ecology & heritage partners

Final Report

Existing Ecological Conditions Report: Bannockburn Growth Area (South East Section)

Prepared for

Victorian Planning Authority

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Disclaimer

Although Ecology and Heritage Partners Pty Ltd have taken all the necessary steps to ensure that an accurate document has been prepared, the company accepts no liability for any damages or loss incurred as a result of reliance placed upon the report and its contents.

EXECUTIVE SUMMARY

Introduction

Ecology and Heritage Partners Pty Ltd was engaged by the Victorian Planning Authority to undertake an Existing Ecological Conditions Report at Bannockburn Growth Area (South East Section).

Targeted surveys were conducted for the following flora species:

- Spiny Rice-Flower *Pimelea spinescens* subsp. *spinescens* (nationally significant);
- Button Winklewort *Rutidosis leptorhynchoides* (nationally significant);
- Large-headed Fireweed *Senecio macrocarpus* (nationally significant);
- Matted Flax-lily *Dianella amoena* (nationally significant);
- Adamson's Blown-grass *Lachnagrostis adamsonii* (nationally significant);
- Cut-leaf Burr Daisy *Calotis anthemoides* (State-significant);
- Small Scurf-pea *Cullen parvum* (State-significant); and,
- Hairy Tails *Ptilotus erubescens* (State-significant).

Targeted Surveys for the following nationally significant fauna species were undertaken:

- Striped Legless Lizard *Delma impar*;
- Growling Grass Frog *Litoria raniformis*; and,
- Golden Sun Moth *Synemon plana.*

The surveys were required to determine the presence or absence of any significant flora and fauna species and address any implications under Commonwealth and State environmental legislation.

A detailed Ecological Assessment was also undertaken to confirm the condition and extent of native vegetation within the whole study area, particularly along Bruce Creek and roadsides.

Methods

Ecological Assessment

A field assessment was undertaken on 13 November 2020 and 16, 17 and 18 December 2020 to obtain information on flora and fauna values within the study area. The study area was walked, with all commonly observed vascular flora and fauna species recorded, significant records mapped, and the overall condition of vegetation and habitats noted.

Targeted Flora Surveys

Targeted surveys for the nationally significant Spiny Rice-Flower and Large-headed Fireweed were undertaken on 25 August 2020, and 30 October and 13 November 2020, respectively. In addition targeted surveys for the nationally significant Button Wrinklewort, Matted Flax-lily and Adamson's Blown-grass, and the State

significant Cut-leaf Burr Daisy, Small Scurf-pea and Hairy Tails were undertaken simultaneously on 3, 16, 17 and 18 December 2020.

The study area was systematically traversed at approximately five-metre linear intervals in accordance with the survey guidelines for significant flora species outlined in the Biodiversity Precinct Structure Planning Kit (DSE 2010). All surveys were conducted by qualified botanists and field ecologists and focused on suitable habitat identified within the study area during the preliminary biodiversity assessment.

Targeted Fauna Surveys

Targeted surveys for nationally significant species (Striped Legless Lizard, Growling Grass Frog and Golden Sun Moth) were conducted by qualified ecologists between October 2020 and December 2020. Surveys were conducted in accordance with the relevant State and Commonwealth survey guidelines.

Surveys focused on suitable habitat identified within the study area during the preliminary flora and fauna assessment.

Results

Ecological Assessment

Sixty-six flora species (37 indigenous and 29 non-indigenous or introduced) and 21 species of fauna, comprising 16 native species and five introduced species were recorded within the study area during the ecological assessment

Detailed vegetation mapping completed across the study area recorded three Ecological Vegetation Classes (EVC) (Plains Grassland (EVC 132), Creekline Grassy Woodland (EVC 68) and Plains Grassy Woodland (EVC 55)) within the study area comprising 8.414 hectares of native vegetation, three Large canopy trees and 87 Large scattered trees .

No nationally listed flora species were identified during the targeted surveys across study area. However, three Melbourne Yellow-gum, listed as endangered under the FFG-Act were recorded within the study area along Charlton Road as part of this ecological assessment. This is in addition to the four Melbourne Yellow-gum identified as during the previous biodiversity assessment. Common Onion-orchid and Cotton Fireweed, protected under the FFG-Act, were also recorded throughout the study area.

A total of 6.37 hectares of *Natural Temperate Grassland of the Victorian Volcanic Plain* ecological community (Habitat Zones PG1, PG4 and PG5) and 7.804 hectares of the Western Basalt Plains Grassland Community was recorded within the study area (Habitat Zones PG1, PG2, PG3, PG4, PG5 and PG6).

Targeted Flora Surveys

None of the targeted significant flora species (Spiny Rice-flower, Button Wrinklewort, Large-headed Fireweed, Matted Flay-lily, Adamson's Blown-grass, Cut-leaf Burr Daisy, Small Scurf-pea or Hairy Tails) were detected within the study area, despite systematic targeted surveys over the area during the known flowering period when the species was known to be flowering within the locality.

Based on the results of the targeted surveys, site condition and proximity and distribution of previous records, there is considered to be a low likelihood that the study area supports a population of any of the national or State significant flora species targeted for assessment.

Targeted Fauna Surveys

Eight individuals of the nationally listed Golden Sun Moth was recorded along the properties adjacent to Bruce Creek.

A small population (five recorded individuals) of the nationally listed Growling Grass Frog occurred throughout Bruce Creek within the study area.

No Striped Legless Lizards were detected within the study area during the targeted survey. While grassland habitats within the study area support habitat characteristics that are suitable for Striped Legless Lizard, given the absence of the species during the surveys, a resident population is not likely within the study area.

However, Tussock Skink, listed as Endangered under the FFG Act, was recorded within the study area as part of the targeted Striped Legless Lizard surveys.

Table S1. Summary of the ecological values that occur within the study area.

Species diversity	Moderate assemblage of plants and animals, with 66 flora species and 21 fauna species recorded during the ecological surveys.
Native vegetation	• 8.414 hectares of native vegetation represented by three EVCs: ○ *Heavier Soils* Plains Grassland (EVC 132_63) 7.804 hectares; ○ Creekline Grassy Woodland (EVC 68) 0.323 hectares; ○ Plains Grassy Woodland (EVC 55_61) 0.288 hectares; ○ Three Large Canopy Trees; ○ 87 Scattered Trees
Wetlands	• The study area is located 30 kilometres to the west of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site.
Significant ecological communities	• A total of 6.37 hectares of the nationally significant ecological community *Natural Temperate Grassland of the Victorian Volcanic Plain* is present in the study area; • A total of 7.804 hectares of the State significant *Western (Basalt) Plains Grassland Community* is present in the study area.
Significant flora species	• No nationally significant flora were recorded in the study area. • Melbourne Yellow-gum *Eucalyptus leucoxylon* subsp. *connata* listed as endangered under the FFG-Act was recorded within the study area. • Common Onion-orchid and Cotton Fireweed, protected under the FFG-Act were also recorded throughout the study area.
Significant fauna species	• Known presence of two nationally significant fauna: ○ Confirmed habitat for Growling Grass Frog along the Bruce Creek corridor; ○ 6.324 hectares of confirmed habitat for Golden Sun Moth within the study area (parcels along Bruce Creek). • Known presence of one State significant fauna: ○ Tussock Skink (Endangered under the FFG Act) was recorded within the study area.

Legislative and Policy Implications

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act - Federal)

Any future development activity should be assessed against the significant impact guidelines for the following nationally significant species and ecological communities recorded within the study area:

- Golden Sun Moth *Synemon plana*
- Growling Grass Frog *Litoria raniformis*
- *Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP).*

Based on the significant impact assessment, a referral to the Commonwealth Environment Minister may be required.

Flora and Fauna Guarantee Act 1988 (FFG Act - Victoria)

Three Melbourne Yellow-gum, listed as endangered under the FFG-Act, were recorded within the study area along Charlton Road as part of this ecological assessment (Figure 2). This is in addition to the four Melbourne Yellow-gum identified as during the previous biodiversity assessment (Ecology and Heritage Partners 2020a).

Common Onion-orchid and Cotton Fireweed, protected under the FFG-Act, were also recorded throughout the study area.

Tussock Skink, listed as endangered under the FFG Act, was recorded during the surveys for Striped Legless Lizard.

One FFG Act-listed community is present in the study area, being Western (Basalt) Plains Grassland. This community corresponds to areas of Plains Grassland mapped in the study area and meets the relevant description and characteristics described for this community.

Catchment and Land Protection Act 1994 (Victoria)

Weeds listed as noxious under the CaLP Act were recorded during the assessment (Willow, Chilean Needle-grass, African Box-thorn, Saffron Thistle, Artichoke Thistle, Serrated Tussock, Sweet Briar and Spiny Rush). Similarly, there is evidence that the study area is currently occupied by several pest fauna species listed under the CaLP Act (Red Fox and European Rabbit). Weed management and pest fauna management actions are likely to be required to be incorporated into any future Construction Environmental Management Plan (CEMP) as part of any future development of the study area.

Mitigation Measures and Recommendations

Given the biodiversity recorded within these areas, it is recommended that these ecological values be retained and enhanced and managed to assist in creating a more diverse, connected and resilient natural environment, particularly those located within the Bruce Creek corridor

A summary of practically achievable ecological enhancement opportunities available within areas of retained vegetation and fauna habitat is provided in Section 5.

Given the results of this assessment, it is recommended that a suitably qualified ecologist undertake an assessment of the quality and extent of native vegetation and undertake any additional targeted surveys for significant flora and fauna species within the remainder of the Bannockburn Growth Area as detailed in the previous Biodiversity Assessment report (Ecology and Heritage Partners 2020a).

CONTENTS

1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was engaged by the Victorian Planning Authority to undertake a suite of detailed ecological investigations in order to determine the existing ecological conditions within the Bannockburn Growth Area (South East Section).

The Victorian Planning Authority has led the development of the Bannockburn Growth Plan to guide the sustainable growth of Bannockburn to the year 2050. The project commenced in early 2020 and has involved close collaboration with Golden Plains Shire Council, as well as state agencies. The Bannockburn Growth Plan identifies future growth areas and associated infrastructure requirements to service the future population at a high level.

Ecology and Heritage Partners Pty Ltd was previously engaged by the Victorian Planning Authority (VPA) to undertake a desktop due diligence assessment within the Bannockburn Growth Area to inform the preparation of the Bannockburn Growth Plan (Growth Plan) and avoid conflicts between urban development and ecological decisions in the more detailed planning process (Ecology and Heritage Partners 2020b).

Following the preliminary Biodiversity Assessment within the Bannockburn Growth Area, recommendations were made pertaining to future detailed assessments and survey work. As a result, an Ecological Assessment and targeted surveys for significant flora and fauna species were undertaken within the South East section of the Bannockburn Growth Area.

The following addresses any implications under Commonwealth and State environmental legislation and provides information on mitigation measures associated with the proposed development should any national or State-significant species or ecological communities be identified within the study area.

1.2 Scope and Objectives

The objective of this report is to inform decisions regarding the future planning and development of the Bannockburn Growth Area.

Specifically, the following have been undertaken as part of the Ecological Assessment are as follows:

- Identification, assessment, and mapping of areas supporting native vegetation and fauna habitat, including a determination of conservation significance;
- To collect and present information about environmental values to allow integration with the planning and potential future development of the area; and,
- Provision of management measures that should be implemented to reduce adverse impacts on biodiversity values known to, or likely to occur in the study area.

The objectives of the targeted surveys were to:

- Determine the presence/absence of significant flora and fauna species recorded or considered likely to occur within the study area;

- Provide information in relation to any implications of Commonwealth and State environmental legislation and Government policy associated with the proposed development;
- Determine any potential impacts on significant flora and fauna, and their habitats at a National and State level associated with the proposed development; and,
- Provide advice on mitigation measures that may be undertaken to avoid and/or mitigate potential adverse impacts on significant ecological values.

1.3 Study Area

The study area is located within the Bannockburn Growth area, and forms part of the Growth Investigation Area, which covers approximately 1,000 hectares (Figure 1).

The study area comprises the South East section of the Growth Area, which is bound by Bruce Creek to west, Charlton Road and Glen Avon Drive to the north, Burnside Road and agricultural land to the east and the rail corridor to the south, and included all land parcels within this area, as well as the public road reserves.

The previous Biodiversity Assessment (Ecology and Heritage Partners 2020a) has identified the majority of the land within the Bannockburn South East Growth Area as a mixture of cropped and/or farmland.

The study area is zoned Farming Zone (FZ) and is partially affected by an Environmental Significance Overlay – Schedule 2 (ESO2) and a Land Subject to Inundation Overlay (LSIO) along the Bruce Creek corridor (DELWP 2021a).

According to the Department of Environment, Land, Water and Planning (DELWP) Native Vegetation Information Management (NVIM) Tool (DELWP 2021b), the study area occur within the Victorian Volcanic Plains bioregion, is located within the jurisdiction of Corangamite Catchment Management Authority (CMA) and the Golden Plains Shire municipality.

2 METHODS

This chapter details the desk-based and field methods used in surveying the current environment as well as the methods used to assess the likelihood of significant flora and fauna species occurring within the study area, including how the survey effort, design and methodology for each of the relevant ecological values are informed by Commonwealth and Victorian flora and fauna survey guidelines. It is noted that the methodology detailed below is in accordance with the standard ecological assessment requirements used to inform the precinct structure planning process.

2.1 Overview

Following the preliminary Biodiversity Assessment within the study area (Ecology and Heritage Partners 2020a), recommendations were made pertaining to future detailed assessments and survey work. As potential and/or suitable habitat for the nationally significant Spiny Rice-Flower *Pimelia spinescens* subsp *spinescens,* Striped Legless Lizard *Delma impar* and Growling Grass Frog *Litoria raniformis* was identified within the South East portion of the Bannockburn Growth Area, targeted surveys were recommended to determine the presence or absence of these species, and where possible, to ascertain its distribution and abundance and the extent of the species habitat within the study area.

Furthermore, during the works associated with undertaking targeted surveys for the Spiny Rice-flower, Ecology and Heritage Partners reviewed the quality and extent of existing habitat values within the south-eastern growth area and determined that areas of suitable habitat for Spring-flowering significant species were present along the Bruce Creek corridor. These species included the nationally significant:

- Button Winklewort *Rutidosis leptorhynchoides*
- Large-headed Fireweed *Senecio macrocarpus*
- Matted Flax-lily *Dianella amoena*
- Adamson's Blown-grass *Lachnagrostis adamsonii*

It is important to note that surveys for State Significant flora are not currently required under existing legislation and policy, however, the presence of the following species were surveyed for concurrently with the surveys for nationally significant flora:

- Cut-leaf Burr Daisy *Calotis anthemoides*
- Small Scurf-pea *Cullen parvum*
- Hairy Tails *Ptilotus erubescens*

Areas located along Bruce Creek were also observed to support Plains Grassland vegetation, with several discrete areas containing a high cover of Kangaroo Grass *Themeda triandra.*

Based on this vegetation observed, it was also recommended that surveys for Golden Sun Moth *Synemon plana* are undertaken in these areas. Furthermore, patches of Plains Grassland have the potential to support the EPBC listed vegetation community, *Natural Temperate Grassland of the Victorian Volcanic Plain.* As such, a detailed ecological assessment was also undertaken to confirm the condition and extent of native vegetation within the whole study area, but particularly along Bruce Creek and roadsides.

2.2 Nomenclature

Common and scientific names of vascular plants follow the Victorian Biodiversity Atlas (VBA) (DELWP 2022a) and the Census of Vascular Plants of Victoria (Walsh and Stajsic 2007). Vegetation community names follow DELWP's EVC benchmarks (DELWP 2021c). The names of aquatic and terrestrial vertebrate and invertebrate fauna follow the VBA (DELWP 2022a).

