC 292) are better described as Permanent Open Freshwater (EVC 682), while almost 40 ha of modelled EVCs were found to be cultivated or planted vegetation and did not meet the condition threshold for native vegetation under the Guidelines.

Descriptions and photos of each EVC recorded during the field assessment is provided below. Detailed results from the Quartenary sites and habitat hectare sites is provided in **Appendix B** and **Appendix C** respectively.

**Figure 4-5** maps the extrapolated site condition scores based on the habitat hectare and Quaternary site assessment scores. It shows that native vegetation quality is mostly poor to moderate, which could be explained by the extensive history of agricultural disturbance and the ongoing impacts of fragmentation. The best quality native vegetation is expected to be the Red Gum Swamp in the south-west corner of the study area.

EVC number	EVC Name or Description	Bioregional Conservation Status	Estimated area (ha)	Notes
125	Plains Grassy Wetland	Endangered	56.5	This EVC has been applied to three areas mapped as EVC 292 or 22 ( <b>Figure 4-1</b> ). EVC 22 was found to be entirely absent from the study area.
292	Red Gum Swamp	Vulnerable	280.4	In some locations the mapped extent of this EVC support plantings of <i>Eucalyptus camaldulensis</i> and other local species.
803	Plains Woodland	Endangered	88.0	
653	Aquatic Herbland	Endangered	23.4	Mapped within the Darragan Wildlife Reserve.

Table 4-4 EVC information for study area





ILUKA



1,000

# EVC Mapping 1:10,000

WIM100 INDIVIDUAL STUDY SITES



Map Produced by Cardno Date: 2019-02-19 | Project: 59918162 Coordinate System: GDA 1994 MGA Zone 54 Map: 59918162-GS024-GroundTruthedEVC\_WIM100.mxd 02 Aerial Imagery Supplied by Water Technology (December, 2016)

A brief description of each mapped EVC follows:

> EVC 125: Plains Grassy Wetland

This EVC occurs in three locations within the study area, which are in the general location of Wetland ID 18316, 18262 and 18265 (**Figure 4-2**). One location is presently heavily grazed but supports native species including *Ranunculus sessiliflorus* var. *pilulifer* and Wooly-heads *Myriocephalus rhizocephalus*. The wetland in the Jallumba Swamp Flora Reserve (**Plate 1**) supports diverse herbs including Prickfoot *Eryngium vesiculosum* and Yellow balls *Craspedia variabilis*. A broad wetland in the west of the study area supports dense Southern Cane-grass *Eragrostis infecunda* in addition to other species such as *Callitriche umbonata* and *Marsilea drummondii*.

> EVC 292: Red Gum Swamp

This EVC is typified by large River Red Gums *Eucalyptus camaldulensis* (**Plate 2**). It is primarily associated with conservation reserves, but is also present in smaller patches in road reserves and paddocks. The ground layer of most patches is dominated by exotic grasses.

> EVC 803: Plains Woodland

While the mapped extent of this EVC within the study area is smaller than EVC 292 it is wider spread with most patches represented by narrow roadside remnants (**Plate 3**) or clusters of trees in paddocks. Grey Box *Eucalyptus microcarpa*, Yellow Gum *Eucalyptus leucoxylon* and Buloke *Allocasuarina luehmannii* are common canopy elements that vary in dominance throughout the study area. The ground layer of most patches is dominated by exotic grasses.

> EVC 653: Aquatic Herbland

Existing mapping for Darragan Wildlife Reserve accepted as accurate.

> EVC 682: Permanent Open Freshwater

Mapped in a single location at areas modelled as supporting Red Gum Swamp (EVC 292) (**Plate 4**). This EVC best describes the conditions at the time of assessment. It is likely the area would be dry after low rainfall periods.



Plate 1 - EVC 125: Plains Grassy Wetland in Jallumba Marsh Flora Reserve



Plate 3 - EVC 803: Plains Woodland



Plate 2 - EVC 292: Red Gum Swamp



Plate 4 - Permanent Open Freshwater



#### 4.2.1.2 Scattered Trees

The field assessment found that, for the most part, preliminary mapping of trees from the desktop assessment was generally correct. Minor discrepancies were observed where there had been natural mortality of individual trees or where they had been removed in cultivated areas. **Figure 4-6** presents the derived density of scattered trees observed within individual 250 m x 250 m grid cells across the study area.

Based on the 942 trees assessed, it was found that 744 (i.e. 79%) meet the definition of a large tree and 198 (i.e. 21%) meet the definition of a small tree in accordance with the Guidelines.



#### 4.2.2 Wetlands

#### 4.2.2.1 Wetland field observations

Wetlands listed under the Victorian Wetland Inventory and within the study area were assessed to verify ecological condition. Many wetlands had been converted to cropping or were dominated by exotic pasture with no wetland species present.

The Guidelines specify that mapped wetlands are treated as a patch of native vegetation (unless covered by hard surfaces e.g. road or house) regardless of current condition. Nonetheless, the field assessment was necessary to understand the values mapped wetlands particularly habitat for threatened species.

Review of historical aerial imagery for the study area found that a number of the mapped wetlands that were dry at the time of survey are subject to inundation (e.g. Wetland #18264 in 2013) and additional areas outside of mapped wetlands supported standing water.

**Table 4-5** provides a summary of field observations for wetlands. Irrespective of condition, all mapped wetlands are treated as a patch for assessing compensation arising from the removal of native vegetation.

The Guidelines stipulate that changing the boundary of a mapped wetland requires a hydrological assessment and the approval of the Secretary to DELWP.

VICTORIAN WETLAND INVENTORY DESCRIPTION			FIELD OBSERVATIONS	
Wetland number	Name	Water Regime	Is the area dominated by native flora species	Notes
18280	Red Gum Swamp	Palustrine or Lacustrine (unknown specifics)	Yes	Reserve
18281	Jallumba Swamp	Palustrine	No	Cropped and grazed
18316	Jallumba Marsh Flora Reserve	Palustrine	Yes	Reserve
18264		Palustrine	No	Cropped
18267		Palustrine	In part	Grazed pasture
18262		Palustrine	Yes	
18265		Palustrine	Yes	Grazed, but supports wetland flora
18319		Palustrine	No	Cropped
18282		Palustrine	No	Cropped
18284		Palustrine	No	Cropped
19097	Darragan Swamp	Palustrine	Yes	Reserve
18292		Palustrine	No	Grazed pasture
18286	Nurrabiel Swamp	Palustrine	Yes	Reserve

Table 4-5 Field observations of mapped wetlands within the study area.

#### 4.2.3 Threatened Ecological Communities

The potential location of TECs within the study area were reduced significantly following the field assessment. Many patches of native vegetation are heavily degraded and unlikely to meet the condition thresholds for a TEC (**Figure 3-2**). There are several discrete locations (predominantly in the south of the study area) that have potential to support EPBC Act TECs, which are detailed in **Table 4-6** and shown in **Figure 4-7**. As explained in the EPBC Act TEC decision tree (**Figure 3-2**), the potential location of EPBC Act TECs is associated with larger, better quality patches of native vegetation.

Threatened Ecological Communities listed under the FFG Act are also likely to be present in the study area. Patches of Red Gum Swamp (EVC 292) are synonymous with the listed Red Gum Swamp No. 1 community, while Plains Woodland (EVC 803) dominated by Buloke is likely to be Semi-arid Northwest Plains Buloke Grassy Woodland Community (**Figure 4-4**).

The Victorian Temperate Woodland Bird Community is present within the study area. Four characteristic species of the community were recorded during the field assessment: Brown Treecreeper, Brown-headed Honeyeater, Red-capped Robin and Diamond Firetail (**Appendix E**). Red-tailed Black-Cockatoo is also likely to occur in the study area.

Detailed field investigations are required to confirm the presence and condition of TECs within the study area.

Table 4-6	Potential location of EPBC TECs within the study area
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TEC	Potential location
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Jalumba Marsh Nature Conservation Reserve, Natimuk-Hamilton Road, Jallumba- Douglas Road, Jallumba-Clear Lake Road and directly east of Red Gum Swamp.
Grey Box ( <i>Eucalyptus</i> <i>microcarpa</i> ) Grassy Woodlands and Derived Native Grasslands of South- eastern Australia	Jalumba Marsh Nature Conservation Reserve, Natimuk-Hamilton Road, Jallumba- Douglas Road, Jallumba-Clear Lake Road and directly east of Red Gum Swamp.
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Wetland ID# 18316, 18262 and 18265




FIGURE 4-7 1:40,000 Scale at A3 letres 1,000 500 ò

## **Threatened Ecological Communities**

WIM100 INDIVIDUAL STUDY SITES



Map Produced by Cardno Date: 2018-12-14 | Project: 59918162 Coordinate System: GDA 1994 MGA Zone 54 Map: 59918162-GS027-ThreatenedEcologicalCommunities\_WIM100.mxd C Aerial Imagery Supplied by Water Technology (December, 2016)

#### 4.2.4 Flora

#### 4.2.4.1 General

In total 183 species were recorded during the field assessment of which 64 (36%) are exotic. A detailed flora list is present in **Appendix D**.

#### 4.2.4.2 Threatened Species

Six threatened flora species were recorded during the field assessment (**Table 4-7** and **Figure 4-8**), all of which are State-significant only. Despite dedicated searches during the known flowering season, the presence of Small Milkwort was not confirmed in the Jallumba Marsh Flora Reserve.

Kamarooka Mallee *Eucalyptus froggattii* was recorded immediately to the north of the study area, but not in the areas traversed within the study area.

The likelihood of presence for threatened flora species was revised following completion of the field assessment. The likelihood of the species identified in **Table 4-7** was upgraded to 'known', while four species were rated as 'possible' (**Appendix A**). The remaining 24 species considered as part of the desktop assessment were either maintained or down-graded to 'unlikely' present within the study area.

Button Rush *Lipocarpha microcephala* is unlikely to occur in the study area, despite being previously found in close proximity to the study area, due lack of suitable habitat. Despite no sightings of Small Milkwort during the field assessment, it is still possible the species occurs due to the ephemeral nature of this species, availability of habitat, and past records within the Jallumba Marsh Nature Reserve.

Species	Common name	EPBC Act <sup>^</sup>	FFG Act*	Victorian Advisory List#	Distribution and abundance in Study Area
Acacia rupicola	Rock Wattle			Rare	Found in one small roadside occurrence of approximately 10 individuals.
Allocasuarina luehmannii	Buloke		Listed	Endangered	Abundant. Located throughout the study area in patches and as isolated trees.
Amyema linophylla subsp. orientalis	Buloke Mistletoe			Vulnerable	Abundant. Frequently encountered as a mistletoe of Bulokes. (Plate 6).
Asperula wimmerana	Wimmera Woodruff			Rare	Abundant. Found in many roadside patches of vegetation and in the Jallumba Marsh Flora Reserve. (Plate 7).
Callitriche umbonata	Winged Water Star- wort			Rare	Found in a single wetland (Wetland ID 18262) where it is abundant.
Dianella porracea	Leek flax-lily			Vulnerable	Found in two roadside locations as individual plants. (Plate 8)

#### Table 4-7 Threatened flora species recorded within the study area

Key:

EPBC<sup>^</sup> – Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

^EPBC Act: VU = vulnerable, CR = critically endangered, EN = endangered

FFG\* - Flora and Fauna Guarantee Act 1988 (FFG Act)

Victorian Advisory# - Advisory List of Threatened Vertebrate Fauna in Victoria (DSE, 2013), Advisory List of Threatened Invertebrate Fauna in Victoria (DSE, 2009), Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014).