2.3 Desktop Assessment

Relevant literature, online-resources and numerous databases were reviewed to provide an assessment of flora and fauna values associated with the study area. The following information sources were reviewed:

- The DELWP Naturekit Map (DELWP 2021a) and Native Vegetation Information Management (NVIM) Tool (DELWP 2021b) for:
    - Modelled data for location risk, remnant vegetation patches, scattered trees and habitat for rare or threatened species; and,
    - The extent of historic and current EVCs.
- EVC benchmarks (DELWP 2021c) for descriptions of EVCs within the relevant bioregion;
- The Victorian Biodiversity Atlas (VBA) for previously documented flora and fauna records within the project locality (DELWP 2022a);
- The Illustrated Flora Information System of Victoria (IFLISV) (Gullan 2017) and Atlas of Victorian Wildlife (AVW) (Viridans 2014) for assistance with the distribution and identification of flora and fauna species;
- The Commonwealth Department of Climate Change, Energy, Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DCCEEW 2022);
- Relevant listings under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act), including the latest Threatened and Protected Lists (DELWP 2022b; DELWP 2019);
- Aerial photography of the study area; and,
- Previous ecological assessments within the study area, including:
    - Biodiversity Assessment: Bannockburn Growth Area (Victoria). Ecology and Heritage Partners Pty Ltd 2020a.
    - Desktop Assessment – Bannockburn Growth Plan, Bannockburn, Victoria. Ecology and Heritage Partners Pty Ltd 2020b.
    - Vegetation and Biodiversity Assessment Report – Levy Road, Bannockburn. Mark Trengrove Ecological Services 2017.
    - Flora and Fauna Assessment – Bannockburn South West Precinct. Golden Plains Shire 2019.
- Relevant environmental legislation and policies pertaining to target species including EPBC Act Policy Statements, FFG Act Action Statements, National Recovery Plans, Advisory Lists, including;

- DEWHA 2009a. Significant impact guidelines for the critically endangered spiny rice-flower (*Pimelea spinescens* subsp. *Spinescens*).
- DEWHA 2009b. Significant impact guidelines for the critically endangered Golden Sun Moth (*Synemon plana*).
- DEWHA 2009c. Background Paper to EPBC Act Policy Statement 3.12 – Nationally Threatened Species and Ecological Communities Significant Impact Guidelines for the Critically Endangered Golden Sun Moth (*Synemon plana*).
- DEWHA 2009d. Significant impact guidelines for the vulnerable growling grass frog (*Litoria raniformis*).
- DEWHA 2010. Survey Guidelines for Australia's threatened frogs. Guidelines for detecting frogs listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*.
- DoE 2013. Significant Impact Guidelines 1.1. Matters of National Environmental Significance. Commonwealth Department of the Environment, Canberra, ACT.
- DSEWPaC 2011a. *Environment Protection and Biodiversity Conservation Act 1999*. Referral guidelines for the vulnerable striped legless lizard, *Delma impar*.
- DSEWPaC 2011b. Survey Guidelines for Australia's threatened reptiles. Guidelines for detecting reptiles listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999.*
- DSEWPaC 2011c. Nationally Threatened Ecological Communities of the Victorian Volcanic Plain: Natural Temperate Grassland and Grassy Eucalypt Woodland A guide to the identification, assessment and management of nationally threatened ecological communities *Environment Protection and Biodiversity Conservation Act 1999*.

2.4 Field Assessments

Ecological field assessments program was completed by qualified ecologists within the South East Section of the Bannockburn Growth Area between 25 August 2020 and 21 December 2020. The field assessments sought primarily to assess the extent and condition of native vegetation communities and potential flora and fauna habitat, with particular consideration given to significant ecological communities and species of conservation concern, such as threatened and migratory species.

All fieldwork was carried out under the appropriate licences, including a Research Permit (1008283) and Scientific Procedures Fieldwork Licence (SPFL20005) issued by DELWP under the *Wildlife Act 1975*, and an Animal Research permit issued by the Wildlife and Small Institutions Animal Ethics Committee (05.17).

The timing and extent of each survey event is summarised below (Table 1).

Table 1. Timeline and extent of each survey event.

Ecological Value	Species / Community	Survey Dates	Resources	Location *
Threatened Ecological Communities	NTGVVP Ecological Community	13 November 2020 16-18 December 2020	2 x ecologists	Throughout; See Figure 2
Threatened EPBC Act Fauna Species	Striped Legless Lizard *Delma impar* (Tile Checks)	Eight tile checks between 2 October and 26 November 2020.	2-4 ecologists	Figure 4a and 4b.
	Growling Grass Frog *Litoria raniformis*	Habitat Assessment Completed 17 November 2020 3x Night Surveys 25 November 2020 26 November 2020 3 December 2020	2 x ecologists	Figure 6
	Golden Sun Moth *Synemon plana*	Surveys completed between on 3, 14, 15 and 21 December 2020.	2-4 ecologists	Figure 5a and Figure 5b
Threatened EPBC Act Flora Species	Large-headed Fireweed *Senecio macrocarpus*	30 October and 13 November 2020.	4 x ecologists	Figure 3
	Matted Flax-lily *Dianella amoena*	3, 16, 17 and 18 December 2020	3 x ecologists	Figure 3
	Button Wrinklewort *Rutidosis leptorhynchoides*	3, 16, 17 and 18 December 2020	3 x ecologists	Figure 3
	Adamson's Blown Grass *Lachnagrostis adamsonii*	3, 16, 17 and 18 December 2020	3 x ecologists	Figure 3
	Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens*	25 August 2020	4 ecologists	Figure 3
Listed/Protected FFG Act Flora Species	Cut-leaf Burr Daisy *Calotis anthemoides*	3, 16, 17 and 18 December 2020	3 x ecologists	Figure 3
	Small Scurf-pea *Cullen parvum*	3, 16, 17 and 18 December 2020	3 x ecologists	Figure 3
	Hairy Tails *Ptilotus erubescens*	3, 16, 17 and 18 December 2020	3 x ecologists	Figure 3
Habitat Hectare Assessment	Patches of Native Vegetation, Large Trees and Scattered Trees	13 November 2020 16-18 December 2020	VQA Methodology	Throughout; See Figure 2

2.4.1 Ecological Assessment (including habitat hectare assessment)

Detailed ecological assessments were undertaken on 13 November 2020 and 16, 17 and 18 December 2020 by botanists accredited by DELWP in the habitat hectare methodology (DSE 2004) to quantify the quality and extent of native vegetation values within the study area, identify flora and fauna habitat values within the study area, and to determine conditions with reference to findings of the desk-based assessment.

The study areas were walked and/or driven, with all observed vascular flora and fauna species recorded, any significant records mapped and the overall condition of vegetation and habitats noted. Native vegetation in the local area was also investigated to assist in determining the pre-European vegetation within the study area. Ecological Vegetation Classes were determined with reference to DELWP pre-1750 and extant EVC mapping (DELWP 2021a) and their published descriptions (DELWP 2021d).

The surveys sought primarily to assess the extent and condition of native vegetation communities and potential flora and fauna habitat, with consideration given to significant ecological communities and species of conservation concern, such as threatened and migratory species.

As outlined above, where native vegetation was identified a habitat hectare assessment was undertaken following the methods described in the Vegetation Quality Assessment Manual (DSE 2004), with the results provided in Appendix 2.2.

Native vegetation was classified in accordance with the definitions provided in Table 4, as defined in the '*Guidelines for the removal, destruction or lopping of native vegetation*' (the Guidelines) (DELWP 2017b).

In summary, the following tasks were undertaken as part of the field assessments within the study area:

- The identification of flora and fauna habitat values;
- An assessment of all watercourses, wetlands and springs;
- An assessment of all potential native fauna habitat, including habitat corridors, food and water sources, nesting and foraging sites;
- The identification of all native vegetation, including:
    - EVCs; and
    - Scattered trees, with Diameter and Breast Height (DBH) quantified, and trees identified as Large Trees or Small Trees;
- Identify the potential presence of any Matters of National Environmental Significance (NES) listed under the EPBC Act;
- A habitat hectares assessment of the native vegetation within the study area, in accordance with the Vegetation Quality Assessment Manual (DSE 2004); and
- The documentation of site and vegetation information, including:
    - the address of the property;
    - photographs of the native vegetation within the study area.

2.4.1.1 *Removal, Destruction or Lopping of Native Vegetation (the Guidelines)*

Under the *Planning and Environment Act 1987*, Clause 52.17 of the Planning Schemes requires a planning permit from the relevant local Council to remove, destroy or lop native vegetation. The assessment process for the clearing of vegetation follow the '*Guidelines for the removal, destruction or lopping of native vegetation*' (the Guidelines) (DELWP 2017b).

Vegetation Assessment

Native vegetation as defined in the Guidelines (DELWP 2017b) (Table 2) is assessed using two key parameters: extent (in hectares) and condition. For the purposes of this assessment, both condition and extent were determined as part of the field assessments.

In addition, the type and general condition of all vegetation was assessed and a determination made as to whether it qualifies for further consideration under local, State or national legislation and policy.

Table 2. Determination of native vegetation (DELWP 2017b)

Category	Definition	Extent	Condition
Patch of native vegetation	An area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native; OR An area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy; OR Any mapped wetland included in the *Current Wetlands map*, available in DELWP systems and tools.	Measured in hectares. Based on hectare area of the patch.	Vegetation Quality Assessment Manual (DSE 2004). Modelled condition for *Current Wetlands*.
Scattered tree	A native canopy tree that does not form part of a remnant patch.	Measured in hectares. Each Large scattered tree is assigned an extent of 0.071 hectares (30m diameter). Each Small scattered tree is assigned a default extent of 0.31 hectares (10 metre diameter)	Scattered trees are assigned a default condition score of 0.2 (outside a patch).

Notes: Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'.

Assessment Pathway

The Guidelines manage the impacts on biodiversity from native vegetation removal using an assessment-based approach. Two factors – extent and location – are used to determine the assessment pathway associated with an application for a permit to remove native vegetation. The location category (1, 2 or 3) has been determined for all areas in Victoria and is available on DELWP's Native Vegetation Information Management (NVIM) Tool (DELWP 2021b). Determination of the assessment pathway is summarised in Table 3.

Table 3. Assessment pathways for applications to remove native vegetation (DELWP 2017b)

Extent		Location		
		1	2	3
Native Vegetation	< 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

Notes: For the purpose of determining the assessment pathway of an application to remove native vegetation the extent includes any other native vegetation that was permitted to be removed on the same contiguous parcel of land with the same ownership as the native vegetation to be removed, where the removal occurred in the five year period before an application to remove native vegetation is lodged.

Current Wetlands (DELWP)

Wetlands can be difficult to map and assess accurately as they respond quite quickly to changes in environmental condition, especially rainfall. After a period of no or low rainfall they can disappear or appear very degraded. However, wetlands are known to rapidly recover when inundated after rainfalls. As a result, all DELWP mapped wetlands (based on 'Current Wetlands' layer in the DELWP NVIM Map [DELWP 2021a]) that are to be impacted must be included as native vegetation, with the modelled condition score assigned to them (DELWP 2017b). Mapped wetlands within the study area are shown in Figure 2.

Note that Current Wetlands do not apply if they are covered by a hardened, man-made surface, for example, a roadway. If covered by any vegetation including crops, bare soil, a mapped wetland should be treated as a remnant patch. The mapped extent of Current Wetlands may be refined if supported by the outcome of a hydrological assessment and approved by DELWP.

Large Tree and Habitat Assessment

Large tree and habitat assessments were undertaken concurrently with the habitat hectare assessments to quantify the number of scattered trees and Large Trees within native vegetation, as well as to collate data pertaining to the presence of hollows and/or nests and significant 'habitat trees' that may provide habitat for fauna. Where present, hollows, nests or other relevant features were noted during the assessments.

Large Tree benchmarks relating to the potential EVCs present within the study area are summarised below (Table 4).

Table 4. Benchmark sizes for large trees within the study area.

EVC	Species	Large Tree (DBH)	Small Tree (DBH)
Creekline Grassy Woodland (EVC 68)	*Eucalyptus* spp.	≥ 80 cm	< 80 cm
Plains Grassy Woodland (EVC 55_61)	*Eucalyptus* spp.	≥ 80 cm	< 80cm

Note. DBH = Diameter at Breast Height (i.e. - 1.3 metres above ground level).

2.4.2 Flora Targeted Surveys

2.4.2.1 *Significant Flora Species*

Table 5. Targeted Significant Flora Species

Common Name	Scientific Name	Conservation Significance	Habitat	Image (Sourced from Flora Victoria [VicFlora 2021])
National Significance				
Spiny Rice-flower	*Pimelea spinescens* var. *spinescens*	EPBC Act Conservation Status: Critically Endangered FFG Act Conservation Status: Critically Endangered	This species is endemic to Victoria and occurs in grasslands and open shrublands. It is known to occur in several locations west of Melbourne, with some very significant occurrences on roadsides in Golden Plains Shire. It has been depleted historically by land clearance for settlement, industry and agriculture but is also threatened by grazing and inappropriate fire regimes. With multiple records of the species present immediately adjacent to the north-eastern boundary of the study area, the species has the potential to occur in areas of relatively undisturbed Plains Grassland and Plains Grassy Woodland within the study area. The species is slow-growing and reaches up to 30 cm in height. Plants are mostly dioecious (male and female flowers on separate plants) but some plants are monoecious (male and female flower on same plant). It bears small yellow flowers between April and August (DEWHA 2009a).	

Common Name	Scientific Name	Conservation Significance	Habitat	Image (Sourced from Flora Victoria [VicFlora 2021])
Button Wrinklewort	*Rutidosis leptorhynchoides*	**EPBC Act Conservation Status:** Endangered **FFG Act Conservation Status:** Endangered	In Victoria the species occurred across the Victorian Volcanic Plain but is now restricted to tiny refugia in the south-west, occurring on the outskirts of Melbourne, Bannockburn, Rokewood, Wickliffe and between Beaufort and Ararat. The species is not known to occur naturally in any conservation reserve in Victoria. Button Wrinklewort is restricted to open stands of plains grassland and grassy woodlands, on fertile clays to clay loams, usually in areas where the grass cover is more open, either as a result of recurrent fires or grazing by native macropods or stock (Golden Plains Shire 2019). The species is threatened by urban development, physical disturbance of sites, weeds, competition from native grasses, heavy grazing and unsuitable fire regimes.	
Large-headed Fireweed	*Senecio macrocarpus*	**EPBC Act Conservation Status:** Vulnerable **FFG Act Conservation Status:** Critically Endangered	The occurrence of Large-fruit Fireweed in Victoria is severely fragmented. Large-fruit Fireweed occurs most commonly in grasslands on red-brown earth soils. It may also occur in grassy woodlands and open woodlands. Most of the locations occur in small, disjunct remnants of vegetation prone to destruction and disturbance. Suitable habitat for this species exists in areas not subject to historical agricultural disturbance (i.e. cropping and/or other major ground disturbances).	

Common Name	Scientific Name	Conservation Significance	Habitat	Image (Sourced from Flora Victoria [VicFlora 2021])
Matted Flax-lily	*Dianella amoena*	**EPBC Act Conservation Status:** Endangered **FFG Act Conservation Status:** Critically Endangered	The Matted Flax-lily is currently known to occur only in Victoria, where it is widely but patchily distributed from eastern to south-western Victoria, in the Victorian Volcanic Plains, South East Coastal Plain, South Eastern Highlands and Victorian Midlands bioregion. It generally occurs in grassland and grassy woodland habitats, on well drained to seasonally wet fertile sandy loams to heavy cracking clay soils. It is known from a single occurrence in the Bannockburn Cemetery.	
Adamson's Blown Grass	*Lachnagrostis adamsonii*	**EPBC Act Conservation Status:** Endangered **FFG Act Conservation Status:** Endangered	Adamson's Blown-grass is confined to slow moving creeks, swamps, flats, depressions or drainage lines (such as along roadsides) that are seasonally inundated or waterlogged and usually moderately to highly saline. Whilst Adamson's Blown-grass has a wide distribution across the volcanic plains of Victoria, it only has approximately 70 sites, many of which are small and impacted by continuing threats. Although there are no previous records of Adamson's Blown-grass within the study area, there is potential that the Bruce Creek riparian corridor may support low quality habitat for this species.	
State Significance				
Cut-leaf Burr Daisy	*Calotis anthemoides*	**EPBC Act Conservation Status:** N/A **FFG Act Conservation Status:** Critically Endangered	The Cut-leaf Burr Daisy is located in scattered populations north and west of Melbourne. It grows on heavier soils prone to waterlogging and is now rare due to habitat depletion.	

Common Name	Scientific Name	Conservation Significance	Habitat	Image (Sourced from Flora Victoria [VicFlora 2021])
Small Scurf-pea	*Cullen parvum*	**EPBC Act Conservation Status:** N/A **FFG Act Conservation Status:** Endangered	Small Scurf-pea is considered very rare in Victoria where it is known from a few localities in the north-central and south-central areas and western suburbs of Melbourne. It grows in grassland or grassy woodland, often on basalt derived soils.	
Hairy Tails	*Ptilotus erubescens*	**EPBC Act Conservation Status:** N/A **FFG Act Conservation Status:** Critically Endangered	Hairy Tails typically occur on relatively fertile soils supporting grassland and woodland communities in northern and western Victoria.	

2.4.2.2 *Nationally Significant Flora*

Spiny Rice-flower

Spiny Rice-flower is a perennial sub-shrub listed as Critically Endangered under both the Commonwealth EPBC Act and the Victorian FFG Act (DELWP 2022a). The species is endemic to Victoria, and is found between the south-west and north-central parts of the State. It occurs in grassy EVCs such as Plains Grassland (EVC 132), Plains Grassy Woodland (EVC 55), Plains Woodland (EVC 803) and Plains Grassland/Grassy Woodland Mosaic (EVC 897) (DEWHA 2009a). Spiny Rice-flower is typically found in small populations (<500 individuals) (DEWHA 2009a).

The species is slow-growing and reaches up to 30 centimetres in height. Plants are mostly dioecious (male and female flowers on separate plants) but some plants are monoecious (male and female flower on same plant) (DEWHA 2009a).

The species is known to occur in several locations west of Melbourne, with some very significant occurrences on roadsides in Golden Plains Shire. Furthermore, with multiple records of the species present immediately adjacent to the north-eastern boundary of the study area, the species has the potential to occur in areas of relatively undisturbed Plains Grassland and Plains Grassy Woodland within the study area.

Due to the presence of these historical records and combined with the presence of potential habitat as identified during the field assessments, targeted surveys were undertaken along the length of Bruce Creek. The survey focused on likely habitat within areas of Creekline Grassy Woodland (EVC 68) and areas of potential Plains Grassland (EVC 132) identified during the Biodiversity Assessment (Ecology and Heritage Partners Pty Ltd 2020a) (Figure 2).

All other areas within the South East Growth Area were identified as either farmland and/or cropped pasture during the previous Biodiversity Assessment (Ecology and Heritage Partners Pty Ltd 2020a). These areas typically contained semi-improved non-native pasture and were land primarily used for cropping of cereal crops with little or no native vegetation present. As such, habitat suitable for the Spiny Rice-flower were deemed absent from these areas.

The flowering season for Spiny Rice-flower generally occurs between April and August, therefore this is the recommended optimal time to conduct targeted survey (DEWHA 2009a).

Targeted flora surveys for Spiny Rice-flower were undertaken on 25 August 2020. Potential habitat along Bruce Creek was systematically traversed at approximately five-meter linear intervals in accordance with the survey guidelines for Spiny Rice-flower outlined in the Biodiversity Precinct Structure Planning Kit (DSE 2010) and the Significant Impact Guidelines for the species (DEWHA 2009a), with any significant records mapped and the overall condition of vegetation noted (Figure 3).

A reference site known to support a population of the species located within Bacchus Marsh was used to confirm that the species was flowering, as well as to examine the diagnostic features of the species. Spiny Rice-flower observed at the reference site were flowering at this time, and as such these specimens were easily detectable. The reference site is located in relatively close proximity to the study area and given that the specimens at the reference site were flowering, this provides evidence that the current surveys were conducted at a suitable time to maximise the likelihood of detection for the species within the Bannockburn South East Growth Area.

Table 6 provides the flowering times of the Spiny Rice-flower and lists the reference site visited on the day of survey.

Button Wrinklewort

Button Wrinklewort is a tufted, simple or few-branched erect herb listed as Endangered under both the Commonwealth EPBC Act and the Victorian FFG Act (DELWP 2022a). The species occurs in the Southern Tablelands of NSW and ACT, the Gippsland Plains in eastern Victoria, and the Volcanic Plains of western Victoria (DAWE 2020a). The species is a perennial wildflower that grows in grassland and woodland communities within the Victorian Volcanic Plain Bioregion (DAWE 2020a). It is primarily associated with Kangaroo Grass with an open distribution between tussocks (Morgan 1995).

In Victoria the species occurred across the Victorian Volcanic Plain but is now restricted to tiny refugia in the south-west, occurring on the outskirts of Melbourne, Bannockburn, Rokewood, Wickliffe and between Beaufort and Ararat.

The dominant grassland species was Kangaroo-grass often defined by the minimum 25% native perennial cover, which is considered likely habitat for the species. In combination with a series of historical records, targeted surveys were undertaken along the length of Bruce Creek within areas of Creekline Grassy Woodland (EVC 68) and Plains Grassland (EVC 132) (Figure 2; Figure 3). Surveys were undertaken on 3, 16, 17 and 18 December 2020 and were completed by qualified botanists and field ecologists familiar with the target species.

A reference site known to support a population of Button Wrinklewort was used to examine the diagnostic features of the species prior to undertaking surveys within the study area (See Table 6). Specimens observed at the reference sites were flowering at this time, and as such these specimens were easily detectable. Given that the specimens at the reference site were flowering, this provides evidence that the current surveys were conducted at a suitable time to maximise the likelihood of detection for the species.

Areas of potential habitat within the study area were traversed on foot, with surveys conducted along transect lines roughly five metres apart, as per the recommended survey guidelines detailed in the Biodiversity Precinct Planning Structure Kit (DSE 2010).

Large-headed Fireweed

Large-headed Fireweed is an erect or sprawling subshrub listed as Vulnerable under the Commonwealth EPBC Act and Critically Endangered under the Victorian FFG Act (DELWP 2022a). The species is largely confined to Kangaroo Grass *Themeda triandra* grasslands on loamy clay soils derived from basalt (DAWE 2020b).

The species is a daisy that grows either as an erect long-lived herb or a small shrub. Each plant has 6–8 large yellowish flower-heads that are about 20 mm long and contain 50–100 individual flowers typically flowering between September – November (DAWE 2020b). The species has the potential to occur within areas of relatively undisturbed Plains Grassland with Kangaroo Grass present (DAWE 2020b).

Large areas of relatively undisturbed Plains Grassland supporting Kangaroo Grass was observed along Bruce Creek, which is considered likely habitat for the species. This area was systematically traversed at approximately five-metre linear intervals in accordance with the survey guidelines for significant flora species outlined in the Biodiversity Precinct Structure Planning Kit (DSE 2010), with any significant records mapped and the overall condition of vegetation noted (Figure 2; Figure 3).

Surveys for Large Headed Fireweed was conducted on 30 October and 13 November 2020. A reference site known to support a population of Large-headed Fireweed was used to examine the diagnostic features of the species prior to undertaking surveys within the study area (See Table 6).

Matted Flax-lily

Matted Flax-lily is a perennial, tufted, mat-forming lily which can form patches of up to five metres wide. The plant can grow vegetatively, through sending underground rhizomatous roots, which rise above the ground with a tiller of several leaves, spread over a distance from the parent plant (DAWE 2020c).

The leaves of the Matted Flax-lily are generally glaucous, blue in colour but may be red at the base and usually but not always having small hooks (teeth) along the margins and midrib. The leaves taper to approximately 45 centimetres long depending on site and climatic conditions, and are born on tillers with the leaves arranged alternatively, with several leaves per tiller. Matted Flax-lily generally flowers between November and January but may continue flowering with summer and autumn rains. It has pale blue to violet flowers with bright yellow stamens and berries, which are generally purple in colour. The flowers and berries are born on culms extending to typically 30 centimetres in height but this may alter depending on plant location and season (Carter 2010).

The Matted Flax-lily generally occurs in grassland and grassy woodland habitats, on well drained to seasonally wet fertile sandy loams to heavy cracking clay soils derived from Silurian or Tertiary sediments, or from volcanic geology (Carter 2010). The Matted Flax-lily is currently known to occur only in Victoria, where it is widely but patchily distributed from eastern to south-western Victoria, in the Victorian Volcanic Plains, South East Coastal Plain, South Eastern Highlands and Victorian Midlands bioregion. Within Bannockburn, it is known from a single occurrence in the Bannockburn Cemetery.

The species has the potential to persist within areas of Plains Grassland and open woodland habitats recorded within the study area. As such, targeted surveys were undertaken along the length of Bruce Creek within areas of Creekline Grassy Woodland (EVC 68) and Plains Grassland (EVC 132) (Figure 2). Surveys were undertaken on 3, 16, 17 and 18 December 2020 and were completed by qualified botanists and field ecologists familiar with the target species (Figure 3).

Areas of potential habitat were systematically traversed at approximately five meter linear intervals in accordance with the survey guidelines for Matted Flax-lily outlined in the Biodiversity Precinct Structure Planning Kit (DSE 2010). These survey guidelines are considered 'best practice' guidelines for conducting Matted Flax-lily Surveys.

Adamson's Blown-grass

Adamson's Blown Grass is a tufted or rarely shortly stoloniferous annual or short-lived perennial listed as Endangered under both the Commonwealth EPBC Act and the Victorian FFG Act (DELWP 2022a). The species occurs in and around saline depressions on the Volcanic Plain where it was recorded from Portalington to the east almost to the South Australian border (DAWE 2020d).

The species' inflorescences are delicate, open, up to 25 centimetres in length and remain partly enclosed by the upper leaf sheath until late maturity, often drying to a pale golden colour. Panicles detach from the plant when mature and are blown away by wind (DAWE 2020d).

Although there are no previous records of Adamson's Blown-grass within the study area, there is potential that the Bruce Creek riparian corridor may support low quality habitat for this species.

No accessible reference sites within the locality were able to be visited prior to the targeted surveys. However, surveys were conducted by qualified ecologists who were familiar with the target species. Surveys were conducted by qualified ecologists who were familiar with the target species and were undertaken on 3, 16, 17 and 18 December 2020. Areas of potential habitat (i.e. Bruce Creek corridor) within the study area were traversed on foot, with surveys conducted along transect lines roughly five metres apart, as per the

recommended survey guidelines detailed in the Biodiversity Precinct Planning Structure Kit (DSE 2010) (Figure 3).

Table 6. Reference sites visited on the day of surveys

Flora Species	Flowering Period	Survey Date	Reference Site
Spiny Rice-flower	April to August	25 August 2020	Bacchus Marsh
Large Headed Fireweed	August to November	30 October 2020	Bannockburn Cemetery
Button Wrinklewort	October to January	3 December 2020	Railway corridor north of study area
Matted Flax-lily	November to January	3 December 2020	Bannockburn Cemetery
Adamson's Blown-grass	November to February	3 December 2020	N/A

2.4.2.3 State Significant Flora

Several State significant species known to occur, or those considered to have a moderate to high likelihood of occurrence (Appendix 2.4), were surveyed for in areas of potential habitat concurrently with the habitat hectare assessments. These species included Cut-leaf Burr Daisy, Small Scurf-pea and Hairy Tails.

Targeted flora surveys for these species were undertaken on 3, 16, 17 and 18 December 2020 (see Table 7). The flowering seasons for Cut-leaf Burr Daisy, Small Scurf-pea and Hairy Tails generally overlaps between November to December, therefore this is the recommended time to conduct the surveys simultaneously.

It is important to note that surveys for State Significant flora are not currently required under existing legislation and policy, however, the presence of Cut-leaf Burr Daisy, Small Scurf-pea and Hairy Tails were surveyed for concurrently with the surveys for nationally significant flora.

Table 7. Survey dates for State Significant flora species

Flora Species	Flowering Period	Survey Date
Cut-leaf Burr Daisy	September to December	3, 16, 17 and 18 December 2020
Small Scurf-pea	October to January	3, 16, 17 and 18 December 2020
Hairy Tails	November to February	3, 16, 17 and 18 December 2020

2.4.3 Targeted Fauna Surveys

2.4.3.1 *Significant Fauna Species*

Table 8. Targeted Significant Flora Species

Common Name	Scientific Name	Conservation Significance	Habitat	Image (Sourced from Ecology and Heritage Partners Pty)
National Significance				
Striped Legless Lizard	*Delma impar*	EPBC Act Conservation Status: Vulnerable FFG Act Conservation Status: Endangered	Striped Legless Lizard is listed as Endangered in Victoria and Vulnerable nationally under the Commonwealth EPBC Act (DSE 2013). The species is also listed as a threatened taxon under the Victorian FFG Act. An FFG Act Action Statement (Webster *et al.* 2003) and a National Recovery Plan 1999-2003 (Smith and Robertson 1999) have been developed for the species. A National Recovery Team also exists for this species. Overall the species is of national conservation significance and is also protected under the Victorian *Wildlife Act 1975*. Striped Legless Lizard is restricted to the lowland tussock grassland habitats (Coulson 1990) in temperate south-eastern Australia where the species has a limited and patchy distribution. Since European settlement the distribution of Striped Legless Lizard is believed to have declined and the species is known to have disappeared from many sites. It has been estimated that 95% of Victoria's native lowland grasslands have been grossly altered since European settlement. The major type of grassland known to support Striped Legless Lizard is the Western (Basalt) Plains Grassland community, and the majority of sites in Victoria occur on cracking clay soils with at least some surface rock which provides shelter (Cogger. 1996; Coulson 1995). A small percentage of the original habitat for Striped Legless Lizard now exists, and this species is known to occur as small, isolated populations, given that the remaining habitat for the species is very limited and severely fragmented (Webster *et al.* 2003). Suitable habitat for Striped Legless Lizard is present in areas of native and introduced grassland throughout the study area, where there are cracking soils (for habitat) and exposed rock.	

Common Name	Scientific Name	Conservation Significance	Habitat	Image (Sourced from Ecology and Heritage Partners Pty)
			Targeted surveys would need to be undertaken in accordance with the Survey Guidelines for Australia's Threatened Reptiles (SEWPaC 2011b), with artificial habitat grids established in winter and surveyed over the species main activity period (September – November) to determine whether the study area supports an extant population.	
Golden Sun Moth	*Synemon plana*	**EPBC Act Conservation Status:** Vulnerable **FFG Act Conservation Status:** Vulnerable	Golden Sun Moth typically occurs in native grassland, grassy woodland, dominated by greater than 40% cover of wallaby-grass, in particular *Rytidosperma* spp. (DSE 2004), but may also inhabit areas dominated by Kangaroo Grass *Themeda triandra* (Endersby and Koehler 2006) and introduced grassland dominated by Chilean Needle-grass *Nassella neesiana* and other introduced species (A. Organ pers. obs.). Male flight is typically low, to about a metre above the ground, fast and can be prolonged, but they are generally not recorded flying more than 100 metres from suitable habitat (Clarke and O'Dwyer 1999). Prior to European settlement, the Golden Sun Moth was widespread and relatively continuous throughout its range, inhabiting grassy open woodlands and grassland, although it now mainly inhabits small isolated sites (DSE 2004). The species is threatened by habitat loss, disturbance and fragmentation due to agricultural expansion and urbanisation. Many populations are isolated and fragmented, impeding the ability of the relatively immobile females to recolonise areas, thereby reducing the likelihood of genetic exchange (DSE 2004). Such populations are therefore vulnerable as there is little likelihood of recolonisation in the event of a local extinction.	

Common Name	Scientific Name	Conservation Significance	Habitat	Image (Sourced from Ecology and Heritage Partners Pty)
Growling Grass Frog	*Litoria raniformis*	**EPBC Act Conservation Status:** Vulnerable **FFG Act Conservation Status:** Vulnerable	Although formerly widely distributed across southern eastern Australia, including Tasmania (Littlejohn 1963, 1982; Hero *et al*. 1991), the Growling Grass Frog has declined markedly over the past two decades and in many areas, particularly in south and central Victoria where some populations have experienced local extinction. Growling Grass Frog are largely associated with permanent or semi-permanent still or slow flowing waterbodies (i.e. streams, lagoons, farm dams and old quarry sites) (Hero *et al.* 1991; Barker *et al*. 1995; Ashworth 1998). The species can also utilise temporarily inundated waterbodies during breeding season, to facilitate reproduction (Organ 2005). The presence of key habitat attributes, primarily an extensive cover of emergent, submerged and floating vegetation (Robertson *et al*. 2002, Organ 2005), and the spatial orientation of waterbodies (Robertson *et al*. 2002; Heard *et al*. 2004; Hamer and Organ 2008) are strong determinants of the species' presence. Terrestrial vegetation (grasses, sedges), rocks and other ground debris around wetland perimeters also provide important foraging, dispersal and over-wintering sites. Dispersal is thought to occur primarily along drainage lines or other low-lying areas between waterbodies, and unhindered movement between and within waterbodies is considered important for population viability.	