FIGURE 4-8 1:40,000 Scale at A3 Metres 500

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1,000

**Observed Threatened Flora** 

WIM100 INDIVIDUAL STUDY SITES

C Cardno

Map Produced by Cardno Date: 2019-02-13 | Project: 59918162 Coordinate System: GDA 1994 MGA Zone 54 Map: 59918162-GS028-TreatenedFlora\_WIM100.mxd 02 Aerial Imagery Supplied by Water Technology (December, 2016)



Plate 5 – Sticky Wattle Acacia dodonaeifolia



Plate 6 - Buloke Mistletoe Amyema linophylla subsp. orientalis



Plate 7 – Wimmera Woodruff Asperula wimmerana



Plate 8 - Leek Flax Lilly Dianella porracea

#### 4.2.4.3 Weeds

The most common weed species found are exotic grasses, consisting predominantly of Toowoomba canarygrass *Phalaris aquatica*, Paradoxical Canary-grass *Phalaris paradoxa*, Madrid brome *Bromus madritensis*, Perennial Rye-grass *Lolium perenne* and Bearded Oat *Avena barbata*. A number of species were recorded that are listed as Noxious weeds under the *Catchment and Land Protections Act 1994*. This includes:

- > Restricted weeds:
  - o Bridal Creeper Asparagus asparagoides. Occasionally encountered in roadside vegetation
  - Slender Thistle *Carduus tenuiflorus*. Occasionally encountered in roadside vegetation and the Jallumba Marsh Flora Reserve
  - o Spear Thistle Cirsium vulgare. Commonly encountered throughout the study area.
- > Regionally controlled weeds:
  - African Boxthorn *Lycium ferocissimum*. This species was occasionally encountered in road reserves and in paddocks.

#### 4.2.5 Fauna

#### 4.2.5.1 General

A full list of the fauna species detected within or in proximity to the study area during the field assessment is provided in **Appendix E**.

#### 4.2.5.2 Threatened species

Seven threatened fauna species were recorded during the field assessment (**Table 4-8** and **Figure 4-9**). Further information on the records of threatened species (and non-threatened species) is provided in the sections below.

The likelihood of presence ratings for threatened fauna species identified during the desktop assessment, were revised after the field assessment. The likelihood of presence rating for each of the species identified in **Table 4-8** was upgraded to 'known'. Four species were assessed as 'likely' to occur in the study area, 29 as 'possible' and 24 as 'unlikely' (**Appendix A**).

Scientific Name	Common Name			Status
		EPBC	FFG <sup>^</sup>	Victorian Advisory List#
Birds				
Circus assimilis	Spotted Harrier	-	-	Near threatened
Anseranas semipalmata⁵	Magpie Goose	-	Listed	Near threatened
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	-	-	Near threatened
Stagonopleura guttata	Diamond Firetail	-	Listed	Near threatened
Chlidonias hybrida	Whiskered Tern	-	Listed	Near threatened
Reptiles				
Pogona barbata	Bearded Dragon	-	-	Vulnerable
Amphibians				
Pseudophryne bibronii	Brown Toadlet	-	Listed	Endangered

Table 4-8 Threatened fauna species recorded during the field assessment

^ - Listed as threatened under the Flora and Fauna Guarantee Act 1988

# - Threatened status is listed on the Advisory List of Threatened Vertebrate Fauna in Victoria 2013

<sup>&</sup>lt;sup>5</sup> Anseranas semipalmata was recorded flying over the study area; as such a location has not been provided in Figure 4-9.





#### 4.2.5.3 Mammals

Eleven mammal species (excluding domesticated animals e.g. sheep) were detected within or in proximity to the study area. Of these, five were introduced species: Red Fox *Vulpes vulpes*, Feral Cat *Felis catus*, Brown Hare *Lepus capensis*, European Rabbit *Oryctolagus cuniculus* and House Mouse *Mus musculus*. These species are common in the locality and often associated with farming/rural areas. The Red Fox is listed as a declared pest species (AG 2018).

No record mammal species are of National or State-significance.

Three species of macropod were recorded. The most commonly encountered were the Western Grey Kangaroo *Macropus fuliginosus* and Eastern Grey Kangaroo *Macropus giganteus*. It was not always possible to distinguish between these two species given the similarity in appearance. Less frequently observed was the Swamp Wallaby *Wallabia bicolor* (**Plate 9**). While some observations were made of these species within the road reserves and adjoining farm land they were most frequently encountered within conservation reserves, specifically the Jallumba Marsh Flora Reserve.

Two species of arboreal mammals were detected during the nocturnal survey: Common Brushtail Possum *Trichosurus vulpecula* and Common Ringtail Possum *Pseudocheirus peregrinus* (**Plate 10**). These species are widely distributed and common across Victoria, often using highly disturbed/modified vegetation. Both species were encountered within the study area along the road verges and within the conservation reserves but generally always in association with hollow-bearing trees which they were likely using for roosting.



Plate 9 - Swamp Wallaby Wallabia bicolor



Plate 10 - Common Ringtail Possum Pseudocheirus peregrinus

Whilst not observed within the study area, scat and tracks of the Short-beaked Echidna *Tachyglossus aculeatus* were found. This species is widely distributed across Victoria as it is tolerant to a wide range of habitat types including farming/rural lands. The evidence of use within the study area was restricted to a well forested section of road reserve. However, it is likely that this species would be encountered across all parts of the study area that support native vegetation.

Whilst no threatened mammal species were detected within the study area, there are species known to occur in the wider region. This includes the Heath Mouse *Pseudomys shortridgei*, Brush-tailed Phascogale *tapoatafa* and Squirrel Glider *Petaurus norfolcensis*. The likelihood of these species occurring within the study area is 'unlikely' owing to their low mobility in highly fragmented landscapes (**Appendix A**).

#### 4.2.5.4 Birds

Eighty-five bird species were observed and/or heard within or in proximity to the study area. Some species were also detected from camera traps. The majority of these species are known to be common in the Wimmera bioregion of Victoria. None of the bird species recorded are nationally-significant; however, two are listed as threatened under the FFG Act:

- > Magpie Goose *Anseranas semipalmata* Near Threatened. A flock of six were observed flying over the study area.
- > Diamond Firetail *Stagonopleura guttata* Near Threatened. Heard calling from within the Jallumba Marsh Flora Reserve.

A further three bird species were recorded that are on the Victorian Advisory List (DSE 2013) but not listed under the FFG Act:

- > Spotted Harrier *Circus assimilis* Near Threatened. A single bird observed low gliding over cropping land within the centre of the study area.
- > Brown Treecreeper (eastern subspecies) Climacteris picumnus victoriae Near Threatened. Several seen within large patches of woodland including the Jallumba Marsh Flora Reserve and Red Gum Swamp, importantly it was not recorded within small patches of woodland along road sides (Plate 11).
- > Whiskered Tern *Chlidonias hybrida* Near Threatened. An individual observed foraging along the edge of the wetland at Darragan Swamp Wildlife Reserve (**Plate 12**).

Two introduced bird species, House Sparrow *Passer domesticus* and Common Starling *Sturnus vulgaris* that are not listed as declared pest animals in Victoria (AG 2018) were also observed.

Birds were observed within all habitat types occurring throughout the study area. The highest quality aquatic habitat for bird species was located at the Red Gum Swamp and Darragan Swamp Wildlife Reserve with commonly seen water bird species including the Black-fronted Dotterel *Elseyornis melanops*, Grey Teal *Anas gracilis*, Black-tailed Native-hen *Tribonyx ventralis*, Black-winged Stilt *Himantopus* and Red-necked Avocet *Recurvirostra novaehollandiae* (**Plate 13**).

The highest quality woodland habitat for birds was predominately located within the Jallumba Marsh Flora Reserve, and the surrounding vegetation of the Red Gum Swamp and Darragan Swamp Wildlife Reserve. The most commonly detected woodland bird species included the White-plumed Honeyeater *Lichenostomus penicillatus*, Yellow-rumped Thornbill *Acanthiza chrysorrhoa*, White-browed Woodswallow *Artamus superciliosus*, Striated Pardalote *Pardalotus striatus* (**Plate 14**) and Brown-headed Honeyeater *Melithreptus brevirostris*. These habitats provide an important foraging and breeding resource for many bird species with the abundance of flowering and hollow-bearing eucalyptus trees observed. Of note is the presence of a Wedge-tailed Eagle *Aquila audax* nest within the Jallumba Marsh Flora Reserve. The nest was in use at the time of the surveys with two young seen in the nest (**Plate 15**).

The cropping/pasture land, whilst highly modified/disturbed, was observed to support many bird species not often seen within other areas of the study area. Bird species most often detected included the Australian Pipit *Anthus novaeseelandiae*, Brown Songlark *Cincloramphus cruralis*, Long-billed Corella *Cacatua tenuirostris*, Straw-necked Ibis *Threskiornis spinicollis*, Australian Magpie *Cracticus tibicen*, Willie Wagtail *Rhipidura leucophrys* and Fairy Martin *Petrochelidon ariel*.

During the spotlighting surveys, three nocturnal bird species were observed, Eastern Barn Owl *Tyto javanica*, Southern Boobook *Ninox novaeseelandiae* and Tawny Frogmouth *Podargus strigoides* (**Plates 16-18** respectively). These species were observed foraging but would also likely breed within the woodland habitat of the study area.



Plate 11 - Brown Treecreeper (eastern subspecies) Climacteris picumnus victoriae



Plate 12 - Whiskered Tern Chlidonias hybrida



Plate 13 - Red-necked Avocet Recurvirostra novaehollandiae



Plate 14 - Striated Pardalote Pardalotus striatus



Plate 15 – Wedge-tailed Eagle's nest



Plate 16 - Eastern Barn Owl Tyto javanica



Plate 17 - Southern Boobook Ninox novaeseelandiae



Plate 18 - Tawny Frogmouth Podargus strigoides

Whilst there are VBA records for the nationally-significant Red-tailed Black-Cockatoo within and in proximity to the study area, no orts or individuals were seen. The study area potentially contains suitable breeding and foraging habitat for this species. Foraging habitat is associated with areas that support abundant River Red Gum, Yellow Gum *Eucalyptus leucoxylon* or Buloke (DEWR 2007). The Red-tailed Black-Cockatoo requires very old, large, hollow eucalypts for nesting and Buloke provide a seasonal foraging resource (DEWR 2007). The most suitable potential breeding resources within the study area are associated with the Jallumba Marsh Flora Reserve, and the surrounding vegetation of the Red Gum Swamp and Darragan Swamp Wildlife Reserve.

There are VBA records for an additional 30 threatened birds within the study area or surrounding 10 km radius (**Table 4-2**). The habitat preferences for these species broadly include wetland habitats, forests habitat and grassland habitat.

The anticipated frequency that a threatened bird species utilises the study area varies. The abundance and scarcity of habitat within the study area, reliability of records and dispersal ability are considerations that may alter the frequency at which the species occurs.

Of the threatened wetland species identified in the VBA records, it is 'likely' or 'possible' that Australasian Shoveler *Anas rhynchotis*, Eastern Great Egret *Ardea modesta*, Little Bittern *Ixobrychus minutus dubius*, Glossy Ibis *Plegadis falcinellus*, Royal Spoonbill *Plegadis regia* are expected to be found in the study area (**Appendix A**). Habitat for these species is present at Red Gum Swamp and Darragan Swamp Wildlife Reserve. It is also 'possible' that White-bellied Sea-Eagle *Haliaeetus leucogaster* is also expected to periodically use the study area given their ability to travel large distances to forage. Other threatened wetland species identified such as the Eastern Curlew *Numenius madagascariensis* are not anticipated to use the study area as they have specialised habitat requirements, and predominately occur coastally.

It is also 'possible' that the small forest bird, White-throated Needletail *Hirundapus caudacutus*, utilises woodland habitats. The nationally-significant Swift Parrot *Lathamus discolor* is 'unlikely' to occur in the study area due to the scarcity of habitat for the species in the locality (**Appendix A**).

Given the extent of cultivation in the study area, habitat for the Australian Bustard *Aredeotis australis* is scarce, as such this species is 'unlikely' to occur in the study area.

#### 4.2.5.5 Reptiles

Eight reptile species were detected within or in proximity to the study area. All species recorded are native and none are of National or State-significance.

Whilst all the study area is expected to provide resources for reptile species from time to time, the woodland habitat types are most important, particularly for breeding purposes. The most commonly detected reptile species was the Robust Ctenotus *Ctenotus robustus* (**Plate 19**). This species was found within all areas supporting woodland habitat, often sheltering under logs. Other less commonly encountered woodland species include the Marbled Gecko *Christinus marmoratus* (**Plate 20**), South-eastern Morethia Skink *Morethia boulengeri* (**Plate 21**) and the Shingle-back *Tiliqua rugosa*. Lizards were encountered in and around fallen logs and leaf litter confirming these areas of micro-habitat within the broader woodland communities are of importance to reptiles. The Eastern Brown Snake *Pseudonaja textilis* was often observed near the road edges and within the Jallumba Marsh Flora Reserve, but is expected to occur throughout the study area particularly given it is known to thrive on farms.