2.4.3.2 Fauna Surveys

Based on the recommendations made by Ecology and Heritage Partners in the initial biodiversity assessment (Ecology and Heritage Partners 2020a), targeted surveys for significant fauna species were undertaken for the nationally significant Striped Legless Lizard, Growling Grass Frog and Golden Sun Moth between October and December 2020 (Table 9). Surveys were undertaken at a time to maximise the likelihood of detection of significant fauna species identified as having the potential to occur within the study area.

Survey methods along with survey timing and effort is summarised below (Sections 2.4.3.3 – 2.4.3.5).

Table 9. Targeted fauna species considered to have the highest likelihood of occurrence.

Common name	Species Name	Significance	Optimal Survey Timing *
Striped Legless Lizard	*Delma impar*	VU	September - May
Growling Grass Frog	*Litoria raniformis*	VU	August - April
Golden Sun Moth	*Synemon plana*	VU	October - January

Note: VU – Vulnerable under the EPBC Act

2.4.3.3 Striped Legless Lizard

Biology

Striped Legless Lizard typically occupy areas of native and introduced grassland, particularly where a high percentage of the native Kangaroo Grass is found. They are typically restricted to lowland tussock grassland habitat (Coulson 1990) in temperate south-eastern Australia, where the species has a limited and patchy distribution. A small percentage of the original habitat for Striped Legless Lizard now exists. As a result, this species is likely to occur in small, isolated populations due to the limited and severely fragmented nature of remaining habitat (Webster *et al.* 2003).

Before European settlement, the Striped Legless Lizard was presumed to be common across many grassland areas in north-eastern, central and south-western Victoria, south-eastern NSW, the ACT, and possibly, south-eastern South Australia (Smith and Robertson 1999). The species has suffered a substantial contraction in both geographic range and abundance over the past 100 years. The range contraction and resultant reduction in population size is likely to continue, due to the ongoing removal, fragmentation and deterioration of suitable grassland habitat (Smith and Robertson 1999). Current populations in Victoria persist primarily in the basalt plains to the west of Melbourne, and areas around Ballarat and Bendigo (Hadden 1995; DSE 2003).

Since European settlement, the distribution of Striped Legless Lizard has declined, and the species is known to have disappeared from many areas. Within Victoria, an estimated 95% of native lowland grasslands have been substantially altered since European settlement, including Western (Basalt) Plains Grassland community, the primary grassland habitat known to support Striped Legless Lizard. Western Plains Grasslands typically occur on cracking clay soils with at least some surface rock, which provides ideal shelter for Striped Legless Lizard (Coulson 1995).

Striped Legless Lizard inhabits lowland native grasslands, typically dominated by native tussock-forming grass species. In Victorian populations, the species frequents habitats with exposed basalt rocks in grassland and areas of cracking clay soils, where the species can seek refuge under rocks and in earth cracks (Dorrough *et al*. 1995). Although Striped Legless Lizards have been reported from areas of relatively undisturbed native grasslands, with a dense cover of perennial tussock grasses (Kukolic 1991; Kukolic and Osborne 1993), they are also known to inhabit areas of non-native grassland (Smith and Robertson 1999). This has been shown at

several sites throughout the Basalt Plains in western Victoria, which are currently grazed at various stock densities (Rohr and Peterson 2003).

Survey Methodology

Habitat within the study area was considered suitable for Striped Legless Lizard, due to the presence of suitable tussock grass species which the species relies on for habitat and the extent of embedded rock.

Three rectangular grids of roof tiles, 5 x 10 tiles (25 metres x 50 metres), were established within the property at 430 Burnside Road on 25 August 2019 in areas identified as potential Striped Legless Lizard habitat identified during the Biodiversity Assessment (Ecology and Heritage Partners 2020a).

A further nine grids were established along the Bruce Creek corridor on 27 August 2020 in areas of native grassland identified during the targeted surveys for Spiny Rice-Flower.

This method is an approved and widely used technique for surveying for Striped Legless Lizard in grassland habitats (SEWPaC 2011a; DSE 2010). The grid of roof tiles acts as artificial refuge under which small ground-dwelling fauna seek shelter during cooler times of the day and cooler months of the year. The intention of establishing a grid of roof tiles is that individuals will be drawn to use the artificial habitat for shelter and thermoregulation and be easily located when the tile is lifted. This adopted methodology is widely accepted as the primary survey technique for this species, particularly in areas supporting surface rock cover (DSE 2003; SEWPaC 2011a, 2011b). In accordance with the *EPBC Act Referral Guidelines for the Vulnerable Striped Legless Lizard, Delma impar* (SEWPaC 2011a) and the Biodiversity Precinct Structure Planning Kit, Guidelines for surveying Striped Legless Lizard *Delma impar*, tile grids were established as follows:

- Tiles were placed within identified patches of appropriate habitat within the study area;
- Each tile grid consisted of 5 x 10 terracotta roof tiles (measuring approximately 25 metres x 50 metres);
- Eight tile check surveys were undertaken by a field ecologist familiar with the identifying features of Striped Legless Lizard; and,
- Surveys were undertaken during weather conditions suitable for detecting the species (i.e. between 7am and 11am on warm, sunny days with minimal cloud cover and no rain.

The following was undertaken as part of the targeted surveys:

- Tile grids were installed within areas of contiguous habitat as per the densities prescribed in the survey guidelines;
- Tile grids were laid in grids consisting of 50 tiles, at 5 metre spacing between tiles, arranged in grids of 10 tiles by 5 tiles, positioned in vegetated areas with a northerly aspect;
- Two corners of each grid were marked with a wooden or steel stake and clearly marked.
- Tile checks involved systematically lifting each tile in the grid and observing and recording the species utilising the artificial habitat;
- Optimal time for checking is when weather is fine but preferably with >50% cloud cover. Air temperature should be in low – mid 20s and ground temperature high 20s to low 30s (C°); and,
- Grids were not checked more than once a week as this may lead to Striped Legless Lizards abandoning the artificial shelters.

The following was recorded:

- Location and number of each tile grid;
- Date and weather conditions for each survey;
- A table of results including a breakdown of what tile grids were checked on which dates / intervals
- Location and number of any Striped Legless Lizard recorded; and,
- Any non-target species identified (the tile-grid method is likely to identify other reptiles and small marsupials on site, including the DELWP vulnerable listed Tussock Skink *Pseudemoia pagenstecheri* and Near Threatened Fat-tailed Dunnart *Sminthopsis crassicaudata*).

Although the time between the establishment of tile grids and the commencement of tile checks was less than the three month period recommended by the Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC 2011a), the three week period was considered by DELWP (Garry Peterson) to be appropriate in this instance, with a greater importance placed on commencing the surveys in late September to maximise the likelihood of detection during the peak period of detectability for the species (late September – late November) (Scroggie *et. al.,* 2019).

2.4.3.4 Golden Sun Moth

Golden Sun Moth typically occur in native grassland, grassy woodland, dominated by greater than 40% cover of wallaby-grass, in particular *Rytidosperma* spp. (DSE 2004), but may also inhabit areas dominated by Kangaroo Grass *Themeda triandra* (Endersby and Koehler 2006) and introduced grassland dominated by Chilean Needle-grass *Nassella neesiana* and other introduced species (A. Organ pers. obs.). Male flight is typically low, to about a metre above the ground, fast and can be prolonged, but they are generally not recorded flying more than 100 metres from suitable habitat (Clarke and O'Dwyer 1999).

Many populations are isolated and fragmented, impeding the ability of the relatively immobile females to recolonise areas, thereby reducing the likelihood of genetic exchange (DSE 2004). Such populations are therefore vulnerable as there is little likelihood of recolonisation in the event of a local extinction.

Targeted surveys for Golden Sun Moth were undertaken on 3, 14, 15 and 21 December 2020. Surveys concentrated in areas identified as supporting Plains Grassland identified during the Ecological Assessment conducted on 13 November 2020, namely those supporting Wallaby-grass *Rytidosperma* spp. which is a known food source for Golden Sun Moth.

Areas of suitable habitat were walked by qualified zoologists over a minimum of four separate days during the known flight season (i.e. November to early January). Surveys were undertaken at a time which is considered suitable for detecting the species (i.e. when adult males are flying), and when Golden Sun Moth was observed flying at nearby locations. The male of this species generally flies between 11am and 3pm on calm, warm (over 20°C), sunny days.

At the time of the surveys, the species was listed as Critically Endangered under the EPBC Act (this has since be downgraded to Vulnerable). As such, survey procedures were in accordance with the *Significant Impact Guidelines for the Critically Endangered Golden Sun Moth* (DEWHA 2009b), with the following tasks undertaken:

- A habitat assessment was completed detailing information on habitat quality, presence of weeds and floristic diversity;
- Surveys were conducted by ecologists experienced in the detection and identification of Golden Sun Moth;

- The study area was surveyed on four separate occasions, with at least one week between surveys where possible;
- Surveys took place during the species' flight season (generally described as late October to early January). Moths were confirmed flying at known, nearby reference sites prior to undertaking each survey;
- Surveys were undertaken during weather conditions suitable for detecting the species (i.e. between 10am and 3pm on warm (over 20˚C by 10am) days with minimal cloud cover and still conditions); and
- Surveys were conducted by qualified zoologists walking or driving (where access was permitted) 10 to 50-metre-wide parallel transects across all areas of suitable habitat.

2.4.3.5 Growling Grass Frog

Habitats favoured by the Growling Grass Frog include permanent or largely permanent still water bodies with extensive emergent and submergent vegetation (DEPI 2013; Hero *et al.* 1991; Robertson *et al.,* 2002). The species is also associated with swamps, irrigated areas, farm dams, former quarry holes and off-stream habitats (DSE 2012). Suitable terrestrial habitat for post-breeding dispersal and overwintering refuge sites are also required, these include dense ground-level vegetation, rocks, logs and other ground debris (Robertson *et al.,* 2002). This species can also utilise temporarily inundated waterbodies for breeding purposes provided they contain water over the breeding season (Organ 2003).

Based on previous investigations there is a strong correlation between the presence of the species and key habitat attributes at a given waterbody. For example, the species is typically associated with waterbodies supporting an extensive cover of emergent, submerged and floating vegetation (Robertson *et al*. 2002, Organ 2004, 2005). Emergent vegetation provides basking sites for frogs and protection from predators, while floating vegetation provides suitable calling stages for adult males and breeding and oviposition (egg deposition) sites. Terrestrial vegetation (grasses, sedges), rocks and other ground debris around wetland perimeters also provide foraging, dispersal and over-wintering sites for frogs.

Overwintering sites recorded by Wilson (2003) included crevices beneath basalt boulders, crevices amongst rock - rubble, and dense vegetation at ground level, including emergent macrophytes and grasses. Most were located close to the waterline (within 100 metres). Wassens *et al.* (2008) observed a similar preference for shelter sites close to the water's edge. Most individuals sheltered among dense vegetation, but a few sheltered in soil cracks and the burrows of freshwater crayfish.

Analysis of detection probability thresholds specified by DELWP based on the survey protocols to be adhered to for this study determines specific cumulative probabilities of detection during the breeding season. For a detection probability threshold of 0.95, two nights' surveys are recommended at each site. For a probability threshold of 0.99, three nights' surveys are recommended at each site (Heard *et. al.* 2010).

Nocturnal Growling Grass Frog surveys were undertaken at five sites along Bruce Creek (Figure 5). Each survey site was visited on three occasions over three nights (25 and 26 November and 3 December 2020) during weather conditions considered suitable for Growling Grass Frog activity.

The sites visited were identified during a preliminary assessment (undertaken on 17 November 2020) as supporting suitable habitat for the species (i.e. moderate to good water quality, moderate to good percentage cover of fringing, emergent and floating vegetation, presence of other refuge).

The following attributes of habitat quality for the Growling Grass Frog were recorded as part of the preliminary habitat assessment:

- The hydroperiod;
- The location and extent of instream pools and off-stream waterbodies;
- Habitat values of each waterbody including the type (pond, dam, wetland, creek, billabong, drain or ditch) flow (still, slow rapid), depth and presence of terrestrial refuge sites (e.g. rocks, logs, debris);
- Aquatic vegetation cover (% cover of emergent, submergent and floating aquatic plants); and,
- Barriers to frog movement between waterbodies.

The hydroperiod (as defined in Heard *et al.,* 2010) is the likelihood that an individual wetland will remain inundated over the course of a single breeding season, on an ordinal scale where:

- 0 = fills only in years with above average rainfall (intermittent);
- 1 = fills and dries out annually with average rainfall (ephemeral);
- 2 = dries out only during years of below average rainfall (semi-permanent);
- 3 = never dries out regardless of rainfall (permanent).

Habitat quality was defined with reference to the following criteria:

- High quality habitat: Areas that currently contain or have a high likelihood to contain important habitat attributes required by the species for breeding as well as foraging and dispersal (e.g. permanent or semi-permanent, extensive aquatic vegetation, high water quality, connected to other occupied sites, absence or low densities of predatory fish, high cover of terrestrial refuge sites).
- Moderate quality habitat: Habitat that supports one or more key habitat characteristics outlined above, but not all (for example site may be important for dispersal or foraging but not breeding).
- Low quality habitat: Sites unlikely to be used by Growling Grass Frogs for breeding and a low likelihood for dispersal due to one or more of the following; absence or lack of aquatic vegetation, low water quality, presence of predatory fish, lack or low cover of terrestrial refuge sites.
- No suitable habitat / degraded: Areas consisting of open pasture have generally been cleared from previous land use activities and are highly modified areas dominated by exotic vegetation (i.e. open pasture) in poor condition and located some distance (e.g. over 200 metres) from wetland habitat .

Growling Grass Frog Surveys were undertaken in accordance with the methods outlined in the Significant Impact Guidelines for the Vulnerable Growling Grass Frog (DEWHA 2010) and Survey Guidelines for Australia's Threatened Frogs (DEWHA 2010) and were completed as follows:

- Two qualified zoologists, experienced in Growling Grass Frog detection, systematically walked along (or around) each watercourse (or waterbody).
- Zoologists searched fringing, emergent and floating vegetation within and adjacent to the watercourse/waterbody with 50W 12V hand-held spotlights and used call-playback to initiate a response from any males that may have been present.
- All frog species heard or seen were recorded and several site-specific habitat variables were documented including a visual assessment of water quality, flow and depth, and records of fringing, emergent, floating and submerged vegetation cover.

- Growling Grass Frog were confirmed to be calling at known reference sites prior to undertaking surveys (T-Section Lagoon at the Western Treatment Plant).

Specifically, targeted surveys including call playback, and active searching focussed on the entirety of Bruce Creek within the study area, and the stretch of the Moorabool River which borders the Western Growth area (Figure 6).

2.5 Likelihood of Occurrence Assessment

Relevant biological databases, literature and expert advice were used to identify all species records of national and State conservation significance within 10 kilometres of the study area. The proximity, number, dispersion and date of known locality records (assuming over-dispersed and random patterns of locality records being more likely to occur in the study area) were considered to determine a species' likelihood of occurrence within the study area.

Additional factors also taken into consideration include: the known biogeographical distribution of the species; underlying geology of existing locality records; and, vegetation and habitat associations. The decision guidelines for determining the likelihood of occurrence of flora and fauna species are presented in Table 10 and Table 11 respectively.

The results of the likelihood of occurrence assessment for listed flora and fauna species are provided in Appendices 2.4 and 3.2, respectively.

All significant flora and fauna species considered to have the highest likelihood of occurrence within potential habitats within the study area are discussed in the body of this report.

Table 10. Decision guidelines for determining a flora species likelihood of occurrence within the study area.

Likelihood of occurrence	Ecology and Heritage Partners Decision Criteria
1 – Known occurrence	Recorded within the study area recently (i.e. within ten years).
2 - High	Previous records of the species in the local vicinity; and/or, the study area contains areas of high-quality habitat.
3 – Moderate	Limited previous records of the species in the local vicinity; and/or, the study area contains some characteristics of the species' preferred habitat.
4 – Low	Poor or limited habitat for the species however other evidence (such as a lack of records or environmental factors) indicates there is a low likelihood of presence.
5 – Unlikely	No suitable habitat and/or outside the species range.

Table 11. Decision guidelines for determining fauna species likelihood of occurrence within the study area.