Plate 19 - Robust Ctenotus Ctenotus robustus



Plate 20 - Marbled Gecko Christinus marmoratus



Plate 21 - South-eastern Morethia Skink Morethia boulengeri

The Eastern Snake-necked Turtle *Chelodina longicollis* was seen in most of the wetlands in the study area. This species is common across south-eastern Australian and is known to be tolerant of disturbed sites.

One Bearded Dragon *Pogona barbata* was seen within the study area as road kill. This species is listed as Vulnerable under the Victorian Advisory List (DSE 2013). A Lace Monitor *Varanus varius* was observed approximately 15 km north-east of the study area near the Wimmera River. This species is listed as Endangered under the Victorian Advisory List (DSE 2013).

#### 4.2.5.6 Amphibians

Six frog species were observed or heard within the study area: Eastern Sign-bearing Froglet *Crinia parinsignifera*, Common Eastern Froglet *Crinia signifera*, Variegated Banjo Frog *Limnodynastes dumerilii variegatus* (**Plate 22**), Brown Toadlet, Sudell's Frog *Neobatrachus sudellae* (**Plate 23**) and Spotted Marsh Frog *Limnodynastes tasmaniensis*. All amphibians encountered are ground dwelling frogs dependent on woodland vegetation adjoining wetland areas, constructed drains and farm dams for foraging habitat. For Sudell's Frog, Brown Toadlet and Variegated Banjo Frog, forested areas adjoining wetlands is a critical dry period refuge where they shelter under moist logs and leaf-litter (Hoskin *et al.* 2015).





Plate 22 - Variegated Banjo Frog Limnodynastes dumerilii variegatus

Plate 23 - Sudell's Frog Neobatrachus sudellae

Brown Toadlet is listed as threatened under the FFG Act. This species was heard calling at two locations, near an old farm dam within the Jallumba Marsh Flora Reserve and from constructed drains along road reserves. However, it is expected to be reasonably wide-spread within suitable habitat throughout the study area and would be more frequently encountered during the peak breeding period of March to May.

The VBA data indicates records for the nationally-significant Growling Grass in proximity to the study area. In disturbed areas, this frog commonly occurs in artificial waterbodies such as farm dams, irrigation channels, irrigated rice crops and disused quarries, particularly where natural habitat is no longer available (Clemann and Gillespie 2012). Favoured sites have a large proportion of emergent, submerged and floating vegetation, and slow-flowing or still water (Clemann and Gillespie 2012). Even though the Growling Grass Frog was not

found within the study area (**Section 3.2**), potentially suitable habitat for the species exists in the form of artificial waterbodies, such as drainage lines, that are periodically inundated. Additionally, habitat of a higher integrity for the species was found at Darragan Swamp Wildlife Reserve and Cookes Wildlife Reserve. Further surveys of potential habitat that comply with Commonwealth survey guidelines (DEWHA 2009) for the species are warranted.

### 5 Legislation and Policy Implications

### 5.1 Commonwealth

#### 5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as MNES. There are nine MNES:

- World heritage properties
- National heritage places
- Wetlands of international importance (Ramsar sites)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

Any action that is likely to have a significant impact on MNES should be referred to the Commonwealth Minister for the Environment, under Part 9 of the Act. The Minister or delegate will assess the action as either:

- Not controlled action
- Not controlled action in a particular manner
- Controlled action.

A 'Not controlled action' does not require approval under the EPBC Act if the action is undertaken in accordance with the referral. An action assessed as a 'Not controlled action in a particular manner' also does not require approval under the EPBC Act, provided it is undertaken in the manner specified by the Minister. A 'Controlled action' is subject to the EPBC Act assessment and approval process, and can be assessed based on the referral information, Preliminary Documentation, Public Environment Report, Public Inquiry or bilateral agreement with local jurisdiction (i.e. EES in Victoria).

#### Implications

The study area is likely to support three TECs:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions
- Grey Box (*Eucalyptus macrocarpa*) Grassy Woodlands and Derived Native Grasslands of Southeastern Australia
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains.

Further survey is required in locations where these TECs are likely to occur within the study area (see **Figure 4-7**) to determine their presence. Spring surveys are the recommended period to undertake TEC surveys as floristic diversity is peaking. Surveys should be after winter/spring rainfall to assist with identification of the Wetlands TEC.

Two threatened fauna species have potential to occur in the study area:

- Red-tailed Black-Cockatoo
- Growling Grass Frog.

Suitable habitat for Red-tailed Black-Cockatoo consists of large hollow-bearing trees (including dead trees) found as scattered paddock trees and in consolidated patches, which provides breeding and nesting habitat. Larger patches of woodland may also provide foraging habitat. Surveys can be undertaken for these species at any time of year and should be in accordance with Commonwealth guidelines (i.e. DEWHA 2010).

Growling Grass Frog has potential to occur in swamps and ephemeral water-bodies fringed by native vegetation. These habitat types are distributed throughout the study area but primarily in the south (see **Figure 4-2**). Surveys should be conducted during the breeding season and preferably within one month of flooding (generally October – February). Commonwealth survey guidelines for Growling Grass Frog should be followed (i.e. DEWHA 2009).

Impacts of radiation are considered under the EPBC Act. While not part of this scope, it is noted that the most recent EPBC Act referral for a mineral sands mine in Victoria (EPBC #2017/7919) was assessed as a 'controlled action' with nuclear action one of several controlling provisions.

### 5.2 Victoria

#### 5.2.1 Flora and Fauna Guarantee Act 1988

The *Flora and Fauna Guarantee Act 1988* (FFG Act) is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. Under the FFG Act it is a requirement to attain a permit to 'take' protected flora species from public land. Impacts on private land to FFG Act-listed species and communities are also considered part of the EES process (Section 5.2.1).

#### 5.2.2 Environment Effects Act 1978

The *Environment Effects Act 1978* provides for assessment of projects that are capable of having a significant effect on the environment. The Minister responsible for administration of the Act makes a decision that an Environment Effects Statement (EES) should be prepared when:

- > There is a likelihood of regionally or State significance adverse effects on the environment
- > There is a need for integrated assessment of potential environmental effects (including economic and social effects) of a project and relevant alternatives
- > Normal statutory processes would not provide a sufficiently comprehensive, integrated and transparent assessment.

A project should be referred to the Minster to determine whether an EES required, if a project that is likely to have adverse environmental effects (individually or in combination) could be significant in a regional or State context. The criteria for referral for individual potential environmental effects, and a combination of potential environmental effects, is listed below in **Table 5-1**.

able 5-1 EES referral criteria (DSE 2006). Criteria in bold a	re applicable to the scope of this study.
Referral criteria: individual potential environmental effects	Referral criteria: a combination of potential environmental effects
Individual types of potential effects on the environment that might be of regional or State significance, and therefore warrant referral of a project, are:	A combination of two or more of the following types of potential effects on the environment that might be of regional or State significance, and therefore warrant referral of a project, are:
<ul> <li>Potential clearing of 10 ha or more of native vegetation from an area that:         <ul> <li>Is of an Ecological Vegetation Class identified as endangered by the Department of Sustainability of Environment (in accordance with Appendix 2 of the Victoria's Native Vegetation Management Framework); or</li> <li>Is, or is likely to be, of very high conservation significant (as defined in accordance with Appendix 3 of Victoria's Native Vegetation Management Framework); and</li> <li>Is not authorized under an approved Forest Management Plan or Fire Protection Plan</li> </ul> </li> <li>Potential long-term loss of a significant proportion (e.g. 1 to 5 percent depending on the conservation status of the species) of known remaining habitat or population of a threatened species within Victoria</li> <li>Potential long-term change to the ecological character of a wetland listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia'</li> <li>Potential extensive or major effects on the health of biodiversity of aquatic, estuarine or marine ecosystems, over the long term</li> <li>Potential extensive or major effects on the health, safety or well-being of a human community, due to emissions to air or water or chemical hazards or displacement of residences</li> <li>Potential greenhouse gas emissions exceeding 200,000 tonnes of carbon dioxide equivalent per annum, directly attributable to the operation of the facility.</li> </ul>	<ul> <li>Potential clearing of 10 ha or more of native vegetation, unless authorized under an approved Forest Management Plan or Fire Protection Plan</li> <li>Matters listed under the <i>Flora and Fauna Guarantee Act 1988</i>:         <ul> <li>Potential loss of a significant area of a listed ecological community; or</li> <li>Potential loss of a genetically important population of an endangered or threatened species (listed or nominated for listing), including as a result of loss or fragmentation of habitats; or</li> <li>Potential loss of critical habitat; or</li> <li>Potential significant effects on habitat values of a wetland supporting migratory bird species.</li> </ul> </li> <li>Potential extensive or major effects on landscape values of regional importance, especially where recognized by a planning scheme overlay or within or adjoining land reserved under the <i>National Parks Act 1975</i></li> <li>Potential extensive or major effects on beneficial uses of waterbodies over the long term due to changes in water quality, streamflows or regional groundwater levels</li> <li>Potential extensive or major effects on social or economic well-being due to direct or indirect displacement of non-residential land use activities</li> <li>Potential for extensive displacement of residences or severance of residential access to community resources due to infrastructure development</li> <li>Potential significant effects on the amenity of a substantial number of residents, due to extensive or major, long-term changes in visual, noise and traffic conditions</li> <li>Potential extensive or major effects on Aboriginal cultural heritage</li> <li>Potential stensive or major effects on cultural heritage places listed on the Heritage Register or the Archaeological lnventory under the <i>Heritage Act 1995</i>.</li> </ul>

#### Implications

The following were collected relating to the referral criteria for individual environmental effects:

- > Potential clearing of 10 ha or more of native vegetation that is an Endangered EVC.
  - The study area is predicted to support 168 ha of Endangered EVCs consisting of Plains 0 Grassy Wetland (EVC 125), Plains Woodland (EVC 805) and Aquatic Herbland (EVC 653) (Table 4-1)
- Potential long-term loss of a significant proportion of known remaining habitat or population of a > threatened species within Victoria.

- Six threatened flora species and seven threatened fauna species were found during the field assessment (see Sections 4.2.4.2 and 4.2.5.2). Additional threatened species including the nationally significant Red-tailed Black-Cockatoo and Growling Grass Frog are likely to occur in the study area.
- > Potential long-term change to the ecological character of a wetland listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia'.
  - No such wetlands occur in the study area. The nearest Ramsar site is Lake Albacutya, located 100 150 km downstream of the study area. The nearest listed 'Directory of Important Wetlands in Australia', are White Lake (approximately 20 km south of the study area) and Heards Lake (approximately 10 km north-west of the study area).
- > Potential extensive or major effects on the health of biodiversity of aquatic, estuarine or marine ecosystems, over the long term.
  - The study area supports a series of permanent and ephemeral wetlands, the most significant in size being Red Gum Swamp and Darragan Swamp Wildlife Reserve. A full assessment of the aquatic biodiversity including fish and invertebrates was not completed.

The following were collected relating to the referral criteria for a combination of potential environmental effects:

- > Potential clearing of 10 ha or more of native vegetation
  - The study area is predicted to support 448 ha of native vegetation (EVC) and 942 scattered trees.
- Matters listed under the FFG Act including potential loss of a significant area of a listed ecological community, potential loss of a genetically importation population of an endangered or threatened species, potential loss of critical habitat, or potential significant effects on habitat values of a wetland supporting migratory bird species
  - The study area supports one listed ecological community, Victorian Temperate Woodland Bird Community, and is likely to support Semi-arid Northwest Plains Buloke Grassy Woodland Community and Red Gum Swamp Community No. 1.
  - One FFG Act-listed flora species was recorded in the study area, Buloke. Four FFG Act-listed fauna species were recorded in the study area, Magpie Goose, Diamond Firetail, Whiskered Tern and Brown Toadlet.
  - There are a number of wetlands within the study area that could potentially support migratory species.
- Potential extensive or major effects on landscape values of regional importance, especially where recognized by a planning scheme overlay or within or adjoining land reserved under the *National Parks Act 1975.* 
  - There are no parks or reserves listed under the National Parks Act 1975 within the study area.
     The closest listed park is the Black Range State Park, located approximately 15 km southeast of the study area.
  - The south-east portion of the study area is covered by Environmental Significance Overlay Schedule 4 under the Horsham Rural City Planning Scheme. Most of the wetland in the study area is covered by Environmental Significance Overlay – Schedule 2, which protects the Natimuk Douglas Wetlands.

#### Implications

The study area supports one listed ecological community (Victorian Temperate Woodland Bird Community) and is likely to support two more (Semi-arid Northwest Plains Buloke Grassy Woodland Community, and Red Gum Swamp Community No. 1).

One FFG Act-listed flora species was recorded in the study area (Buloke). Four FFG Act-listed fauna species were recorded in the study area (Magpie Goose, Diamond Firetail, Whiskered Tern and Brown Toadlet).

Separate to species listed as threatened under the FFG Act, many common native species are listed as protected including most Wattles (*Acacia* spp.) and Daisy (Asteraceae) plants. Listing of protected species is relevant to any public land within the study area, e.g. road-reserves and conservation reserves.

#### 5.2.3 Mineral Resources (Sustainable Development) Act 1990

The *Mineral Resources (Sustainable Development) Act 1990* (MSRD) provides a legislative framework for the development and regulation of the exploration and mining of mineral sands, and other extractive industries. The MSRD addresses licensing and approval requirements, and other issues including compensation, rehabilitation and royalties for extractive industries, mineral exploration and development activities.

It is assumed that the project will require a mining license under MRSD. Part of the conditions of the mining license may be the provision of appropriate native vegetation offsets. A planning permit is not required if an EES has been prepared and assessed for the works.

#### Implications

A mining licence under the MRSD is likely to stipulate provision of native vegetation offsets in accordance with the Guidelines. The conditions of the licence may override those of a planning permit, and also depend on the outcome of the EES process.

## 5.2.4 *Planning and Environment Act 1987* – Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017)

The *Planning and Environment Act 1987* controls the planning and development of land in Victoria, and provides for the development of planning schemes for all municipalities. Amongst the requirements of the Act is the inclusion of Clauses 52.16 and 52.17 in all planning schemes within Victoria. Relevant to development proposals within the study area are controls relating to the removal, destruction or lopping of native vegetation contained within the Horsham Planning Scheme.

Clause 52.17 (Native Vegetation) requires a planning permit to remove, destroy or lop native vegetation including some dead native vegetation. The assessment and offset requirements to remove native vegetation are determined in accordance with the Guidelines which are an incorporated document under the *Planning and Environment Act 1987.* 

The assessment pathway for a planning permit to remove native vegetation is determined by its potential impact on biodiversity and is calculated based on the extent and location of native vegetation to be removed. There are three assessment pathways:

- > Basic limited impacts on biodiversity
- > Intermediate could impact on large trees, endangered EVCs, and sensitive wetlands and coastal areas
- > Detailed could impact on large trees, endangered EVCs, sensitive wetlands and coastal areas, and could significantly impact on habitat for rare or threatened species.

Assessment pathway is determined in accordance with Table 5-2.

Extent of native vegetation	Location Category			
	Location 1	Location 2	Location 3	
Less than 0.5 hectares and not including any large trees	Basic	Intermediate	Detailed	
Less than 0.5 hectares and including one or more large trees	Intermediate	Intermediate	Detailed	
0.5 hectares or more	Detailed	Detailed	Detailed	

#### Implications

Mapping undertaken at 1:10,000 scale identified 448 ha of native patches (**Section 4.2.1.1**) and 942 scattered trees within the study area. There are also a series of mapped wetland within the study area (**Figure 4-2**) recognised as native vegetation under the Guidelines. A habitat hectare assessment is required across all patches and scattered trees in accordance with the Vegetation Quality Assessment (VQA) manual, in order to calculate the implications of native vegetation removal under the Guidelines (only a subsample of native vegetation within the study area was subject to a habitat hectares assessment).

Native vegetation within the study area is assigned on NVIM as occurring within Location 1 or Location 2.

#### 5.2.5 Catchment and Land Protection Act 1994

The Catchment and Land Protection Act 1994, sets up a framework for the integrated management and protection of land, soil and water resources across catchments. It encourages community participation in the management of land and water resources. It is the main legislation in Victoria for the management of noxious weeds and pest animals and has the objective of protecting primary production, Crown land, the environment and community health from the effects of noxious weeds and pest animals.

Under the Act, land owners have legal obligations regarding the management of declared noxious weeds and pest animals on their land.

#### Implications

Three restricted weeds were recorded within the study area:

- > Bridal creeper
- > Slender Thistle
- > Spear Thistle.

One Regionally controlled weed was recorded:

> African Boxthorn.

The following declared pest species were recorded:

- > Red Fox
- > Brown Hare
- > European Rabbit
- > Feral Cat.

#### 5.2.6 Wildlife Act 1975 and Wildlife Regulations 2013

Under the *Wildlife Act 1975,* all native wildlife is protected in Victoria. It is an offence to kill, take, control or harm wildlife under the Act. Anyone wishing to control or handle wildlife must have appropriate authorisation by DELWP.

#### Implications

The study area provides a range of habitats that support or are likely to support protected wildlife including woodland, scattered trees, wetlands, and degraded grassland. A full list of protected wildlife recorded in the study area is provided in **Appendix A**. Any handling of fish or aquatic species may also require authorisation under the *Fisheries Act 1995*.

### 6 Conclusion and Recommendations

This study provides a comprehensive understanding of the baseline ecological conditions of the study area. The following was identified:

- Native vegetation mapped to 1:10,000 scale (previous mapping was 1: 100,000 scale) including 448 ha of native patches across four EVCs, and 942 scattered trees. In addition, all mapped wetlands within the study area were confirmed as meeting the definition of native vegetation under the Guidelines (i.e. not replaced by roads, buildings or other hard surfaces)
- Patches of native vegetation that have potential to qualify as EPBC Act TECs, namely Grey Box TEC, Buloke TEC, or Wetlands TEC
- > Confirmed presence of the FFG Act TEC Victorian Temperate Woodland Bird Community, and the likely presence of Red Gum Swamp Community No. 1 and Semi-arid Northwest Plains Buloke Grassy Woodland Community
- Six threatened flora species, all of State-significance (Sticky Wattle, Rock Wattle, Buloke, Buloke Mistletoe, Wimmera Woodruff, Winged Water Star-wort and Leek Flax-lily)
- > Seven threatened fauna species, all of State-significance (Spotted Harrier, Magpie Goose, Brown Treecreeper, Diamond Firetail, Whiskered Tern, Beared Dragon and Brown Toadlet)
- > Comprehensive species list consisting of 183 flora species and 113 fauna species
- > Short-listed of threatened species likely to occur in the study area (i.e. rated as 'known', 'likely' or 'possible' in **Appendix A**).

A summary of findings in the context of applicable legislation is provided in **Table 6-1**.

Table 6-1Summary of findings relevant to environmental legislation.

Legislation	Findings
Commonwealth Environment Protection and Biodiversity Conservation Act 1999 <sup>6</sup>	One category MNES present or likely to be present within the study area: listed threatened species and ecological communities. The study area has potential to support three TECs (Grey Box, Buloke and Wetland) and two threatened fauna species (Red-tailed Black-Cockatoo and Growling Grass Frog).
Victorian Flora and Fauna Guarantee Act 1988	Study area supports one listed ecological community (Victorian Temperate Woodland Bird Community) and likely to support two more (Semi-arid Northwest Plains Buloke Grassy Woodland Community, and Red Gum Swamp Community No. 1).
	Goose, Diamond Firetail, Whiskered Tern and Brown Toadlet).
Victorian Environment Effects Act 1978	In response to the EES referral triggers for individual environmental effects, the study area supports more than 10 ha of an endangered EVC (168 ha), and provides habitat for threatened species. An assessment of aquatic biodiversity has not been undertaken. There are no Ramsar sites or wetlands listed under the 'Directory of Important Wetlands in Australia', although several lie less than 20 km outside of the study area. In response to the EES referral triggers for a combination of potential environmental effects, the study area was mapped as supporting 448 ha of native vegetation and 942 scattered trees, supports or is likely to support FFG Act-listed ecological communities and species, and is covered by Environmental Significance Overlays which relate to the protection of the Natimuk Douglas Wetlands and other local values.
Victorian Mineral Resources (Sustainable Development) Act 1990	A mining license under the MSRD is likely to stipulate conditions on the removal of native vegetation and offset requirements
Victorian <i>Planning and Environment Act</i> 1987 – Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017)	Mapping at 1:10,000 scale identified 448 ha of native patches and 942 scattered trees within the study. Mapped wetlands (which are classified as

<sup>&</sup>lt;sup>6</sup> This study did not consider 'nuclear action' as potential controlling provision for the EPBC Act. A previous EPBC Act referral for a mineral sands mine in Victoria did assess the action as a 'controlled action' with 'nuclear action' one of several controlling provisions.

Legislation	Findings
	native vegetation under the Guidelines) are also present throughout the study area.
	According to NVIM native vegetation within the study area has been assigned to Location 1 or Location 2.
Victorian Catchment and Land Protection Act 1994	Four declared weeds (Bridal Creeper, Slender Thistle, Spear Thistle and African Boxthorn) and one declared pest (Red Fox0 was recorded in the study area.
Victorian <i>Wildlife Act 1975</i>	Study area provides a variety of habitats including mature woodland, large scattered trees and permanent and ephemeral swamps and wetlands that support, or are likely to support, wildlife protected under the Act.

The project is still in the planning phase and no impacts to ecological values were assessed as part of this study. If the project was to advance the following studies are likely to be required to support environmental approval and planning requirements:

- > Targeted surveys in spring of locations where TECs are likely to occur (Figure 4-7)
- > Targeted surveys for EPBC Act-listed species likely to occur in accordance with Commonwealth survey guidelines and in appropriate seasons:
  - Red-tailed Black-Cockatoo (year round). Surveys should focus on large-hollow bearing trees for nesting, and woodland patches with River Red Gum, Buloke and Yellow Gum for foraging habitat.
  - Growling Grass Frog (October to February one month after flood commences). Surveys should focus on permanent wetlands and swamps, and large ephemeral water-bodies surrounded by fringing vegetation, such as Darragan Swamp Wildlife Reserve and Cookes Wildlife Reserve
- > Full habitat hectares assessment for areas of native vegetation mapped at 1:10,000 scale including patches (Figure 4-4) and scattered trees (Figure 4-6)
- > Assessment of wetlands, swamps and other aquatic habitats to establish the presence of fish, invertebrates and other ecological values.

If the project was to require an EES, the scope of the ecological surveys would be determined by the Victorian Government in conjunction with the Technical Reference Group appointed to the project.

Any impact assessment should consider both direct and indirect impacts. Indirect impacts likely to be relevant to a mining development within the study area, include changes in hydrological regimes such as surface water-flow, groundwater levels and water quality, which may impact on wetlands and swamps immediately surrounding the study area.

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### Likelihood of presence assessment for threatened flora and fauna

A likelihood of presence assessment was undertaken for all threatened species<sup>1</sup> identified via the VBA and PMST search. Each species was assigned one of the following likelihood of presence ratings, based on the location, date and number of records, as well as modelled EVC data:

- > Known: species has been recorded in the study area by a qualified ecologist in the past 20 years
- > Likely: suitable habitat for the species occurs in the study area and species has been recorded proximate to the study area
- > **Possible:** suitable habitat for the species occurs in the study area but no recent records from the study area or proximate areas, OR, suitable habitat for the species may occur in the study area and there are recent records for the species proximate to the study area
- > Unlikely: suitable habitat for the species does not occur in the study area and no recent records from the study area or proximate areas.

<sup>&</sup>lt;sup>1</sup> Threatened is defined as any species or ecological community listed as threatened under the EPBC Act, FFG Act or Victorian Advisory Lists.