Likely presence or use of the study area	Ecology and Heritage Partners Decision Criteria
1 – Known occurrence	Recorded within the study area recently (i.e. within ten years).
2 - High	Likely resident in the study area based on database records, or expert advice; and/or, recent records (i.e. within ten years) of the species in the local area; and/or, the study area contains the species' preferred habitat.
3 - Moderate	The species is likely to visit the study area regularly (i.e. at least seasonally); and/or, previous records of the species in the local area; and/or, the study area contains some characteristics of the species' preferred habitat.

Likely presence or use of the study area	Ecology and Heritage Partners Decision Criteria
4 - Low	The species may visit the study area occasionally or opportunistically whilst en route to more suitable sites; and/or, there are only limited or historical records of the species in the local area (i.e. more than 20 years old); and/or, the study area contains few or no characteristics of the species' preferred habitat.
5 - Unlikely	No previous records of the species in the local area; and/or, the species may fly over the study area when moving between areas of more suitable habitat; and/or, out of the species' range; and/or, no suitable habitat present.

2.6 Assessment Qualifications and Limitations

Data and information held within the ecological databases and mapping programs reviewed as part of the desktop assessment (e.g. VBA, PMST, NatureKit Maps etc.) are unlikely to represent all flora and fauna observations within, and surrounding the study area. It is therefore important to acknowledge that a lack of documented records does not necessarily indicate that a species or community is absent. Furthermore, a documented record may indicate a species' presence in an area at a given point in time, but it generally does not offer information about how a species is making use of an area (e.g. foraging, nesting, dispersing). This can be important information when determining the potential impact of a proposed action on a threatened species.

The 'snap shot' nature of a biodiversity assessment, meant that migratory, transitory or uncommon fauna species may have been absent from typically occupied habitats at the time of the field assessment. In addition, annual or cryptic flora species such as those that persist via underground tubers may also be absent. Nevertheless, the terrestrial flora and fauna data collected during the field assessment and information obtained from relevant desktop sources is considered adequate to provide an accurate assessment of the ecological values present within the study area.

Ecological values identified within the study area were recorded using a hand-held GPS or tablet with an accuracy of +/-1 metres. This level of accuracy is considered to provide an accurate assessment of the ecological values present within the study area; however, this data should not be used for detailed surveying purposes. It should be noted, in some instances where the Diameter at Breast Height (DBH) of trees were unable to be measured (i.e. due to presence within Bruce Creek), the size of the tree (i.e. large or small) was estimated via visual assessment.

2.6.1 Targeted Flora Surveys

Targeted surveys were undertaken during optimal seasons for the identification of the targeted fauna species. it is considered that the survey effort, timing and results presented meet the objectives of the surveys and provide sufficient information to support any future approvals process.

Fauna surveys were conducted under the Ecology and Heritage Partners Pty Ltd research permit (#10005952) issued by DEPI under the *Wildlife Act 1975*.

2.6.2 Striped Legless Lizard Surveys

Although the time between the establishment of new tile grids and the commencement of tile checks was less than the three month period recommended by the Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC 2011a), the three week period was considered by DELWP (Garry Peterson) to be appropriate in this instance, with a greater importance placed on commencing the surveys in late September to maximise the

likelihood of detection during the peak period of detectability for the species (late September – late November) (Scroggie *et. al.,* 2019).

In this instance, to compensate for the shorter period prior to the first tile check, all tile grids were checked on eight occasions, over a 10 week period, which exceeds the number of checks recommended (i.e. six checked recommended) in the guidelines (DSEWPaC 2011a).

Based on the results of previous Striped Legless Lizard surveys undertaken within western Melbourne, it has regularly been observed that Striped Legless Lizard (and other reptiles) will generally commence using artificial shelter sites (i.e. tiles) 2-3 weeks after the tiles are established. Several reptile species, including the Eastern Blue-tongued Lizard *Tiliqua scincoides scincoides,* Eastern Brown Snake *Pseudonaja textilis* and the State significant Tussock Skink *Pseudemoia pagenstecheri* were detected under tiles during the first few tile checks between 2 and 16 October 2020. This provides substantive evidence that reptiles regularly and opportunistically acclimatise to using artificial shelter tiles for thermoregulation and cover within short timeframes.

The peak detection of Striped Legless Lizard typically occurs between late September – late November (DSEWPaC 2011a; Scroggie *et. al.,* 2019). As such, it is considered that the survey timing was appropriate (high detection probability) to detect the species should a resident population of the species occur within the study area.

2.6.3 Golden Sun Moth

Recommended survey conditions specify targeted searches for the species be conducted within climatic conditions relating to temperature (above 20 degrees Celsius before 10am) with minimal cloud cover, wind speed and days since rain. Surveys for the species were conducted in line with the recommended conditions, although if the species was confirmed flying at a reference site during conditions outside of the optimal conditions stated in the recommended survey guidelines, then surveys proceeded under sub-optimal conditions until the species was no longer recorded.

The suboptimal conditions of rain, and cool weather over the 2020/2021 flight season meant that it was not always possible to achieve at least a one week period between surveys. Given the suboptimal survey conditions, targeted surveys had to be undertaken opportunistically when conditions were optimal, and/or the species was confirmed to be flying. As such, the surveys may not have captured the additional emergence of larvae, making it difficult to capture the size of the full population of the species. However, it is noted that where the species was recorded in areas of suitable habitat, the entire contiguous extent of suitable habitat has been noted as confirmed habitat for the species. Further, additional numbers of the species would not alter the findings or implications of the assessments.

2.6.4 General Limitations

General ecological limitations associated with the ecological investigations include:

- Surveys for listed flora and fauna species were undertaken during the optimal flowering/breeding period for all targeted species to maximise the probability of detecting each species. Given that accessible areas of suitable habitat for significant flora and fauna species were extensively surveyed, it is considered that sufficient effort has been employed to determine the likely presence or otherwise of targeted species within accessible areas;
- The assessment of likelihood of occurrence is based on survey effort and results, background information and previous records compiled;

- Non-vascular flora (i.e. mosses, liverworts) were not recorded, although their presence is noted as part of the cover of native species in the definition of a patch of native vegetation;
- Ecological features identified during field assessments were recorded using a hand-held Digital GPS or tablet with an accuracy of between +/- 1 to 5 metres. This level of accuracy is considered adequate to provide an accurate assessment of the ecological features present within the study area; however, this data should not be used for detailed surveying purposes; and,
- For cryptic and less abundant species that are known to, or that have the potential to use habitat resources within the study area as a resident or a visitor on a regular or infrequent basis, the precautionary principle has been applied when determining the likelihood of occurrence.

3 EXISTING ENVIRONMENT

The following description of the existing environment is based on the landscape, vegetation, fauna habitats and species identified from the desktop assessment and within the study area during the ecological surveys.

3.1 Ecological Values

Ecological values of the study area, as determined through field assessments and targeted surveys undertaken within the property parcels, are summarised below.

3.1.1 Overview

Most of the study area is highly modified due to past and current agricultural and farming practices and is dominated by pasture supporting non-indigenous grasses and weeds. Much of the indigenous vegetation and terrestrial fauna habitat remaining within the study area are confined to riparian corridors (i.e. Bruce Creek) or agricultural areas not subjected to historical cropping activities. Native vegetation, where present within existing farmland, is highly modified, with vegetation generally lacking structure and exhibiting a low diversity of native species.

Three EVC's were mapped across both study areas: *Heavier Soils* Plains Grassland (EVC_132_61), Creekline Grassy Woodland (EVC 68) and Plains Grassy Woodland (EVC 55_61). This is broadly consistent with extant (2005) DELWP modelled mapping that shows both study areas are modelled to contain discrete areas of Plains Grassland (EVC 132), with areas adjacent to the Bruce Creek modelled as Creekline Grassy Woodland (EVC 68) (DELWP 2021d).

Commonly observed species recorded in grassland habitats included Kangaroo Grass *Themeda triandra,* Common Wallaby-grass *Rytidosperma caespitosum*, Rough Spear-grass *Austrostipa scabra* and Kneed Spear Grass *Austrostipa bigeniculata*. River Red-gum *Eucalyptus camaldulensis* was the dominant tree species within the study area, however Melbourne Yellow-gum *Eucalyptus leucoxylon* subsp. *connata* also occurred within the study area.

Specific details relating to observed EVCs are provided below, with a summary of the extent of each vegetation type provided in Table 12.

Table 12. Extent of vegetation type (EVC) recorded within the study area.

Ecological Vegetation Class	Bioregional Conservation Significance	Area (hectares)
Plains Grassland (EVC 132)	Endangered	7.804
Plains Grassy Woodland (EVC 55_61)	Endangered	0.288
Creekline Grassy Woodland (EVC 68)	Endangered	0.323
Total		**8.414**

There is suitable habitat for water-dependent fauna species, including the nationally listed Growling Grass Frog within Bruce Creek. In addition, modified Plains Grassland within farmland provides suitable habitat for Golden Sun Moth.

Several large trees are present along Bruce Creek and currently project suitable nesting (hollows and fissures), foraging and roosting habitat for a range of native fauna species, including arboreal mammals (microbats, possums) and birds (owls, parrots and woodland species).

3.1.1.1 Flora

Sixty-six flora species (37 indigenous and 29 non-indigenous or introduced) were recorded within the study area during the field assessment. No nationally listed flora species were identified during the targeted surveys across study area. However, three Melbourne Yellow-gum, listed as threatened under the FFG Act were recorded within the study area along Charlton Road as part of this ecological assessment (Figure 2). This is in addition to the four Melbourne Yellow-gum identified as during the previous biodiversity assessment (Figure 2). Common Onion-orchid *Microtis unifolia* and Cotton Fireweed *Senecio quadridentatus*, protected under the FFG-Act, were also recorded throughout the study area. A consolidated list of flora species recorded is provided in Appendix 2.1.

Noxious Weeds

Eight species recorded in the study area are declared noxious weeds listed under the Victorian *Catchment and Land Protection Act 1994* (CaLP Act) (Table 13). Chilean Needle-grass *Nassella neesiana*, Serrated Tussock *Nassella trichotoma,* African Box-thorn *Lycium ferocissimum* and Willow *Salix* sp. are also Weeds of National Significance (WoNS), under national management as part of the National Weeds.

Table 13. Noxious weeds recorded within the study area.

Species Name	Common Name	CaLP Act Category[1]	WoNS[2]
Nassella neesiana	Chilean Needle-grass	**Restricted Weed**	Yes
Juncus acutus	Spiny Rush		No
Salix sp.	Willow		Yes
Carthamus lanatus	Saffron Thistle		No
Lycium ferocissimum	African Box-thorn	**Regionally Controlled**	Yes
Cynara cardunculus	Artichoke Thistle		No
Nassella trichotoma	Serrated Tussock		Yes
Rosa rubignosa	Sweet Briar		No

Note: 1) Regionally Controlled Weed and Restricted Weed under the CaLP Act; 2) WoNS under national management.

3.1.1.2 Fauna

Ecological surveys of the study area recorded 21 species of fauna, comprising 16 native species and five introduced species (Table 14). Several mammal species were detected within study area (five species), while a range of bird species were also observed (e.g. woodland specialists), along with those adapted to open and/or modified landscapes. A consolidated list of fauna species recorded is provided in Appendix 3.1.

Table 14. Summary of fauna species identified within the study areas.

Fauna Guild	Species Richness	
	Native	Introduced
Mammals	1	4

Fauna Guild	Species Richness	
	Native	Introduced
Birds	8	1
Reptiles	4	0
Frogs	2	0
Invertebrate	1	0
Total	**16**	**5**

Pest Animals

Two of the introduced fauna species recorded within the study area are declared pests under the Victorian CaLP Act (Table 15). These species are classified as Established Pest Animals, which indicates they pose a serious threat to primary production, Crown Land, the environment or community health in Victoria. It is not possible to eradicate these pest animals form Victoria, therefore asset protection is considered to the most effective approach to minimise impacts to high value assets.

Table 15. Pest Animals recorded in the study areas

Common Name	Scientific Name	CaLP Act Category[1]	Priority Pest[2]
European Rabbit	*Oryctolagus cuniculus*	**Established**	Yes
Red Fox	*Vulpes vulpes*		No

Note: 1) Declared Established pest animal under the CaLP Act; 2) designated for priority control under the CaLP Act.

3.1.2 Patches of Native Vegetation

Modelling undertaken by DELWP provides an indication of the likely extent and type of patches of native vegetation present within the study area prior to European settlement (1750), and in 2005 (DELWP 2021a).

Native vegetation in the study area is representative of three Ecological Vegetation Classes (ECVs): Plains Grassland (EVC 132), Creekline Grassy Woodland (EVC 68) and Plains Grassy Woodland (EVC 55). The presence of these EVCs is generally consistent with the modelled pre-1750s native vegetation mapping (DELWP 2021a).

The remainder of the study area comprises introduced and planted vegetation, present as pasture. Specific details relating to observed EVC is provided below.

3.1.2.1 Plains Grassland

Plains Grassland is characterised by treeless vegetation, mostly less than one metre tall, and dominated largely by graminoid and herb life forms. It typically occurs on fertile cracking basalt soils prone to seasonal waterlogging (DELWP 2021c).

Plains Grassland consisted of six habitat zones of varying condition (PG1 to PG6), which occurred within the pastural properties adjacent to the Bruce Creek corridor and along the roadsides bordering the study area (Figure 2).

PG1 (Plate 1) was of moderate quality, dominated by Kangaroo Grass *Themeda triandra,* with scattered occurrences of Common Wallaby-grass *Rytidosperma caespitosum*, Rough Spear-grass *Austrostipa scabra* and Kneed Spear Grass *Austrostipa bigeniculata* also present throughout. Native herbs such as Crane's-bill *Geranium* sp. and Common Onion Orchid *Microtis unifolia* was also occasionally present. Weed cover was

relatively low, but generally comprised of Wild Oat *Avena fatua*, Large Quaking-grass *Briza maxima* and Ribwort *Plantago lanceolata.* Bare ground and inter-tussock spacing was also apparent.

PG2 (Plate 2) just met the required 25% cover to be considered a patch of native vegetation. However, it supported an equal mix of Kangaroo Grass, Common Wallaby-grass and Spear Grass *Austrostipa* spp. in addition to Common Wheat-grass *Anthosachne scaber*. It was dominated by weeds such as Wild Oat, Large Quaking-grass, Toowoomba Canary-grass *Phalaris aquatica,* Yorkshire Fog *Holcus lanatus.* Turnip *Brassica* sp., Ribwort *Plantago lanceolata* and Cat's-ear *Hypochaeris radicata.* Bare ground and inter-tussock spacing was also apparent.

PG3 (Plate 3) comprised approximately 30% cover of native vegetation, however, possessed a greater diversity of native grasses and herbs (greater than that of PG1). Whilst it had a moderate cover of weeds, it comprised of predominantly Kangaroo Grass and Common Wallaby-grass. Native herbs species were also abundant and included Crane's-bill, Common Onion Orchid, Sundew *Drosera* sp. and Narrow Plantain *Plantago gaudichaudii.* Additional grass species also included Common Tussock-grass *Poa labillardierei* and Long-hair Plume-grass *Dichelachne crinita.*

PG4 (Plate 4) was dominated by Kangaroo Grass. The remaining areas generally consisted of bare ground, with a small number of herbaceous weeds present, which included Ribwort *Plantago lanceolata* and Flatweed *Hypochaeris radicata.*

PG5 (Plate 5) was dominated by an equal mix of Wallaby-grass and the Weed of National Significance (WoNS) Chilean Needle-grass *Nassella neesiana*. Scattered occurrences of Wild Oat and Kangaroo Grass were also present. Biomass for these species was high with little to no inter-tussock spacing.

PG6 (Plate 6) comprised of Toowoomba Canary-grass intermixed with Common Wallaby-grass. Occasional occurrences of Brown-back Wallaby-grass was also present.

Habitat Zones PG1, PG4 and PG5 also meet the definition of the nationally significant Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) ecological community. The State Significant Western (Basalt) Plains Grassland community corresponds to all areas of Plains Grassland mapped in the study area (Habitat Zones PG1 to PG6) and meets the relevant description and characteristics described for this community.

Plate 1. PG1 within the study area (Ecology and Heritage Partners Pty Ltd 13/11/2020).

Plate 2. PG2 within the study area (Ecology and Heritage Partners Pty Ltd 13/11/2020).

Plate 3. PG3 within the study area (Ecology and Heritage Partners Pty Ltd 13/11/2020).

Plate 4. PG4 within the study area (Ecology and Heritage Partners Pty Ltd 13/11/2020).

Plate 5. PG5 within the study area (Ecology and Heritage Partners Pty Ltd 16/12/2020).