#### Table 1-1 Likelihood of presence assessment for threatened flora

						Likelihood of Occurrence	
Scientific Name	Common Name	EPBC Act <sup>^</sup>	FFG Act	Victorian Advisory List#	Preferred Habitat	Prior to field assessment	Post field assessment
Lipocarpha microcephala	Button Rush			Vulnerable	Open damp places such as sandy stream banks	Unlikely	Unlikely
Thelymitra azurea	Azure Sun-orchid			Vulnerable	Moist coastal heath on sandy to peaty soil	Unlikely	Unlikely
Acacia glandulicarpa	Hairy-pod Wattle	VU	Listed	Vulnerable	Woodland, shrubland and open mallee communities, on sandy clay to clay-loam soils	Possible	Unlikely
Eucalyptus froggattii	Kamarooka Mallee		Listed	Rare	Mallee scrubs and woodlands	Possible	Unlikely
Allocasuarina luehmannii	Buloke		Listed	Endangered	Usually growing in woodland with Eucalyptus microcarpa, on non-calcareous soils	Likely	Known
Amyema linophylla subsp. orientalis	Buloke Mistletoe			Vulnerable	Allocasuarina luehmannii is the host plant	Likely	Known
Ptilotus erubescens	Hairy Tails		Listed	Vulnerable	Fertile soils supporting grassland and woodland communities	Possible	Unlikely
Senecio hypoleucus	Pale Groundsel			Vulnerable	Usually growing in shallow soil amongst rock	Unlikely	Unlikely
Davallia solida var. pyxidata	Hare's-foot Fern			Vulnerable	Rainforest	Unlikely	Unlikely
Asterolasia phebalioides	Downy Star-Bush	VU	Listed	Vulnerable	Open woodland, forest and heath on sandstone and sandy soils	Possible	Unlikely
Eucalyptus hawkeri	Arapiles Peppermint-box			Vulnerable	Remnant woodlamds around Mt Arapiles	Unlikely	Unlikely

						Likelihood of Occurrence	
Scientific Name	Common Name	EPBC Act <sup>^</sup>	FFG Act	Victorian Advisory List#	Preferred Habitat	Prior to field assessment	Post field assessment
Melaleuca halmaturorum	Salt Paperbark		Listed	Vulnerable	Near-coastal occurrence on saline ground	Unlikely	Unlikely
Cyperus subulatus	Pointed Flat-sedge			Vulnerable	Seasonally inundated areas in the Jeparit and Natimuk	Unlikely	Unlikely
Comesperma polygaloides	Small Milkwort		Listed	Vulnerable	Clays and alluvium supporting grassland and grassy woodland communities	Possible	Possible
Xerochrysum palustre	Swamp Everlasting	VU	Listed	Vulnerable	Lowland swamps, usually on black cracking clay soils	Possible	Possible
Asperula wimmerana	Wimmera Woodruff			Rare	Woodlands on heavier water-retentive soils	Likely	Known
Asterolasia phebalioides	Downy Star-Bush	VU	Listed	Vulnerable	Open woodland, forest and heath on sandstone and sandy soils	Possible	Possible
Callitriche umbonata	Winged Water- starwort			Rare	Damp and swampy places	Possible	Known
Calotis lappulacea	Yellow Burr-daisy			Rare	Open woodlands	Possible	Unlikely
Comesperma polygaloides	Small Milkwort		Listed	Vulnerable	On heavier soils (clays, alluvium) supporting grassland and grassy woodlands	Likely	Possible
Daviesia pectinata	Thorny Bitter-pea			Rare	Mallee scrublands and woodlands on dry stony or sandy soils	Possible	Unlikely
Eremophila gibbifolia	Coccid Emu-bush			Rare	Mallee scrub on sandy loam soils	Unlikely	Unlikely
Eucalyptus wimmerensis	Wimmera Mallee- box			Rare	Sandy soils or gravelly loams in mallee vegetation or mixed mallee woodland	Possible	Unlikely
Gnephosis drummondii	Slender Cup- flower			Rare	Mallee eucalypt communities	Unlikely	Unlikely
Gnephosis tenuissima	Dwarf Cup-flower			Rare	Sandy soils	Unlikely	Unlikely

						Likelihood of Occurrence	
Scientific Name	Common Name	EPBC Act <sup>^</sup>	FFG Act	Victorian Advisory List#	Preferred Habitat	Prior to field assessment	Post field assessment
Goodenia benthamiana	Small-leaf Goodenia			Rare	Open-forest, woodland and mallee scrub	Possible	Unlikely
Leucopogon thymifolius	Thyme Beard- heath			Rare	Open-forest and heathy woodland usually in elevated sites	Possible	Unlikely
Pultenaea daltonii	Common Beard- heath			Rare	Dry forest associated with Eucalyptus obliqua	Unlikely	Unlikely
Senecio hypoleucus	Pale Groundsel			Rare	Usually growing in shallow soil amongst rock	Unlikely	Unlikely
Thryptomene calycina	Grampians Thryptomene			Rare	Heathlands and heathy woodlands mostly on sandy soils	Possible	Unlikely
Xanthorrhoea caespitosa	Tufted Grass-tree			Rare	Sandy soils	Possible	Unlikely
Zieria veronicea subsp. veronicea	Pink Zieria			Rare	Mallee and mallee-heath	Unlikely	Unlikely
Dianella porracea	Leek flax-lily			Vulnerable	Woodlands on heavier water-retentive soils	Not identified	Known

^EPBC Act: VU = vulnerable, CR = critically endangered, EN = endangered Victorian Advisory# - Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014).

#### Table 1-1 Likelihood of presence assessment for threatened fauna

Likelihood of Occurrence

Scientific Name

Common Name

EPBC Act<sup>\*</sup> FFG Act<sup>\*</sup> Victorian Advisory List# Preferred Habitat

Prior to field assessment Post field assessment

Anas rhynchotis	Australasian Shoveler			Vulnerable	Fresh and salt water wetlands and lakes with heavy vegetation	Possible	Possible
Calyptorhynchus banksii graptogyne	Red-tailed Black- Cockatoo	EN	Listed	Endangered	Woodlands - stringybark and buloke for foraging and red gum for nesting	Likely	Likely
Grus rubicunda	Brolga		Listed	Vulnerable	Dry grassland or ploughed paddocks or even desert claypans. Dependent on wetlands	Possible	Possible
Biziura lobata	Musk Duck			Vulnerable	Deep freshwater lagoons, with dense reed beds	Possible	Possible
Melanodryas cucullata cucullata	Hooded Robin		Listed	Near threatened	Lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee	Unlikely	Unlikely
Oxyura australis	Blue-billed Duck		Listed	Endangered	Deep water in large permanent wetlands and swamps with dense aquatic vegetation	Possible	Possible
Lichenostomus cratitius	Purple-gaped Honeyeater			Vulnerable	Mallee heathlands	Unlikely	Unlikely
Leipoa ocellata	Malleefowl	VU	Listed	Endangered	Semi-arid scrub	Unlikely	Unlikely
Stagonopleura guttata	Diamond Firetail		Listed	Near threatened	Grassy eucalypt woodlands	Likely	Known
Ardea modesta	Eastern Great Egret		Listed	Vulnerable	Wetlands	Possible	Possible
Aythya australis	Hardhead			Vulnerable	Deep freshwater and open wetlands	Possible	Possible
Oreoica gutturalis gutturalis	Crested Bellbird		Listed	Near threatened	Acacia shrublands, eucalypt woodlands, spinifex and chenopod (saltbush) plains or dunes	Unlikely	Possible
Stictonetta naevosa	Freckled Duck		Listed	Endangered	Deep freshwater marshes	Possible	Possible

on Name

EPBC Act<sup>\*</sup> FFG Act<sup>\*</sup> Victorian Advisory

Victorian Advisory List# Preferred Habitat

Likelihood of Occurrence

Prior to field assessment Post field assessment

Lophochroa leadbeateri	Major Mitchell's Cockatoo		Listed	Vulnerable	Dry inland areas usually along tree- lined watercourses	Unlikely	Possible
Anthochaera phrygia	Regent Honeyeater	CR	Listed	Critically endangered	Dry eucalypt woodland and open forest, rural and urban areas with mature eucalypts	Unlikely	Unlikely
Neophema elegans	Elegant Parrot			Vulnerable	Open forests, woodlands, mallee, mulga, salt marsh	Unlikely	Unlikely
Burhinus grallarius	Bush Stone-curlew		Listed	Endangered	Roost and nest in grassy woodlands of buloke, gum or box with low, sparse grassy or herb understorey	Possible	Unlikely
Pachycephala rufogularis	Red-lored Whistler	VU	Listed	Endangered	Low mallee shrublands, heathlands and woodlands	Possible	Possible
Hirundapus caudacutus	White-throated Needletail			Vulnerable	Wooded areas, including open forest and rainforest	Possible	Possible
Egretta garzetta nigripes	Little Egret		Listed	Endangered	Large wetlands, mudflats and marshlands	Unlikely	Possible
Chlidonias hybridus	Whiskered Tern			Near threatened	Wetlands	Unlikely	Known
Pedionomus torquatus	Plains-wanderer	CR	Listed	Critically endangered	Semi-arid, lowland native grasslands	Unlikely	Unlikely
Pomatostomus temporalis temporalis	Grey-crowned Babbler		Listed	Endangered	Box-Gum Woodlands on the slopes, Box-Cypress-pine and open Box Woodlands on alluvial plains	Unlikely	Unlikely
Acanthiza iredalei hedleyi	Slender-billed Thornbill		Listed	Near threatened	Mature heath	Possible	Possible
Polytelis anthopeplus monarchoides	Regent Parrot	VU	Listed	Vulnerable	Riparian or littoral River Red Gum forests or woodlands	Unlikely	Unlikely
Ninox connivens connivens	Barking Owl		Listed	Endangered	Open dry eucalypt woodland, riparian scrubs and Melaleuca woodland	Possible	Possible

nmon Name

EPBC Act<sup>\*</sup> FFG Act<sup>\*</sup> Victorian Advis

Victorian Advisory List# Preferred Habitat

Likelihood of Occurrence

Prior to field assessment Post field assessment

lxobrychus minutus dubius	Little Bittern		Listed	Endangered	Wetlands	Unlikely	Possible
Hydroprogne caspia	Caspian Tern		Listed	Near threatened	Coastal regions	Unlikely	Unlikely
Haliaeetus leucogaster	White-bellied Sea- Eagle		Listed	Vulnerable	Coastal regions and wetlands in tropical and temperate regions.	Possible	Possible
Anseranas semipalmata	Magpie Goose		Listed	Near threatened	Shallow wetlands with dense growth of rushes or sedges	Possible	Known
Pyrrholaemus sagittatus	Speckled Warbler		Listed	Vulnerable	Forests, shrubland, rocky areas (eg. inland cliffs, mountain peaks)	Possible	Possible
Ardeotis australis	Australian Bustard		Listed	Critically endangered	Tussock and hummock grasslands	Possible	Unlikely
Falco subniger	Black Falcon		Nominated	Vulnerable	Densely forested areas	Unlikely	Unlikely
Calamanthus pyrrhopygius	Chestnut-rumped Heathwren		Listed	Vulnerable	Dense heathland and undergrowth in Eucalyptus forests and woodlands in rocky areas	Unlikely	Unlikely
Calidris ferruginea	Curlew Sandpiper	CR		Endangered	Coastal regions	Unlikely	Unlikely
Climacteris picumnus victoriae	Brown Treecreeper (south-eastern ssp.)			Near threatened		Likely	Known
Botaurus poiciloptilus	Australasian Bittern	EN	Listed	Endangered	Shallow, permanent freshwater and brackish swamps or lagoons that are densely vegetated	Unlikely	Unlikely
Lathamus discolor	Swift Parrot	CE	Listed	Endangered	A variety of woodlands with mature eucalypts.	Possible	Unlikely
Circus assimilis	Spotted Harrier			Near threatened	Grassy open woodland	Possible	Known

mmon Name

EPBC Act<sup>\*</sup> FFG Act<sup>\*</sup> Victorian Advis

Victorian Advisory List# Preferred Habitat

Prior to field assessment Post field assessment

Likelihood of Occurrence

Grantiella picta	Painted Honeyeater	VU	Listed	Vulnerable	Misteltoes in eucalypt forests/woodlands	Possible	Possible
Lewinia pectoralis pectoralis	Lewin's Rail		Listed	Vulnerable	Coastal saltwater areas, also freshwater wetlands and swamps	Unlikely	Possible
Numenius madagascariensis	Eastern Curlew	CR		Vulnerable	Sheltered intertidal sandflats or mudflats	Unlikely	Unlikely
Porzana pusilla palustris	Baillon's Crake		Listed	Vulnerable	Freshwater to saline, permanent to ephemeral palustrine wetlands	Possible	Possible
Lophoictinia isura	Square-tailed Kite		Listed	Vulnerable	Dry woodlands and open forests	Possible	Possible
Ardea intermedia	Intermediate Egret		Listed	Endangered	Inland habitats with abundant emergent aquatic vegetation	Possible	Possible
Calidris melanotos	Pectoral Sandpiper	CR		Endangered	Fresh to saline wetlands	Unlikely	Unlikely
Chrysococcyx osculans	Black-eared Cuckoo			Near threatened	Forest and shrubland	Unlikely	Unlikely
Cinclosoma castanotus	Chestnut Quail- thrush			Near threatened	Shrubland	Unlikely	Unlikely
Dromaius novaehollandiae	Emu			Near threatened	Plains, scrublands, open woodlands, pastoral lands, semi-desert and margins of lakes	Possible	Possible
Nycticorax caledonicus hillii	Nankeen Night Heron			Near threatened	Wetlands	Possible	Possible
Phalacrocorax varius	Pied Cormorant			Near threatened	Coastal regions	Unlikely	Unlikely
Platalea regia	Royal Spoonbill			Near threatened	Wetlands	Possible	Possible
Plegadis falcinellus	Glossy Ibis			Near threatened	Wetlands and coastal regions	Possible	Likely