Plate 6. PG6 within the study area (Ecology and Heritage Partners Pty Ltd 17/12/2020).

3.1.2.2 Creekline Grassy Woodland

Creekline Grassy Woodland is typically defined as a Eucalypt-dominated woodland (to 15 metre tall) with occasional scattered shrub layer over a mostly grassy/sedgy to herbaceous ground-layer. Occurs on low-gradient ephemeral to intermittent drainage lines which can include a range of graminoid and herbaceous species tolerant of water-logged soils (DELWP 2021c).

Creekline Grassy Woodland (CGW1) (Plate 7) within the study area comprised of an overstorey dominated by River Red-gum. Hedge Wattle *Acacia paradoxa* and the Weed of National Significance African Box-thorn were intermixed throughout the shrublayer and the ground layer was dominated by a mixture of Toowoomba Canary-grass, Rush *Juncus* sp. and Common Reeds *Phragmites australis.*

Whilst there was only a single patch of Creekline Grassy Woodland along Bruce's Creek, scattered native vegetation reminiscent of this EVC were also present along the creekline, namely Common Reed and Rush, as well as Hedge Wattle and scattered juvenile and mature River Red-gum (Plate 8).

Plate 7. CGW1 within the study area (Ecology and Heritage Partners Pty Ltd 17/12/2020).

Plate 8. Creekline Grassy Woodland along Bruce Creek (17/12/2020).

3.1.2.3 Plains Grassy Woodland

Plains Grassy Woodland is typically defined as an open, eucalypt woodland to 15 metres tall. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer (DELWP 2021c).

Plains Grassy Woodland within the study area consists of three habitat zones of differing quality (PGW1, PGW2 and PGW3).

PGW1 (Plate 9) consists of a canopy dominated by relatively young River Red-gum trees (no large trees present). The shrub layer was dense, comprising purely of Hedge Wattle. The understorey was predominantly bare, albeit for the occasional grassy and herbaceous weed, which included Ribwort, Cat's-ear and Yorkshire Fog *Holcus lanatus*.

PGW2 (Plate 10) consisted of a canopy dominated by large River Red-gum trees with an open shrub layer comprising of sparse Hedge Wattle. The ground layer was predominantly bare, with small occasional patches of Wallaby-grass also present.

PGW3 (Plate 11) consisted of a canopy comprising three Melbourne Yellow-gum over an absent understorey. Ground cover was dominated by the exotic grasses Kikuyu *Cenchrus clandestinus* and Couch *Cynodon dactylon.*

3.1.3 Large Trees in Patches

A total of three Large Trees (LTs) in Plains Grassy Woodland and Creekline Grassy Woodland patches were present (Figure 2). All specimens were River Red-gum (Plate 12; Plate 13; Appendix 2.3).

3.1.4 Scattered Trees

A total of 87 scattered trees (River Red-gum, Melbourne Yellow-gum and Dead Stags) were recorded within the study area, which consisted of 56 large and 31 small scattered trees (Figure 2; Appendix 2.3). These trees would have once formed part of the Plains Grassy Woodland EVC; however, the understorey vegetation contained predominantly introduced species (mainly exotic pasture grasses) and the trees no longer formed a patch of native vegetation (Plate 14; Plate 15).

Plate 9. PGW1 within the study area (Ecology and Heritage Partners Pty Ltd 17/12/2020).

Plate 10. PGW2 within the study area (Ecology and Heritage Partners Pty Ltd 17/12/2020).

Plate 11. PGW3 within the study area (Ecology and Heritage Partners Pty Ltd 16/12/2020).

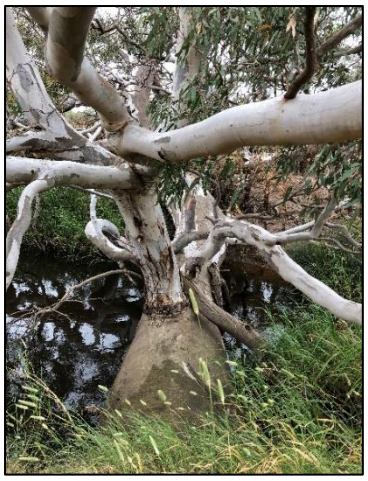

Plate 12. Large Tree (River Red-gum) in CGW1 in patch (Ecology and Heritage Partners Pty Ltd 18/12/2020).

Plate 13. Large Tree (River Red-gum) in PGW2 in patch (Ecology and Heritage Partners Pty Ltd 17/12/2020).

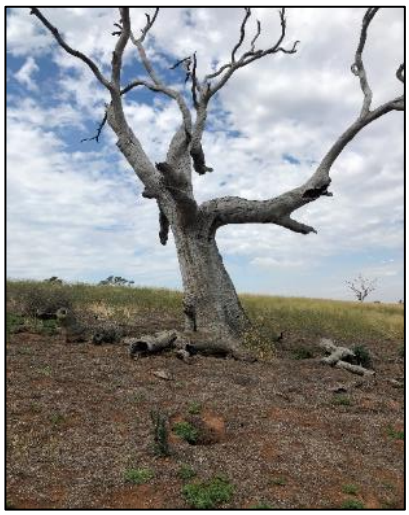

Plate 14. A large scattered tree (Dead Stag) within the study area (Ecology and Heritage Partners Pty Ltd 17/12/2020).

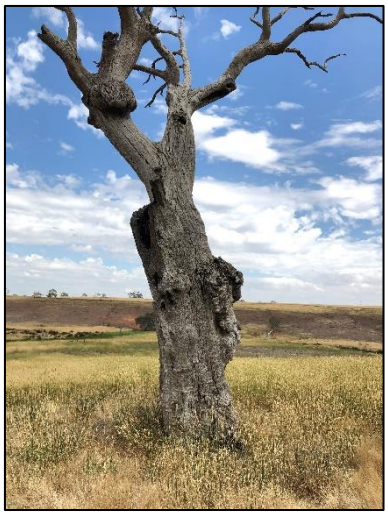

Plate 15. A large scattered tree (Dead Stag) within the study area (Ecology and Heritage Partners Pty Ltd 17/12/2020).

3.1.5 Introduced and Planted Vegetation

Areas not supporting native vegetation had a high cover (>90%) of exotic grass species, many of which were direct-seeded for use as pasture. Scattered native grasses were generally present in these areas, however they did not have the required 25% relative cover to be considered a patch.

Non-native areas were dominated by environmental weeds such as Toowoomba Canary-grass, Wild Oat, Large Quaking-grass, Yorkshire Fog and Rye-grass. Prevalent herbaceous weeds included Red Sorrel *Acetosella vulgaris,* Plumeless Thistle *Carduus acanthoides* and Cape Weed *Arctotheca calendula.*

Noxious weeds were present throughout the study area, the most prevalent of which were the Weeds of National Significance (WoNS) African Box-thorn, Serrated Tussock and Chilean Needle-grass. Scattered occurrences of the noxious Sweet Briar, Saffron Thistle, Artichoke Thistle and Spiny Rush were also present (Plate 16; Plate 17; Plate 18). Occasional specimens of Willow (a WoNS) was also observed to be present along the banks of Bruce Creek.

Eucalypts *Eucalyptus* sp. and Sheoak *Allocasuarina* sp. were planted as a windrow along the boundary to the parcels adjacent to Bruce Creek (Figure 2) (Plate 19). Furthermore, immature Sugar Gum *Eucalyptus cladocalyx* were observed to be planted along the southern road reserve of Charlton Road.

Plate 16. Sweet Briar within the study area (Ecology and Heritage Partners Pty Ltd 16/12/2020).

Plate 17. African Box-thorn within the study area (Ecology and Heritage Partners Pty Ltd 16/12/2020).

Plate 18. Serrated Tussock within the study area (Ecology and Heritage Partners Pty Ltd 17/12/2020).

Plate 19. Planted Eucalypts and Sheoak along the boundary of the study area (Ecology and Heritage Partners Pty Ltd 16/12/2020).

3.1.6 Fauna Habitat

The areas of Plains Grassy Woodland and Creekline Grassy Woodland provide habitat for a range of fauna, including arboreal species that require trees for nesting/roosting (e.g. possums and bird species), as well as ground-dwelling species reliant on a grassy ground cover for their food or shelter (e.g. lizards). Eucalypt (*Eucalyptus* spp.) and Wattle (*Acacia* spp.) trees will provide foraging habitat for nectarivores (nectar-eating) and frugivorous (fruit-eating) bird species. Many eucalypts are mature, providing an array of small, medium and large hollows, bark fissures and crevices. These are likely to be used for shelter and nesting by a range of hollow-dependent fauna, including parrots, microbats, possums, gliders and owls.

Mature scattered trees are likely to act as 'stepping-stones' for fauna moving through the predominantly agricultural landscape, increasing landscape permeability. The Melbourne Yellow Gum trees are also potential foraging source for the critically endangered EPBC listed Swift Parrot *Lathamus discolour* (Trengrove 2017).

Fauna observed using this habitat included Eastern Rosella *Platycercus eximius,* Galah *Eolophus roseicapilla,* Rainbow Lorikeet *Trichoglossus haematodus,* Sulphur-crested Cockatoo *Cacatua galerita,* Superb Fairy-wren *Malurus cyaneus* and Willie Wagtail *Rhipidura leucophrys*. An Australian Wood Duck *Chenonetta jubata* was also observed on numerous occasions to be nesting within the hollow of Tree 34 (Figure 2).

An Eagle's nest was noted in the canopy of Tree 23 (Plate 20) and a beehive was also present in the hollow of Tree 46.

Areas of emergent vegetation were dispersed throughout Bruce Creek and Bannockburn Lagoon, which can provide important habitat for various frog species, such as the nationally vulnerable Growling Grass Frog *Litoria raniformis* which requires still to slow moving waters with intact emergent vegetation on the margins (DEWHA 2009b). The Eastern Pobblebonk Frog *Limnodynastes dumerilii* was heard calling in the vicinity and rabbit warrens were also observed along the banks of Bruce Creek.

The majority of the study area consists of paddocks which contain improved exotic pastures, likely to be used as a foraging resource by common generalist bird species which are tolerant of modified open areas. Macropods (e.g. Eastern Grey Kangaroo *Macropus giganteus*) as well as Sheep *Ovis aries* were also observed to graze in these areas. In addition, a fox den was noted in one of the adjacent parcels to Bruce Creek (Figure 2) and a Red Fox *Vulpes vulpes* cub was observed along Levy Road.

Areas of native grassland can support a diversity of animal species, notably skinks, snakes, birds of prey and ground-dwelling birds (TSSC 2008) (Plate 21). Suitable habitat for the FFG Act-listed Tussock Skink (confirmed to be present on site) exists within the study area (Figure 4c), particularly in areas that support native grassland and secondary grasslands with cracking soils, and surface or embedded rock which the species relies on for habitat. Although some discrete areas of embedded rock are still present, most of the study area has either been cropped or is highly disturbed (i.e. dominated by exotic grasses with an absence of cracking soils). The native grassland and secondary grassland also provides suitable habitat for the EPBC Act-listed Golden Sun Moth.

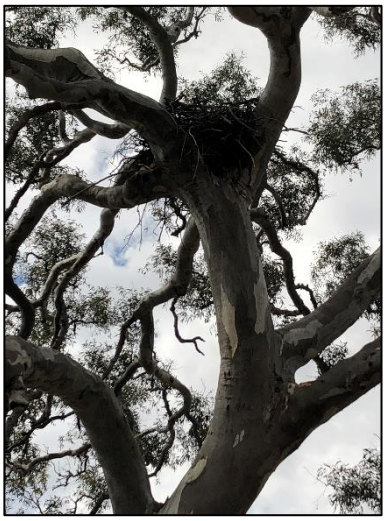

Plate 20. An eagle's nest present in Tree 23 (Ecology and Heritage Partners Pty Ltd 17/12/2020).

Plate 21. Eastern Blue-tongued Lizard recorded within the study area (Ecology and Heritage Partners Pty Ltd 16/10/2020).

3.2 Nationally Significant Values

Matters of National Environmental Significance (NES) are listed and protected under the EPBC Act. Matters of NES relating to biodiversity are discussed below in relation to the entire study area based on the results of the PMST (DCCEEW 2022), desktop review of literature, and the results of ecological surveys.

3.2.1 Flora

The VBA contains records of seven nationally significant flora species previously recorded within 10 kilometres of the study area (DELWP 2022a) (Figure 7; Appendix 2.4).

The PMST nominated an additional 13 nationally significant species which have not been recorded in the locality but have the potential to occur (DCCEEW 2022; Appendix 2.4).

While there are multiple records of significant species within 10 kilometres of the study area, there are no recorded occurrences within the study area itself. However, this may not indicate the absence of the listed species but may simply reflect the lack of detailed flora survey in the area.

Given the distribution of records and the habitat encountered during the preliminary biodiversity assessment, five nationally significant species were considered to have a moderate or higher likelihood of occurrence within the study area (Table 16).

Table 16. Nationally significant flora with potential habitat in the study area

Species	Suitable habitat within the study area	Closest known records
Spiny Rice-flower	The species has the potential to occur in areas of relatively undisturbed Plains Grassland and Plains Grassy Woodland within the study area.	Approx. 1.7 kilometres north of the study area, within the rail corridor.
Large-headed Fireweed	Suitable habitat for this species exists in areas not subject to historical agricultural disturbance (i.e. cropping and/or other major ground disturbances), such as the intact areas of Plains Grassland and Plains Grassy Woodland.	Approximately 500 metres from the study area, in the Bannockburn Cemetery.
Matted Flax-lily	Likely habitat for the species is identified within areas of moderate to high quality plains grassland. Areas of embedded rock not supporting native vegetation have a moderate to low likelihood of occurrence.	Approximately 500 metres from the study area, in the Bannockburn Cemetery.
Button Wrinklewort	Likely habitat for the species is identified within areas of moderate to high quality plains grassland. Areas of embedded rock not supporting native vegetation have a moderate to low likelihood of occurrence.	Approximately 1.7 kilometres north of the study area, within the rail corridor.
Adamson's Blown-grass	Likely habitat for the species is identified within Creekline Grassy Woodland vegetation within the area.	Approximately 5 kilometres east of the study area, within the rail corridor.

3.2.1.1 Spiny Rice-flower

Potential habitat for the EPBC Act-listed Spiny Rice-flower was identified during previous ecological assessments undertaken throughout the study area (Ecology and Heritage Partners 2020a). The species was

considered to have the potential to occur within patches of native vegetation (i.e. Plains Grassland EVC) and areas supporting embedded rock (Figure 2).

There are numerous records of Spiny Rice-flower recorded in the Victorian Biodiversity Atlas (VBA) within 10 kilometres of the study area, with the most recent recorded immediately adjacent to the north-eastern boundary of the study area (Figure 7).

The study area predominately comprises patches of native grassland, suitable to support individuals of Spiny Rice-flower. However, no Spiny Rice-flower were detected within the study area, despite systematic targeted surveys over the area during the known flowering period when the species was known to be flowering within the locality (Figure 3).

Based on the results of the targeted survey, site condition and proximity and distribution of previous records, there is considered to be a low likelihood that the immediate study area supports a population of Spiny Rice-flower.

3.2.1.2 Large-headed Fireweed

Potential habitat for the EPBC Act-listed Large-headed Fireweed was identified during previous ecological assessments undertaken throughout the study area (Ecology and Heritage Partners 2020a). The species was considered to have the potential to occur within patches of relatively undisturbed Plains Grassland with Kangaroo Grass present (Figure 2).

Despite targeted surveys being undertaken at an appropriate time of year when the species is generally known to be flowering, no specimens of Large-headed Fireweed were recorded within the study area (Figure 3).

Whilst relatively intact areas of Plains Grassland persisted within the study area, the existing condition of habitat showed signs of historical clearing and/or high weed invasion. As such, habitat for the species is considered marginal and given the results of the targeted surveys the species is considered highly unlikely to occur within the study area.

3.2.1.3 Matted Flax-lily

The species has the potential to persist within areas of Plains Grassland and open woodland habitats recorded within the study area (Figure 2). The species is known from a single occurrence in the Bannockburn Cemetery (Figure 7).

Whilst relatively intact areas of Plains Grassland persisted within the study area, the existing condition of habitat showed signs of historical clearing and/or high weed invasion.

Despite targeted surveys being undertaken at an appropriate time of year when the species is generally known to be flowering, no specimens of Matted Flax-lily were recorded within the study area (Figure 3).

Based on the results of the targeted survey, site condition and proximity and distribution of previous records, there is considered to be a low likelihood that the immediate study area supports a population of Matted Flax-lily.

3.2.1.4 Button Wrinklewort

The species grows in grassland and woodland communities primarily associated with Kangaroo Grass with an open distribution between tussocks (Morgan 1995).

Despite targeted surveys being undertaken at an appropriate time of year when the species is generally known to be flowering, no specimens of Button Wrinklewort were recorded within the study area (Figure 3)

Areas dominated by Kangaroo Grass were prevalent throughout the northern section of the study area (Figure 2), however, in considering the identified threats to Button Wrinklewort within the study area (i.e., physical disturbance of sites, weeds, competition from native grasses, heavy grazing, (OEH 2012), habitat for the species is considered marginal and given the results of the targeted surveys the species is considered highly unlikely to occur within the study area.

3.2.1.5 Adamson's Blown Grass

The most recent documented records of Adamson's Blown Grass within the VBA (DELWP 2020a) occurs approximately five kilometres east of the study area, within the rail corridor (Figure 7). The species has the potential to persist within or adjacent to wetlands and drainage lines located within the study areas (Figure 2).

Despite targeted surveys being undertaken at an appropriate time of year when the species is generally known to be flowering and readily detectable, no specimens of Adamson's Blown Grass were recorded within the study area (Figure 3).

Potential habitat adjacent to Bruce Creek was highly modified and dominated by exotic grasses including Toowoomba Canary-grass and Kikuyu *Pennisetum clandestinum.* The drainage lines along road reserves contained little native vegetation and were generally comprised of improved and exotic pasture.

Given the known threats to the species that are present within the study area, including a high cover of annual and perennial weeds within or adjacent to areas of potential habitat, it is considered that existing habitat quality for the species is marginal. Given the results of the targeted surveys and the presence of highly modified habitat, the species is considered highly unlikely to occur within the study area.

3.2.1.6 Other Nationally Significant Flora

Based on the landscape context, highly modified, agricultural nature of the study area and extent of previous vegetation removal, the likelihood of any additional nationally significant flora occurring within the study area is considered low due to the absence of suitable habitat and lack of records in close proximity (Appendix 2.4).

3.2.2 Fauna

The VBA contains records of 11 nationally significant fauna species previously recorded within 10 kilometres of the study area (DELWP 2022a) (Appendix 3.2) (Figure 8). The PMST nominated an additional 15 nationally significant species which have not been previously recorded but have the potential to occur in the locality (DCCEEW 2022).

Of the 26 nationally significant fauna species that are known to, or are predicted to occur within the locality, three were considered to have a moderate or higher likelihood of occurrence within the study area (Table 17).

Based on the results of the desktop assessment and field assessments, it is considered highly unlikely that any additional nationally significant fauna occur within the study area due to highly modified condition of the understorey and ongoing land use of the site resulting in the absence of suitable habitats likely to support nationally significant species.

The likelihood of occurrence of nationally threatened species within the study area is outlined in Appendix 3.2.

Table 17. Nationally significant fauna with suitable habitat in the study area

Species	Suitable habitat within the study area	Closet known records
Striped Legless Lizard	Areas of suitable tussock structure, cracking soils and embedded rock without major disturbance from ploughing.	No records within 10 kilometres of study area.
Growling Grass Frog	Still or water flowing waterbodies with emergent vegetation	Within creeks adjacent to Hamilton High (6 kilometres from the study area).
Golden Sun Moth	Areas supporting a moderate cover (i.e. 20-40%) of Wallaby-grass, Spear-grass and other native perennial species	Teesdale Sheoak Conservation Reserve (approximately 5 kilometres from the study area)

3.2.2.1 Striped Legless Lizard

No Striped Legless Lizards were detected within the study area during the targeted survey (Table 18). Reptiles recorded during the surveys were the Tussock Skink *Pseudemoia pagenstecheri* (State Significant), Eastern Blue-tongued Lizard *Tiliqua scincoides*, the Eastern Brown Snake *Pseudonaja textilis* and the Tiger Snake *Notechis scutatus* (Plate 22; Plate 23) (Figure 4b). An unidentified frog species and several House Mouse *Mus musculus* were also observed during the survey period (Figure 4b). The full results of the Striped Legless Lizard surveys are presented in Appendix 3.3.

While grassland habitats within the study area support habitat characteristics that is suitable for Striped Legless Lizard, given the absence of the species during the surveys, a resident population is unlikely to be present within the study area.

Table 18. Summary of Striped Legless Lizard survey results

Check #	1	2	3	4	5	6	7	8
Total number of Striped Legless Lizard	0	0	0	0	0	0	0	0

Plate 22. Eastern Brown Snake (Juvenile) located at Grid #5 (Ecology and Heritage Partners Pty Ltd 06/11/2020).

Plate 23. Eastern Blue-tongued Lizard located at Grid #7 Mown (Ecology and Heritage Partners Pty Ltd 06/11/2020).

3.2.2.2 *Growling Grass Frog*

Whilst no records of Growling Grass Frog were identified in the study area as part of the previous biodiversity assessment (Ecology and Heritage Partners 2020a), potential habitat for the species is present along Bruce Creek. Areas of fringing and emergent vegetation were present along the water's edge, which can provide important habitat for Growling Grass Frog, which requires still to slow moving waters with intact emergent vegetation on the margins (DEHA 2009b).

Nocturnal Growling Grass Frog surveys were undertaken at five sites along Bruce Creek (Figure 6). The sites visited were identified during a preliminary assessment (undertaken on 17 November 2020) as supporting suitable habitat for the species (i.e. moderate to good water quality, moderate to good percentage cover of fringing, emergent and floating vegetation, presence of other refuge).

Habitat Assessment

Site 1 (Plate 24) consisted of a section of Bruce Creek that comprise relatively open water fringed by Rushes *Juncus* spp. and Hedge Wattle *Acacia paradoxa.* The water was relatively deep, but turbid with emergent vegetation including the native Common Reed *Phragmites australis* and the exotic Toowoomba Canary-grass *Phalaris aquatica.* Few refuges in the form of rocks or logs were noted during the assessment.

Site 2 (Plate 25) was dominated by fringing and emergent vegetation consisting of Rushes and Toowoomba Canary-grass with little open water present. Logs and rocks were observed along the creek banks, which would provide areas of refuge for the Growling Grass Frog.

Site 3 (Plate 26) comprised of a small area of still, open water fringed by Common Reeds. The water was clear, with little evidence of disturbance and a hollow dead tree (stag) also emerged from the water's edge. Site 4 (Plate 27) was fringed by Common Reeds and Rushes. The water quality was clear and logs and fallen litter were also evident along the edges of the site.

Site 5 (Plate 28) had a hollow tree stump partially submerged at the water's edge and was fringed by Rushes and Common Reeds. The water was turbid and rabbit warrens were observed to in close proximity to the creek side.

Table 19. Percentage cover of aquatic vegetation type at survey sites

Aquatic Vegetation Type	Site Number				
	1	2	3	4	5
Emergent (%)	25	20	5	5	0
Floating (%)	0	0	0	0	0
Open water (%)	50	0	80	80	40
Riparian Vegetation (%)	25	80	15	15	60

Table 20. Habitat features at survey sites

Habitat Features	Site Number				
	1	2	3	4	5
Water depth (metres)	0.5-1.0	0-0.5	0.5-1.0	0-0.5	0-0.5
Hydrology	Semi-permanent	Semi-permanent	Semi-permanent	Semi-permanent	Semi-permanent

Habitat Features	Site Number				
	1	2	3	4	5
Water flow	Slow	Still	Still	Still	Still
Litter	Absent	Absent	Absent	Absent	Absent
Introduced species	Unknown	Unknown	Unknown	Unknown	Unknown

Survey Results

Five Growling Grass Frog were detected during the targeted surveys, which were conducted when weather conditions were suitable (Table 21). A single Growling Grass Frog was heard calling at Site 5 on the first night of surveys, as were two additional Growling Grass Frogs at Site 4 (one heard to the north and one heard to the south of Site 4). The Eastern Pobblebonk Frog *Limnodynastes dumerilii* was also heard calling at Site 3 on both the first and second nights of surveys. During the third night of surveys, two Growling Grass Frog were heard; one calling at Site 5 and one at Site 1.

Growling Grass Frog individuals were recorded within areas of pooling water with fringing habitat, indicating that Bruce Creek supports a population of the species, and is likely used as a dispersal corridor. General frog activity was relatively low during all three survey events with less than 10 individuals heard calling on each occasion.

Table 21. Fauna species observed during targeted surveys

Date	Survey times	Temperature (°C) (start and finish)		Wind (km.h-1)	No. of days since rain	No. GGF	Other Species observed
25/11/2020	20:02 – 21:31	25.0	18.0	14.0	1	3	Eastern Pobblebonk Frog *Limnodynastes dumerilii*
26/11/2020	19:59 – 21:24	14.0	14.0	14.0	2	0	Eastern Pobblebonk Frog *Limnodynastes dumerilii*
03/12/2020	20:18 – 21:56	24.0	12	21.0	2	2	-

Plate 24. Site 1 along Bruce Creek (Ecology and Heritage Partners Pty Ltd 17/11/2020).

Plate 25. Site 2 along Bruce Creek (Ecology and Heritage Partners Pty Ltd 17/11/2020).

Plate 26. Site 3 along Bruce Creek (Ecology and Heritage Partners Pty Ltd 17/11/2020).

Plate 27. Site 4 along Bruce Creek (Ecology and Heritage Partners Pty Ltd 17/11/2020).

Plate 28. Site 5 along Bruce Creek (Ecology and Heritage Partners Pty Ltd 17/11/2020).

3.2.2.3 *Golden Sun Moth*

Patches of Plains Grassland within the study area generally displayed the most suitable habitat for Golden Sun Moth due to the presence of moderate quality vegetation and the increased abundance of the species' preferred food plant, Wallaby Grass, in combination with Chilean Needle Grass.

As such, targeted surveys for Golden Sun Moth were undertaken over four separate days during the known flight season on 3, 14, 15 and 21 December 2020. A total of eight Golden Sun Moth individuals were identified within the study area, with three individuals observed during the second survey and five individuals observed during the third survey. No individuals were observed on the first and fourth (final) surveys (Figure 5).

A summary of survey results, reference sites where Golden Sun Moth were known to be flying on the survey day, and weather conditions is given below in Table 22.

Table 22. Golden Sun Moth survey results

Date	Survey times	Reference Site	Temperature (°C) (start time and end time)		Wind (km/hr)	Cloud cover (%)	No. of days since rain	No. GSM
03/12/2020	12:26-15:25	Avalon / Bacchus Marsh	21.0	24.0	8	0	>2	0
14/12/2021	11:00-13:44	Avalon / Bacchus Marsh	31.0	34.0	24	0	>2	3
15/12/2021	11:19 – 14:22	Avalon / Bacchus Marsh	32.0	27.0	16	5	>2	5
21/12/2021	11:05-14:31	Avalon / Bacchus Marsh	22.5	21.0	13	0	>2	0

3.2.3 Ecological Communities

Five nationally listed ecological communities have the potential to occur within 10 kilometres of the study area (DCCEEW 2022).

- Grassy Eucalypt Woodland of the Victorian Volcanic Plain;
- Natural Damp Grassland of the Victorian Coastal Plains;
- Natural Temperate Grassland of the Victorian Volcanic Plain;
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains; and
- White Box-Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

Extensive survey was undertaken of all areas where it was considered likely that significant ecological communities could occur, with a particular focus on those areas identified by Ecology and Heritage Partners Pty Ltd (2020a) as potentially supporting the relevant community. The ecological assessments completed

identified a single nationally listed community to occur, the *Natural Temperate Grassland of the Victorian Volcanic Plain.*

Plains Grassy Woodland patches within the study area did not meet the diagnostic characteristics that define the nationally significant *Grassy Eucalypt Woodland of the Victorian Volcanic Plain* given the dominance of non-native grasses in the understorey, lack of community structure and poor native species diversity.

Although the *Grassy Eucalypt Woodland of the Victorian Volcanic Plain* and *Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains* communities have the potential to occur within the broader area, the on ground assessment determined them to be absent within the study area based on a lack of indicator species, structure, species diversity, and/or falling outside of the community's distribution.

3.2.3.1 Natural Temperate Grassland of the Victorian Volcanic Plain

Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) is an ecological community that is listed as 'Critically Endangered' under the EPBC Act. The vegetation of the NTGVVP is mostly limited to a ground layer of grasses and herbs. Large shrubs and trees are typically absent, and the ground layer is dominated by native tussock-forming perennial grasses (such as Kangaroo Grass, Spear-grasses *Austrostipa* spp. and Tussock-grasses *Poa* spp., with a variety of herbs (typically daisies, lilies and orchids) occupying the spaces among grass tussocks (TSSC 2008).

Condition Thresholds:

The listed Natural Temperate Grassland of the Victorian Volcanic Plain ecological community comprises those patches that meet the key diagnostic characteristics, above, and the condition thresholds, below.

- The total perennial tussock cover represented by the native grass genera *Themeda, Austrodanthonia, Austrostipa* or *Poa* is at least 50%; or,
- If the total perennial tussock cover represented by the above 4 native grass genera is less than 50%, then the ground cover of native forbs (wildflowers) is at least 50% of total vegetation cover during spring-summer (September to February); or,
- The cover of non-grass weeds is less than 30% of total vegetation cover at any time of the year.

A total of 6.37 hectares of *Natural Temperate Grassland of the Victorian Volcanic Plain* ecological community was recorded within the study area (Habitat Zones PG1, PG4 and PG5).

Although areas of PG4 recorded on site qualified as the nationally listed community, the relative diversity and structure of the patches only met the minimum conditions of cover and were relatively low in species diversity typically being defined by a combination of Wallaby Grass and Spear Grass and lacking an herb component.

The Zones PG2, PG3 and PG6 did not qualify as the listed ecological community as it was dominated by exotic perennial species forming greater than 50% cover, and therefore do not meet the criteria that defines the community.

3.2.4 Migratory Species

Migratory species listed under the EPBC Act are those protected under international agreements to which Australia is a signatory. These include the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA), the Republic of Korea Migratory Bird Agreement (ROKAMBA), and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered matters of NES under the EPBC Act.

No species of bird recognised under the migratory provisions of the EPBC Act were recorded during ecological surveys.

While migratory species of bird may occasionally inhabit the broader locality, the study area is not considered to be classed as an 'important habitat' as defined under the *EPBC Act Policy Statement 1.1 Principal Significant Impact Guidelines* (DoE 2013a), in that it does not contain:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- Habitat utilised by a migratory species which is at the limit of the species range; or,
- Habitat within an area where the species is declining.

3.2.5 Other Matters of NES

The study area does not support any other features corresponding with matters of NES protected under the EPBC Act (i.e. World or National Heritage Areas) (DCCEEW 2022).

3.3 State Significant Values

Biodiversity matters present within the study area that are considered of significance to the State of Victoria are outlined below.

3.3.1 Flora

The VBA contains records of 21 State-significant flora species within 10 kilometres of the study area (DELWP 2022a) (Appendix 2.4). The majority of these species are located outside of the study area in relatively high quality, undisturbed reserves such as the Bannockburn Flora and Fauna Reserve, or within rail corridors (Figure 7).

However, there is considered to be a moderate likelihood of occurrence within the study area for the following species (Table 23):

Table 22. State significant flora with moderate to high likelihood of occurrence.

Species	Suitable habitat within the study area	Closet known records
Cut-leaf Burr Daisy	Throughout the parcels adjacent to Bruce Creek	Approx. 1.7 kilometres north of the study area, within the rail corridor.
Small Scurf-pea	Throughout the parcels adjacent to Bruce Creek	Approx. 1.7 kilometres north of the study area, within the rail corridor.
Hairy Tails	Throughout the parcels adjacent to Bruce Creek	Approx. 1.7 kilometres north of the study area, within the rail corridor.

Three Melbourne Yellow-gum, listed as endangered under the FFG-Act were recorded within the study area along Charlton Road as part of this ecological assessment (Figure 2). This is in addition to the four Melbourne Yellow-gum identified as during the previous biodiversity assessment (Figure 2). Common Onion-orchid and Cotton Fireweed, protected under the FFG-Act were also recorded throughout the study area.

No other state listed species were recorded within the study area.