Common Name

EPBC Act<sup>\*</sup> FFG Act<sup>\*</sup>

Victorian Advisory List# Preferred Habitat

Prior to field assessment Post field assessment

Likelihood of Occurrence

Turnix velox	Little Button-quail			Near threatened	Grasslands and woolamds	Possible	Possible
Litoria raniformis	Growling Grass Frog	VU	Listed	Endangered	Emergent vegetation	Likely	Likely
Pseudophryne bibronii	Brown Toadlet		Listed	Endangered	Forests, heathlands and grasslands	Known	Known
Petrogale penicillata	Brush-tailed Rock- wallaby	VU	Listed	Critically endangered	Rocky habitats	Unlikely	Unlikely
Phascogale tapoatafa	Brush-tailed Phascogale		Listed	Vulnerable	Dry sclerophyll open forest with sparse groundcover	Possible	Possible
Cercartetus concinnus minor	Western Pygmy- possum			Near threatened	Mallee shrubland	Possible	Possible
Pseudomys apodemoides	Silky Mouse			Near threatened	Dry mallee-heathlands	Unlikely	Unlikely
Sminthopsis crassicaudata	Fat-tailed Dunnart			Near threatened	Sparse grasslands, open shrublands and farmlands	Possible	Possible
Tandanus tandanus	Freshwater Catfish		Listed	Endangered	Slow-flowing streams and lake habitats	Unlikely	Unlikely
Varanus varius	Lace Monitor			Endangered	Dry sclerophyll forests and woodlands	Possible	Likely
Pogona barbata	Bearded Dragon			Vulnerable	Temperate to tropical arid to semi-arid woodland, shrubland and hummock grassland (with scattered trees)	Possible	Known

^EPBC Act: VU = vulnerable, CR = critically endangered, EN = endangered Victorian Advisory# - Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014).

# APPENDIX

B

### HABITAT HECTARE FIELD SHEETS & QUATERNARY SITES



Sites	Height (m)	T1 Species	Allocasuarina luemannii^	Eucalyptus camaldulensis	Eucalyptus leucoxylon	Eucalyptus microcarpa	Planting	Other species
QA1	8	11 Opeoleo	Y	oumululensis	leadexylon	morocarpa	riunnig	
QA3	7		Y					
QA4	15				Y			
								Acacia dodonaeifolia\ Calutrix tetragona Hakea mitchellii
QA5	14		Y	Y	Y	Y		Lolium perenne* . Phalaris paradoxa*. Walwhalleya proluta .
QA6	15			Y	Y			Amphibromus nervosus. Arctotheca calendula* . Hordeum secalinum*.
0.47	47			V				Acetosella vulgaris*. Arctotheca calendula*. Cyperus
QA7	17			Y				Acaena echinata. Amphibromus nervosus. Avena barbata*.
OA8	15				Y	Y		Hypochaeris radicata*. Lolium perenne* . Oxalis perennans *.
0.10								Acacia paradoxa . Acaena echinata. Bromus madritensis*.
QA9	14				Y	Y		Acacia ligulata. Acacia provincialis. Agave americana*.
								Arctotheca calendula*. Cynodon dactylon*. Hypochaeris radicata*. Isolepis marginata*. Lythrum hyssopifolia. Santalum acuminatum. Sanacia guadridantatus. Trifolium
QA10	20			Y		Y		campestre var. campestre*.
QA11	10		Y					Lysiana exocarpi .
								Ávena barbata* . Ehrharta longifolia* . Hypochaeris radicata*. Juncus radula. Lolium perenne* . Rumex brownii .
QA12	13			Y				Trifolium campestre var. campestre*. Acaena echinata. Avena barbata* . Ehrharta longifolia* .
QA13	11		Y					Eryngium ovinum. Juncus radula. Lobelia pratoides. Rytidosperma setaceum . Sida corrugata .
								Acaena echinata. Acetosella vulgaris*. Asparagus africanus. Bomus madritossis* Ektarta logoifolia* Hugoshaoris
								radicata*. Lolium perenne* . Lycium ferocissimum. Lysiana
QA14	18					Y		exocarpi . Oxalis perennans *. Rumex brownii . Senecio quadridentatus. Sida corrugata .
								Acacia pychantha, Ayona barbata*, Convolutius
QA15	8							angustissimus subsp. angustissimus. Eucalyptus spp. 1 (P). Eucalyptus spp. 2 (P). Melaleuca spp (P). Pine spp. (P).
								Acetosella vulgaris*. Arctotheca calendula*. Avena barbata* . Cynodon dactylon*. Ehrharta longifolia*. Hypochaeris radicata*. Lvsiana exocaroi. Panicum effusum.
QA16	8		Y					Rytidosperma setaceum . Sonchus oleraceus*.
								Acacia pycnantha. Acaena echinata. Acetosella vulgaris*. Avena barbata*. Bromus hordeaceus *. Convolvulus angustissimus subspp. omnigracilis. Ehrharta longifolia*. Goodenia gracilis. Helminthotheca echioides*. Hordeum secalinum*. Lolium perenne*. Maireana enchylaenoides.
QA17	8		Y					Oxalis perennans <sup>*</sup> . Phalaris paradoxa*. Swainsona procumbens. Vittadinia megacephala .
QA18	14		Y	Y				Hordeum secalinum*. Lolium perenne* . Phalaris paradoxa*. Trifolium campestre var. campestre*.
								Arctotheca calendula*. Bromus hordeaceus *. Bromus madritensis*. Cirsium vulgare*. Hordeum secalinum*. Lolium
QA19	13				Y	Y		perenne* . Trifolium repens var. repens*.
								Acaena echinata. Arctotheca calendula*. Bromus hordeaceus *. Convolvulus angustissimus subsp. angustissimus. Hordeum secalinum*. Hypochaeris radicata*. Lolium perenne*. Oxalis perennans *. Trifolium campestre
QA20 QA21	NA NA							var. campestre*. Tritolium repens var. repens*.
QA22	NA							
QA23	10		Y	<b>_</b>	<b>_</b>			
QA24a	8		Y					
QA24b	8		Y					
QA25	8		Y					
QA26	NA	NA						Aira cupaniana*. Avena barbata*. Bromus hordeaceus *. Craspedia variabilis. Eleocharis acuta. Geranium potentilloides. Hordeum secalinum*. Juncus radula. Lobelia pratoides. Lolium perenne*. Phalaris aquatica*. Romulea rosea var. australis*. Sonchus oleraceus*. Swainsona procumbens. Trifoljum repens var. repens*.
0.407			v					Avena barbata* . Hordeum secalinum*. Oxalis perennans *.
QAZ/	4							r naians paraduxa . waliwinaliteya prolutta . Avena barbata*. Bromus hordeaceus *. Hordeum secalinum*. Hypochaeris radicata*. Lolium perenne*.
QA28a	6		Y					Modiola caroliniana*. Phalaris paradoxa*. Rumex brownii . Sida corrugata . Sonchus oleraceus*. Walwhalleya proluta .

Sites	Height (m)	T1 Species	Allocasuarina luemannii^	Eucalyptus camaldulensis	Eucalyptus leucoxylon	Eucalyptus microcarpa	Planting	Other species
								Amphibromus nervosus. Avena barbata* . Bromus
								noraeaceus *. Bromus madritensis*. Hordeum secalinum*. Juncus radula. Lolium perenne* Phalaris aquatica* Rumey
								brownii . Sida corrugata . Sonchus oleraceus*. Walwhalleya
QA28b	5		Y					proluta .
								Amphibromus nervosus. Avena barbata* . Euphorbia
								dallachyana . Hordeum secalinum*. Juncus radula. Lolium
								perenne* . Lysiana exocarpi . Phalaris paradoxa*. Phodanthe conumbiflora . Pomuloa rosoa yar australis*
QA29	6		Y					Rumex brownii . Sida corrugata . Walwhalleya proluta .
								angustissimus subspp. omnigracilis. Eutaxia microphylla var.
								microphylla. Goodenia pinnatifida . Helminthotheca
0 4 3 0	6		v					echioides*. Hordeum secalinum*. Lolium perenne*. Phalaris
QA00	0		1					Bromus hordeaceus *. Hordeum secalinum*. Lolium
0.494	7		N.					perenne*. Trifolium campestre var. campestre*. Trifolium
QA31	/		Y					repens var. repens". Bromus hordeaceus *. Hordeum secalinum*. Lolium
								perenne* . Trifolium campestre var. campestre*. Trifolium
QA32	15		Y		Y			repens var. repens*.
								Bromus hordeaceus *. Geranium potentilloides. Hordeum
0.422	10		v					secalinum*. Lolium perenne* . Trifolium campestre var.
QA33	12		1					campesue . Inionum repens val. repens .
								Bromus hordeaceus *. Geranium potentilloides. Hordeum
0434	14		Y					secalinum*. Lolium perenne* . Tritolium campestre var. campestre* Trifolium repens var repens*
Q. 10 T	14		•					Bromus madritensis*. Hordeum secalinum*. Lolium
QA35	10		Y					perenne*. Trifolium campestre var. campestre*.
								Avena barbata* . Bromus hordeaceus *. Chloris truncata .
								Geranium potentilloides. Helminthotheca echioides*. Lolium
QA36	15						Y	perenne* . Modiola caroliniana*. Phalaris paradoxa*. Schinus molle. Trifolium arvense var. arvense*.
QA37	6						Y	
QA38	6		Y					Ehrharta longifolia* . Hordeum secalinum*.
QA39	5		Y					Avena barbata* . Lolium perenne* . Phalaris aquatica*.
QA40	6						Y	Avena barbata*. Fraxinus spp. (P).
								Arctotheca calendula* . Bromus madritensis*. Juncus radula. Lythrum hyssopifolia. Oxalis perennans *. Romulea
QA41	NA	NA						rosea var. australis*. Trifolium striatum.
QD1	8		Y			Y		Amyema linophylla subsp. orientalis^.
QD2	NA							sulcatus.
0.00								Epilobium hirtigerum. Lachnagrostis filiformis. Lolium
QD3 QD4	NA							perenne .
QD5	8					Y		
QD6	NA 8			v				Eragrostis infecunda.
QD7 QD8	o 10		Y	1	Y			Acacia saligna ++.
QD9	6		Y					Acacia acinacea.
								Arctotheca calendula*. Asperula conferta. Avena barbata*.
								Brachyscome paludicola. Briza minor *. Chorizandra enodis.
								variabilis. Einadia nutans. Eutaxia microphylla var.
								microphylla. Goodenia fasicicularis. Haloragis aspera.
								Helminthotheca echioides*. Lobelia pratoides. Lolium perenne* Malva parviflora * Marsilea drummondii. Mimulus
								gracilis. Phalaris aquatica*. Phalaris paradoxa*. Swainsona
0010	ΝΔ			v				procumbens. Teucrium racemosum. Trifolium arvense var. arvense*. Trifolium campestre var. campostro*
QD11	10			Y	<u> </u>	Y		arvense : monum campesire var. campesire .
QD12	15		¥		Y	Y		Acacia paradoxa . Lycium ferocissimum.
QD13 QD14	8 10		Y			Y		Dianella revoluta var. revoluta.
QD15	6		Y					
QD16	15				Y			Pittosporum angustifolium.
QD17 QD18	5 8		Y Y					
QD19	8		Y					Muehlenbeckia cunninghamii.
QD20	15					Y		
QD21 QD22	NA							
QD23	10		Y					
QD26	15		Y		Y	V		
QD27	15					Y	1	

			Allocasuarina	Eucalyptus	Eucalyptus	Eucalyptus		
Sites	Height (m)	T1 Species	luemannii^	camaldulensis	leucoxylon	microcarpa	Planting	Other species
QD28								
QD29	18			Y				
QD30	8		Y			Y		Acacia dodonaeifolia^.
QD31	3							Acacia dodonaeifolia^.
QD32	5		Y					Acacia dodonaeifolia^.
QD33	10					Y		Dianella porracea^.
QD34	8		Y					
QD35	10		Y			Y		
QD36	8		Y					
QD37	4		Y					
QD38	8						Y	
QD39	9						Y	
QD40	8						Y	

E = Exotic; P = Planted; ++ = Non-local Native, ^ = Threatened
## APPENDIX



# HABITAT HECTARE SITE CONDITION SCORES





Habit	at Zone		HD4	HD5	HD7	HD1 0	HD1 1	HD1 3	HD1 4	HD1 5	HD1 7	HD1 8	HA2	HA3	HA4	HA8	HAD 1	HA1 0	HA1
EVC Number		803	803	803	803	803	803	803	803	803	803	803	292	292	292	292	292	125	
		Max Score																	
	Large Trees	10	5	9	9	0	0	9	10	10	9	10	9	9	9	9	5	9	0
	Tree Canopy Cover	5	2	4	2	3	3	4	5	5	2	3	4	2	2	4	4	4	0
e	Lack of Weeds	15	2	2	4	2	2	2	9	9	2	4	2	6	2	2	4	0	11
Scol	Understorey	25	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	15
tion	Recruitment	10	6	3	1	6	3	3	6	6	3	3	3	3	1	6	3	3	0
ondi	Organic Litter	5	3	3	3	3	3	5	5	5	5	5	5	5	3	5	5	5	3
č e	Logs	5	5	5	5	3	2	3	5	3	3	5	5	5	5	5	5	5	Na
Sit	Standardiser (e.g. 55/75)	X 1.36																	X 1.36
	Subtotal	75	28	31	29	22	18	31	45	43	29	35	33	35	27	36	31	31	33.3 5

Habitat Zone			HA1 0	HA1	HA9	HD2	HD3	HD6	HD8	HD1 2	HD9	HD16	HA5	HA6	HA7	HA1 1	HD1
EVC Number		292	125	292	292	292	292	292	292	125	125	803	803	803	803	803	
		Max Score															
	Large Trees	10	9	0	10	9	9	9	9	9	0	0	3	9	0	0	2
	Tree Canopy Cover	5	4	0	3	2	4	4	2	2	0	0	3	2	1	3	3
e	Lack of Weeds	15	0	11	2	2	4	2	4	6	11	13	13	2	2	2	11
Scol	Understorey	25	5	15	5	5	5	5	5	5	5	10	5	5	5	5	5
tion	Recruitment	10	3	0	1	6	1	6	6	3	3	0	6	1	1	6	6
ondi	Organic Litter	5	5	3	3	5	5	5	5	3	3	3	5	5	3	3	5
ŭ	Logs	5	5	Na	0	5	5	5	3	5	Na	Na	3	5	5	3	5
Sit	Standardiser (e.g. 55/75)	X 1.36		X 1.36							X 1.36	X 1.36					
	Subtotal	75	31	33.3 5	24	34	33	36	34	33	25.3	29.9	38	29	17	22	37

### APPENDIX



#### FLORA SPECIES LIST



Family	Scientific Name	Commo Name	Status
Anacardiaceae	Schinus molle	Pepper tree	*
Apiaceae	Eryngium ovinum	Blue devil	LC
Apiaceae	Eryngium vesiculosum	Prick foot	LC
Araliaceae	Hydrocotyle laxiflora	Stinking Pennywort	LC
Asparagaceae	Arthropodium fimbriatum	Nodding Chocolate-lily	LC
Asparagaceae	Arthropodium fimbriatum		LC
Asparagaceae	Arthropodium minus		LC
Asparagaceae	Arthropodium strictum		LC
Asparagaceae	Asparagus asparagoides		*
Asparagaceae	Lomandra micrantha subsp. micrantha		LC
Asparagaceae	Lomandra nana		LC
Asphodelaceae	Dianella porracea	Leek flax-lily	V <sup>#</sup>
Asteraceae	Arctotheca calendula	Cape weed	*
Asteraceae	Brachyscome paludicola		LC
Asteraceae	Calocephalus citreus		LC
Asteraceae	Calocephalus sonderi		LC
Asteraceae	Carduus tenuiflorus	Winged Slender-thistle	*
Asteraceae	Centipeda cunninghamii		LC
Asteraceae	Cirsium vulgare	Spear thistle	*
Asteraceae	Coronidium scorpioides		LC
Asteraceae	Cotula coronopifolia	Water-buttons	LC
Asteraceae	Craspedia variabilis	Yellow balls	LC
Asteraceae	Erigeron bonariense		LC
Asteraceae	Erigeron sumatrensis		*
Asteraceae	Helminthotheca echioides	Bristly ox tongue	*
Asteraceae	Hypochaeris radicata		*
Asteraceae	Lactuca serriola		*
Asteraceae	Laphangium luteoalbum	Jersey Cudweed	LC
Asteraceae	Leontodon saxatilis		*
Asteraceae	Myriocephalus rhizocephalus		LC
Asteraceae	Pseudognaphalium luteoalbum		LC
Asteraceae	Reichardia tingitana		*
Asteraceae	Rhodanthe corymbiflora		LC
Asteraceae	Senecio picridioides		LC
Asteraceae	Senecio quadridentatus	Cotton fireweed	LC
Asteraceae	Sonchus oleraceus		*
Asteraceae	Vittadinia gracilis		LC
Asteraceae	Vittadinia megacephala		LC
Boraginaceae	Cynoglossum suaveolens	Sweet forget-me-not	LC
Brassicaceae	Brassica napus		*
Brassicaceae	Lepidium africanum		*
Campanulaceae	Lobelia concolor		LC
Campanulaceae	Lobelia pratioides		LC
Campanulaceae	Wahlenbergia fluminalis		LC
Campanulaceae	Wahlenbergia graniticola	Tufted Bluebell	LC
Casuarinaceae	Allocasuarina luehmannii	Buloke	E <sup># ^</sup>
Chenopodiaceae	Einadia nutans		LC
Chenopodiaceae	Enchylaena tomentosa var tomentosa	Ruby saltbush	

Family	Scientific Name	Commo Name	Status
Chenopodiaceae	Maireana enchylaenoides		LC
Convolvulaceae	Convolvulus angustissimus subsp. angustissimus		LC
Convolvulaceae	Convolvulus angustissimus subspp. omnigracilis		LC
Crassulaceae	Crassula sieberiana		LC
Cupressaceae	Callitris gracilis		LC
Cyperaceae	Chorizandra enodis		LC
Cyperaceae	Cyperus gymnocaulos		LC
Cyperaceae	Eleocharis acuta	Common Spike-rush	LC
Cyperaceae	Isolepis marginata		LC
Cyperaceae	Lepidosperma laterale		LC
Euphorbiaceae	Euphorbia dallachyana		LC
Fabaceae	Acacia acinacea		LC
Fabaceae	Acacia baileyana	Cootamundra Wattle	LC
Fabaceae	Acacia dodonaeifolia	Sticky wattle	R <sup>#</sup>
Fabaceae	Acacia mearnsii		LC
Fabaceae	Acacia paraxoda		LC
Fabaceae	Acacia pycnantha		LC
Fabaceae	Acacia rupicola		R <sup>#</sup>
Fabaceae	Acacia saligna		#
Fabaceae	Chamaecytisus palmensis	Tree Lucerne	*
Fabaceae	Eutaxia microphylla var. microphylla	Common Eutaxia	LC
Fabaceae	Kennedia prostrata	Running postman	LC
Fabaceae	Medicago truncatula		*
Fabaceae	Swainsona procumbens	Broughton pea	LC
Fabaceae	Swainsona sericea	Silky Swainson-pea	LC
Fabaceae	Templetonia stenophylla		*
Fabaceae	Trifolium arvense var. arvense	Hare's-foot clover	*
Fabaceae	Trifolium campestre var. campestre	Hop Clover	*
Fabaceae	Trifolium fragiferum	Strawberry clover	*
Fabaceae	Trifolium repens var repens	White clover	*
Fabaceae	Trifolium striatum	Knotted clover	*
Fabaceae	Vicia hirsuta		*
Gentianaceae	Centaurium erythraea		*
Geraniaceae	Geranium potentilloides	Soft Crane's-bill	LC
Geraniaceae	Geranium solanderi		LC
Goodeniaceae	Goodenia gracilis		LC
Goodeniaceae	Goodenia humilis		LC
Goodeniaceae	Goodenia pinnatifida	Cut-leaf goodenia	LC
Haloragaceae	Haloragis aspera		LC
Haloragaceae	Haloragis heterophylla		LC
Hemerocallidaceae	Dianella revoluta		LC
Hypericaceae	Hypericum gramineum		LC
Iridaceae	Romulea rosea	Onion grass	*
Juncaceae	Juncus flavidus		LC
Juncaceae	Juncus holoschoenus		LC
Juncaceae	Juncus procerus		LC
Juncaceae	Juncus radula		LC
Lamiaceae	Marrubium vulgare	Horehound	*

Family	Scientific Name Co	ommo Name	Status
Lamiaceae	Mentha diemenica		LC
Lamiaceae	Salvia verbenaca		*
Lamiaceae	Teucrium racemosum		LC
Loranthaceae	Amyema linophylla subsp. orientalis Bu	uloke Mistletoe	V <sup>#</sup>
Loranthaceae	Lysiana exocarpi		LC
Lythraceae	Lythrum hyssopifolia		LC
Malvaceae	Malva nicaeensis		*
Malvaceae	Malva parviflora Sr	mall-flowered Mallow	*
Malvaceae	Modiola caroliniana		*
Malvaceae	Sida corrugata		LC
Marsileaceae	Marsilea drummondii		LC
Myrtaceae	Corymbia citriodora		Р
Myrtaceae	Eucalyptus camaldulensis		LC
Myrtaceae	Eucalyptus leucoxylon		LC
Myrtaceae	Eucalyptus microcarpa		LC
Myrtaceae	Leptospermum continentale		LC
Onagraceae	Epilobium hirtigerum		LC
Onagraceae	Oenothera stricta subsp stricta Co	ommon evening primrose	*
Oxalidaceae	Oxalis corniculata Cr	reeping Wood-sorrel	*
Oxalidaceae	Oxalis perennans		*
Phrymaceae	Mimulus gracilis		LC
Pinaceae	Pinus radiata Ra	adiata Pine	*
Pittosporaceae	Bursaria spinosa Ku	urwan	LC
Pittosporaceae	Pittosporum angustifolium		LC
Plantaginaceae	Callitriche umbonata		R <sup>#</sup>
Plantaginaceae	Plantago coronopus		*
Plantaginaceae	Plantago coronopus subsp. commutata		*
Plantaginaceae	Plantago coronopus subsp. coronopus		LC
Plantaginaceae	Plantago varia		LC
Poaceae	Aira cupaniana		*
Poaceae	Amphibromus nervosus Fi	ne native grass	LC
Poaceae	Anthosachne scabra		LC
Poaceae	Aristida behriana		LC
Poaceae	Austrostipa nodosa		LC
Poaceae	Avena barbata		*
Poaceae	Briza maxima		*
Poaceae	Briza minor		*
Poaceae	Bromus diandrus		*
Poaceae	Bromus hordeaceus		*
Poaceae	Bromus madritensis		*
Poaceae	Bromus rubens		*
Poaceae	Chloris truncata W	/indmill-grass	LC
Poaceae	Cynodon dactylon		*
Poaceae	Cynosurus echinatus Ro	ough Dog's-tail	*
Poaceae	Dactylis glomerata Co	ocks foot	*
Poaceae	Ehrharta calycina		LC
Poaceae	Ehrharta longifolia		*
Poaceae	Eragrostis infecunda Sc	Southern Cane-grass	

Family	Scientific Name	Commo Name	Status
Poaceae	Hordeum marinum		*
Poaceae	Hordeum secalinum	Knotted Barley Grass	*
Poaceae	Lachnagrostis filiformis		LC
Poaceae	Lolium perenne		*
Poaceae	Lolium rigidum		*
Poaceae	Panicum capillare		*
Poaceae	Panicum effusum	Hairy panic	LC
Poaceae	Phalaris aquatica		*
Poaceae	Phalaris paradoxa		*
Poaceae	Poa annua		*
Poaceae	Poa labillardierei var. labillardierei		LC
Poaceae	Rytidosperma duttonianum		LC
Poaceae	Rytidosperma geniculatum		LC
Poaceae	Rytidosperma setaceum		LC
Poaceae	Themeda triandra	Kangaroo Grass	LC
Poaceae	Triticum aestivum		*
Poaceae	Vulpia myuros		*
Poaceae	Walwhalleya proluta		LC
Polygonaceae	Acetosella vulgaris		*
Polygonaceae	Duma florulenta		LC
Polygonaceae	Muehlenbeckia diclina		LC
Polygonaceae	Rumex brownii		LC
Polygonaceae	Rumex tenax		LC
Potamogetonaceae	Potamogeton sulcatus		LC
Primulaceae	Lysimachia arvensis	Pimpernel	*
Proteaceae	Hakea mitchellii		LC
Ranunculaceae	Ranunculus sessiliflorus var. pilulifer		LC
Rosaceae	Acaena echinata	Sheep's burr	LC
Rosaceae	Acaena novae-zelandiae		LC
Rubiaceae	Asperula conferta		LC
Rubiaceae	Asperula wimmerana		R <sup>#</sup>
Rubiaceae	Galium murale		*
Santalaceae	Santalum acuminatum	Sweet quandong	LC
Solanaceae	Lycium ferocissimum	African box thorn	*
Solanaceae	Solanum nigrum	Black nightshade	*
Thymelaeaceae	Pimelea curviflora		LC
Thymelaeaceae	Pimelea curviflora var. sericea		LC
Urticaceae	Urtica urens		*
Verbenaceae	Verbena officinalis	Common Verbena	LC

LC = Least Concern; R = Rare; V = Vulnerable; E = Endangered; \* = Exotic; P= planted, # = Non-local Native

^= Listed as a threatened under the Flora and Fauna Guarantee Act 1988

<sup>#</sup> = Threatened status listed on the Advisory List of Rare or Threatened Plants in Victoria 2014







Class	Scientific Name	Common Name	Status
Amphibia	Crinia signifera	Common Eastern Froglet	LC
Amphibia	Crinia parinsignifera	Eastern Sign-bearing Froglet	LC
Amphibia	Limnodynastes dumerilii variegatus	Eastern Banjo Frog	LC
Amphibia	Pseudophryne bibronii	Brown Toadlet	E <sup>#</sup> ^
Amphibia	Limnodynastes tasmaniensis	Spotted Marsg Frog	LC
Amphibia	Neobatrachus sudellae	Sudell's Frog	LC
Aves	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	LC
Aves	Acanthiza nana	Yellow Thornbill	LC
Aves	Acanthiza pusilla	Brown Thornbill	LC
Aves	Aphelocephala leucopsis	Southern Whiteface	LC
Aves	Smicrornis brevirostris	Weebill	LC
Aves	Accipiter fasciatus	Brown Goshawk	LC
Aves	Aquila audax	Wedge-tailed Eagle	LC
Aves	Circus assimilis	Spotted Harrier	NT <sup>#</sup>
Aves	Elanus axillaris	Black-shouldered Kite	LC
Aves	Haliastur sphenurus	Whistling Kite	LC
Aves	Milvus migrans	Black Kite	LC
Aves	Dacelo novaeguineae	Laughing Kookaburra	LC
Aves	Anas gracilis	Grey Teal	LC
Aves	Anas superciliosa	Pacific Black Duck	LC
Aves	Chenonetta jubata	Australian Wood Duck	LC
Aves	Tadorna tadornoides	Australian Shelduck	LC
Aves	Anseranas semipalmata	Magpie Goose	NT <sup>#</sup> ^
Aves	Ardea pacifica	White-necked Heron	LC
Aves	Egretta novaehollandiae	White-faced Heron	LC
Aves	Artamus cyanopterus	Dusky Woodswallow	LC
Aves	Cracticus tibicen	Australian Magpie	LC
Aves	Cacatua galerita	Sulphur-crested Cockatoo	LC
Aves	Cacatua tenuirostris	Long-billed Corella	LC
Aves	Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	LC
Aves	Eolophus roseicapillus	Galah	LC
Aves	Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC
Aves	Lalage sueurii	White-winged Triller	LC
Aves	Elseyornis melanops	Black-fronted Dotterel	LC
Aves	Erythrogonys cinctus	Red-kneed Dotterel	LC
Aves	Vanellus miles	Masked Lapwing	LC
Aves	Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	NT <sup>#</sup>
Aves	Ocyphaps lophotes	Crested Pigeon	LC
Aves	Phaps chalcoptera	Common Bronzewing	LC
Aves	Corvus bennetti	Little Crow	LC
Aves	Corvus coronoides	Australian Raven	LC
Aves	Chalcites basalis	Horsfield's Bronze-Cuckoo	LC
Aves	Stagonopleura guttata	Diamond Firetail	NT <sup>#</sup>
Aves	Falco berigora	Brown Falcon	LC
Aves	Falco cenchroides	Nankeen Kestrel	LC
Aves	Falco longipennis	Australian Hobby	LC

Class	Scientific Name	Common Name	Status
Aves	Falco peregrinus	Peregrine Falcon	LC
Aves	Petrochelidon ariel	Fairy Martin	LC
Aves	Chlidonias hybrida	Whiskered Tern	NT <sup>#</sup> ^
Aves	Chroicocephalus novaehollandiae	Silver Gull	LC
Aves	Malurus cyaneus	Superb Fairy-wren	LC
Aves	Cincloramphus cruralis	Brown Songlark	LC
Aves	Cincloramphus mathewsi	Rufous Songlark	LC
Aves	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	LC
Aves	Anthochaera carunculata	Red Wattlebird	LC
Aves	Epthianura albifrons	White-fronted Chat	LC
Aves	Lichenostomus penicillatus	White-plumed Honeyeater	LC
Aves	Manorina melanocephala	Noisy Miner	LC
Aves	Melithreptus brevirostris	Brown-headed Honeyeater	LC
Aves	Phylidonyris novaehollandiae	New Holland Honeyeater	LC
Aves	Purnella albifrons	White-fronted Honeyeater	LC
Aves	Grallina cyanoleuca	Magpie-lark	LC
Aves	Anthus novaeseelandiae	Australian Pipit	LC
Aves	Dicaeum hirundinaceum	Mistletoebird	LC
Aves	Daphoenositta chrysoptera	Varied Sittella	LC
Aves	Colluricincla harmonica	Grey Shrike-thrush	LC
Aves	Pachycephala rufiventris	Rufous Whistler	LC
Aves	Pardalotus striatus	Striated Pardalote	LC
Aves	Passer domesticus	House Sparrow	*
Aves	Pelecanus conspicillatus	Australian Pelican	LC
Aves	Petroica goodenovii	Red-capped Robin	LC
Aves	Phalacrocorax carbo	Great Cormorant	LC
Aves	Podargus strigoides	Tawny Frogmouth	LC
Aves	Tachybaptus novaehollandiae	Australasian Grebe	LC
Aves	Glossopsitta concinna	Musk Lorikeet	LC
Aves	Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC
Aves	Platycercus elegans	Crimson Rosella	LC
Aves	Platycercus eximius	Eastern Rosella	LC
Aves	Psephotus haematonotus	Red-rumped Parrot	LC
Aves	Trichoglossus haematodus	Rainbow Lorikeet	LC
Aves	Tribonyx ventralis	Black-tailed Native-hen	LC
Aves	Himantopus himantopus	Black-winged Stilt	LC
Aves	Recurvirostra novaehollandiae	Red-necked Avocet	LC
Aves	Rhipidura leucophrys	Willie Wagtail	LC
Aves	Ninox novaeseelandiae	Southern Boobook	LC
Aves	Sturnus vulgaris	Common Starling	*
Aves	Platalea flavipes	Yellow-billed Spoonbill	LC
Aves	Threskiornis molucca	Australian White Ibis	LC
Aves	Threskiornis spinicollis	Straw-necked Ibis	LC
Aves	Tyto javanica	Eastern Barn Owl	LC
Aves	Artamus superciliosus	White-browed Woodswallow	LC
Mammalia	Vulpes vulpes	Fox	*

Class	Scientific Name	Common Name	Status
Mammalia	Felis catus	Cat	*
Mammalia	Lepus capensis	Brown Hare	*
Mammalia	Wallabia bicolor	Swamp Wallaby	LC
Mammalia	Oryctolagus cuniculus	European Rabbit	*
Mammalia	Macropus fuliginosus	Western Grey Kangaroo	LC
Mammalia	Macropus giganteus	Eastern Grey Kangaroo	LC
Mammalia	Trichosurus vulpecula	Common Brushtail Possum	LC
Mammalia	Pseudocheirus peregrinus	Common Ringtail Possum	LC
Mammalia	Tachyglossus aculeatus	Short-beaked Echidna	LC
Mammalia	Mus musculus	House Mouse	*
Reptilia	Amphibolurus muricatus	Jacky Lizard	LC
Reptilia	Pogona barbata	Bearded Dragon	V <sup>#</sup>
Reptilia	Chelodina longicollis	Eastern Snake-necked Turtle	LC
Reptilia	Pseudonaja textilis	Eastern Brown Snake	LC
Reptilia	Christinus marmoratus	Marbled Gecko	LC
Reptilia	Ctenotus robustus	Robust Ctenotus	LC
Reptilia	Tiliqua rugosa	Shingle-back	LC
Reptilia	Morethia boulengeri	South-eastern Morethia Skink	LC

LC = Least Concern; NT = Near Threatened; V = Vulnerable, E = Endangered; \* = Exotic

^= Listed as threatened under the Flora and Fauna Guarantee Act 1988

# = Threatened status is listed on the Advisory List of Threatened Vertebrate Fauna in Victoria 2013

## APPENDIX

#### SCAT & PELLET IDENTIFICATION RESULTS



Scat and p	ellet analysis, north-west of	Horsham, Vic No	vember 2018		
Batch 1					
No.	Sample no.	Description	Sample ID	Mammal ID - definite	Mammal ID - probable
1	Q?	?koala scat	possum scats	Trichosurus sp.	T. vulpecula
2	Jallumba 1	?predator scat	?fox scat	Ovis aries	
3	QD11	?predator scat	dog scat	O. aries	
4	QD13	Scat	herbivore scats	O. aries	
5	HD3	?fox scat	?fox scat	O. aries	
6	Jallumba 2	?herbivore scat	possum scats	Trichosurus sp.	T. vulpecula
7	HD5	Scat	?fox scat	O. aries	
8	HD12	?predator scat	dog scat	no hairs (feathers, bone fragments)	
9	HD7	?predator scat	dog scat	no hairs (feathers, bone fragments)	
10	QD21	Scat	macropod scat	no hairs (coarse plant material)	
11	HD18	Pellet	?old owl pellet	Mus musculus (and feathers)	
12	QD14	Pellet	?owl pellet	M. musculus	
13	Wedge-tailed Eagle nest	Prey parts	1. lower jaw	Oryctolagus cuniculus	
			2. pellet	O. aries	
			3. pellet	O. aries (and feathers)	
			4. pellet	O. cuniculus	
			5. pellet	O. cuniculus	
			6.pellet	O. cuniculus	
			7.pellet	O. aries (and feathers)	
			8. loose material	O. cuniculus (and feathers)	
Batch 2					
1	Jallumba skull	Unknown	lower jaws	Trichosurus sp.	T. vulpecula