Given additional State significant species were not detected through ecological surveys undertaken by Ecology and Heritage Partners any populations within the study area that may occur are expected to be very small in numbers and possibly represented by only a few individuals. The likelihood of any remaining State significant species occurring within the study area is considered low due to the absence of suitable habitat and/or lack of documented records of these species within close proximity to the study area (Appendix 2.4).

3.3.2 Fauna

The VBA contains records of 21 State significant fauna species previously recorded within 10 kilometres of the study area (DELWP 2022a) (Appendix 3.2; Figure 8).

All historical records of state listed fauna species have been observed outside or adjacent to the study areas, with notable clusters within Bannockburn Flora and Fauna Reserve and Inverleigh Flora Reserve (Figure 8).

However, there is considered to be a moderate to high likelihood of occurrence within the study area for the following species (Table 24).

Table 24. State significant fauna with moderate to high likelihood of occurrence

Species	Suitable habitat within the study area	Closet known records
Tussock Skink	Plains Grassy Woodland/Plains Grassland along Bruce Creek	10 kilometres north-east of the study area
Hooded Robin	Creekline Grassy Woodland/ Plains Grassy Woodland along Bruce Creek	Three kilometres north-west of the study area
Diamond Firetail	Creekline Grassy Woodland/ Plains Grassy Woodland along Bruce Creek	Three kilometres north-west of the study area

Habitat for the above State significant species is mainly found in woodland and/or grassland areas within the study area. Areas of Plains Grassy Woodland and Creekline Grassy Woodland within the study area was of low quality and relatively degraded (i.e. understorey dominated by exotic vegetation) and Hooded Robin and Diamond Firetail were not observed during the ecological assessments undertaken by Ecology and Heritage Partners.

However, Tussock Skink, listed as Endangered under the Victorian FFG Act, was observed within the study area. Eight individuals were recorded as part of the targeted Striped Legless Lizard surveys. Further consideration of Tussock Skink and appropriate mitigation measures are detailed below.

Based on the results of the ecological surveys, habitat assessments and landscape context, the remaining State significant fauna species considered as having potential habitat within the project locality have been assessed as having a low likelihood of occurrence within the study area (Appendix 3.2). This determination is based on the modification of potential habitats and the findings of the on-ground assessments.

3.3.1 Ecological Communities

Field assessments confirmed the presence of one ecological community listed as threatened under the FFG Act.

3.3.1.1 Western (Basalt) Plains Grassland

Areas of Plains Grassland within the study area (PG1, PG4 and PG5) meet the description of the FFG Act-listed vegetation community *Western (Basalt) Plains Grassland*. Although there are no specific condition thresholds that defines the community, its presence was based on species diversity and overall cover of native species within any particular area (i.e. areas defined as PG1, PG4 and PG5).

Furthermore, given that this community can also include degraded areas heavily invaded by introduced grasses and weed species ('Degraded Western (Basalt) Plains Grassland community'), Habitat Zones PG2, PG3 and PG6 are also considered part of this community.

4 LEGISLATIVE AND POLICY IMPLICATIONS

4.1 *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

The EPBC Act is administered by the Commonwealth Department of Climate Change, Energy, Environment and Water (DCCEEW) and provides a national framework for the protection of heritage and the environment, and the conservation of biodiversity. The Act establishes a Commonwealth process for the assessment of proposed actions that are likely to have a significant impact on matters of National Environmental Significance (MNES), or on Commonwealth land. An action (i.e. - project, development, undertaking, activity, or series of activities), requires approval from the Commonwealth Environment Minister if it is likely to have a significant impact on any MNES, described in Table 25.

Table 25. Potential impacts to matters of National Environmental Significance (NES)

Matter of NES	Potential Impacts
World Heritage properties	The proposed action will not impact any properties listed for World Heritage.
National Heritage places	The proposed action will not impact any places listed for national heritage.
Ramsar wetlands of international significance	The study area is located 30 kilometres to the west of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site. Provided management practices and construction techniques are consistent with Construction Techniques for Sediment Pollution Control (EPA 1991) and Environmental Guidelines for Major Construction Sites (EPA 1996), the proposed action is unlikely to impact the ecological character of the Ramsar wetland.
Threatened species and ecological communities	No nationally significant flora were recorded during targeted surveys. Confirmed presence of two nationally significant fauna species: - Golden Sun Moth; - Growling Grass Frog; and, Confirmed presence of one nationally significant ecological community: - NTGVVP (6.37 hectares).
Migratory and marine species	While a number of species may occasionally forage or fly over habitat within the study areas it would not be classed as an 'important habitat' as defined under the EPBC Act Policy Statement 1.1 Principal Significant Impact Guidelines (DoE 2013).
Commonwealth marine area	The proposed action will not impact any Commonwealth marine areas.
Nuclear actions (including uranium mining)	The proposed action is not a nuclear action.
Great Barrier Reef Marine Park	The proposed action will not impact the Great Barrier Reef Marine Park.
Water resources impacted by coal seam gas or mining development	The proposed action is not a coal seam gas or mining development.

4.1.1 Implications For Confirmed Matters Of National Environmental Significance

4.1.1.1 Natural Temperate Grassland of the Victorian Volcanic Plain

A total of 6.37 hectares of the nationally significant ecological community Natural Temperate Grassland of the Victorian Volcanic Plain was recorded within the NGGA study area.

Potential impacts to the NTGVVP community as a result of future development and an assessment against the significant impact thresholds for the community detailed in DoE (2013) are provided below (Table 26).

Table 26. Significant Impact Guidelines 1.1 – Significant Impact Criteria for Endangered or Critically Endangered Ecological Communities (NTGVVP).

Significant Impact Guidelines 1.1 – Significant Impact Criteria for Endangered or Critically Endangered Ecological Communities (NTGVVP)	
Significant impact Criteria	**Comment**
1. Reduce the extent of an ecological community.	Any impact to NTGVVP should be referred under the EPBC Act
2. Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	Future development of the study area has the potential to fragment the ecological community
3. Adversely affect habitat critical to the survival of an ecological community.	Future development of the study area has the potential to adversely affect the ecological community
4. Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	Future development of the study area has the potential to alter surface water drainage patterns
5. Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.	Disturbance associated with any future development may cause a substantial change in the composition of the ecological community
6. Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:	Future development of the study area has the potential reduce the quality of the ecological community
a. assisting invasive species, that are harmful to the listed ecological community, to become established or;	
b. causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.	
7. Interfere with the recovery of an ecological community.	Future development of the study area may interfere with the recovery of the ecological community

Based on the above significant impact thresholds, any impact to the NTGVVP ecological community is likely to be assessed as a significant impact, and the action should be referred for assessment under the EPBC Act.

4.1.1.2 *Growling Grass Frog*

Targeted surveys identified the species' presence within the study area following surveys of Bruce Creek. A population of Growling Grass Frog was identified within Bruce Creek and supported suitable habitat for the species throughout the watercourse within the study area.

Given the confirmed presence of a viable population within the study area that is not isolated or fragmented from other habitats, it is considered that this population is an 'important population' as described in the significant impact guidelines for the species (DEWHA 2009d).

Potential impacts to Growling Grass Frog as a result of future development and an assessment against the significant impact thresholds for the species detailed in DEWHA (2009) are provided below (Table 27).

Table 27. Significant impact thresholds for Growling Grass Frog (DEWHA 2009d).

Ecological element affected	Impact Threshold
Habitat degradation in an area supporting an important population	Permanent removal or degradation of terrestrial habitat within 200 metre of a waterbody in temperate regions that results in the loss of dispersal or overwintering opportunities for an important population.
	Alteration of aquatic vegetation, diversity or structure that leads to a decrease in habitat quality.
	Alteration to wetland hydrology, diversity and structure.
	Introduction of predatory fish and/or disease agents.
Isolation and fragmentation of populations	Net reduction in the number and/or diversity of waterbodies available to a population.
	Removal or alteration of available terrestrial or aquatic habitat corridors.
	Construction of physical barriers to movement between waterbodies, such as roads or buildings.

To mitigate against a potential impact to Growling Grass Frog and associated habitats, a buffer of at least 200 metres should be applied from confirmed habitat along each bank of Bruce Creek. Frogs are known to use terrestrial areas for foraging and overwintering.

Indirect impacts to the quality of the species' habitat caused by alterations to the hydrology of Bruce Creek must also be carefully mitigated. Increased or decreased flows into potential habitat may alter the diversity and structure of riparian vegetation (i.e. fringing and emergent vegetation used for foraging and breeding), change the pH of the water, and decrease water quality through increased sedimentation and siltation. A summary of mitigation measures that should be considered as part of any future development are summarised in Section 5.

If any of the thresholds detailed in Table 27 are exceeded, then the proposed action may result in a significant impact to Growling Grass Frog.

4.1.1.3 *Golden Sun Moth*

Approximately 6.324 hectares of confirmed Golden Sun Moth habitat is present within the study area (Figure 5b). In addition, approximately 1.480 hectares of potential Golden Sun Moth habitat is present along Levy Road (Figure 5b).

Systematic surveys for the species within areas of suitable habitat and at an appropriate time of year recorded a total of eight Golden Sun Moth individuals.

An assessment of the potential impacts against the significant impact guidelines for the Golden Sun Moth is provided in Table 28 below.

Table 28. Assessment against the Significant Impact Guidelines for the vulnerable Golden Sun Moth (DoE 2013).

Significant Impact Criteria	Comment
An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:	
1. Disrupt the breeding cycle of an 'important population',	The Project Site is not considered to support an ' important population' as: - The population is not necessary for the species' long-term survival or recovery; - A key source population for breeding or dispersal is not present; - The population is not considered necessary to maintain genetic diversity; and - The population is not at the limit of the species range (DAWE 2021) Therefore, the breeding and dispersal capabilities of this population are unlikely to be affected or compromised by any future proposed development.
2. Lead to a long-term decrease in the size of an important population of a species	The Project Site is not considered to support an ' important population'. It is highly unlikely that any future action will lead to a long-term decrease in the size of the population. However, it must be acknowledged that the accidental loss of several larvae may occur during habitat removal.
3. Reduce the area of occupancy of an important population	The Project Site is not considered to support an ' important population'. Future development may result in a reduction of the area of occupancy of the existing population at this location, however, fragmentation of existing populations or habitat is unlikely to occur.
4. Fragment an existing important population into two or more populations	
5. Adversely affect habitat critical to the survival of a species	The proposed action will not adversely affect habitat critical to the survival of the species.
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Although some areas of confirmed habitat may be impacted as a result of future works, the extent and overall quality of surrounding areas of Golden Sun Moth habitat is not likely to be affected provided appropriate management during the construction process ensures weed species, pollutants and/or pathogens are not inadvertently spread into areas supporting known habitat.
7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Any future works areas not likely to interfere with the ecological processes or recovery of areas considered to be habitat for Golden Sun Moth. Appropriate management during the construction process will ensure weed species, pollutants and/or pathogens/diseases are not inadvertently spread into areas supporting known habitat.
8. Introduce disease that may cause the species to decline, or	

Significant Impact Criteria	Comment
9. Interfere substantially with the recovery of the species.	

Based on the above significant impact guidelines for the species, the study area is not considered to support an important population. However, any future development should seek to avoid impacts to Golden Sun Moth habitat where possible. Should any impacts be proposed, a further assessment against the significant impact thresholds should be undertaken.

4.2 *Environment Effects Act 1978* (Victoria)

The *Environment Effects Act 1978* (EE Act) provides for assessments of proposed actions that are capable of having a significant impact on the environment via the preparation of an Environment Effects Statement (EES). A project with potential adverse environmental effects that, individually or in combination, could be significant in a regional or State context should be referred.

4.2.1 Implications

Actions undertaken in accordance with a prescribed PSP are exempt from the requirements of the EE Act. Provided a PSP is prepared guiding future development within the Bannockburn Growth Area then a referral under the EE Act is not required.

4.3 *Flora and Fauna Guarantee Act 1988* (Victoria)

The FFG Act is the primary legislation dealing with biodiversity conservation and sustainable use of native flora and fauna in Victoria. Proponents are required to apply for an FFG Act Permit to 'take' listed and/or protected flora species, listed vegetation communities and listed fish species in areas of public land (i.e. within road reserves, drainage lines and public reserves). An FFG Act permit is generally not required for removal of species or communities on private land, or for the removal of habitat for a listed terrestrial fauna species.

4.3.1 *Flora and Fauna Guarantee Amendment Act 2019* (the Amendment Act)

Amendments to the Flora and Fauna Guarantee Act 1988 came into effect on 1 June 2020 following the passing of the Flora and Fauna Guarantee Amendment Act 2019 (the Amendment Act) through the Victorian Parliament in 2019. The Amendment Act was introduced to update the approach to conservation and regulation outlined in the original Act, and improve its relevance for protecting Victoria's biodiversity.

The Amendment Act now applies to both Crown land and freehold land that is managed by a public authority. Public authorities are defined as bodies established for a public purpose under any act, including administrative offices, departments, councils, public entities and state-owned enterprises. The amended Act contains an obligation or duty on public authorities and ministers to consider potential biodiversity impacts when exercising their function.

The Amendment Act introduces two categories of protected flora; 'restricted use protected flora', and all other protected flora (referred to as 'generally protected flora'). The Restricted Use category applies to species which are not currently threatened, but may be at risk of commercial or personal use if not managed accordingly.

This report has been updated to reflect the Amendment Act.

4.3.2 Implications

The FFG Act listed fauna species Growling Grass Frog and Golden Sun Moth were recorded across the study area. *Western (Basalt) Plains Grassland* was also recorded within the study area. A permit under the FFG Act will be required where impacts to listed FFG Act matters occur on public land. Furthermore, three Melbourne Yellow-gum, listed as endangered under the FFG-Act were recorded within the study area along Charlton Road as part of this ecological assessment (Figure 2). This is in addition to the four Melbourne Yellow-gum identified during the previous biodiversity assessment (Figure 2). Common Onion-orchid and Cotton Fireweed, protected under the FFG-Act were also recorded throughout the study area.

4.3.2.1 Implications under the Amendment Act

Actions which require a permit under the Amendment Act remain largely consistent with the original Act. A permit will still be required for impacts to protected or listed species and/or communities and areas of critical habitat on public land. However, under the Amendment Act, a permit will also be required where impacts to listed FFG Act matters occur on any freehold land that is managed by a public authority.

The Amendment Act introduces changes to the categories of protected flora, the way they are regulated, and the penalties associated with their protection.

With the creation of the 'restricted use protected flora' category under the amended FFG Act, the current protected flora list will be reviewed. As such, there is potential for protected flora species recorded within the study area to become categorised as 'restricted use protected flora,' and therefore experience changes to the way they are regulated, and the penalties associated with their protection. For the moment, all current protected flora will remain as 'generally protected flora' until this review is complete.

The Amendment Act includes no changes to the threatened communities or threatening processes listed under the FFG Act.

4.4 *Catchment and Land Protection Act 1994* (Victoria)

The *Catchment and Land Protection Act 1994* (CaLP Act) contains provisions relating to catchment planning, land management, noxious weeds and pest animals. Landowners are responsible for the control of any infestation of noxious weeds and pest fauna species to minimise their spread and impact on ecological values.

Weeds listed as noxious under the CaLP Act were recorded during the assessment (Willow, Chilean Needle-grass, African Box-thorn, Saffron Thistle, Artichoke Thistle, Serrated Tussock, Sweet Briar and Spiny Rush). Similarly, there is evidence that the study area is currently occupied by several pest fauna species listed under the CaLP Act (Red Fox and European Rabbit). Weed management and pest fauna management actions are likely to be required to be incorporated into any future Construction Environmental Management Plan (CEMP) as part of any future development of the study area.

5 MITIGATION MEASURES

As outlined in both State and Commonwealth policy, a project should be designed to take into consideration the three-step approach, which is:

- Avoid environmental impacts;
- Minimise impacts; and,
- Where impacts cannot be avoided or minimised, compensate for the residual impacts using other mitigation measures such as offsets.

5.1 Precinct Design Principles

At a broad scale, the following measures should be considered as part of the detailed design process for the future PSPs within the Bannockburn Growth Area:

- Retain areas of high conservation value:
- Large areas of native vegetation should be protected in habitat nodes;
- Provide a variety of flora and fauna habitats to promote and retain biodiversity;
- Undertake habitat creation (i.e. waterways, drainage lines and designated revegetation areas);
- Provide linear corridors of vegetation along walking/cycling tracks;
- Create linear habitat corridors along waterways/drainage lines/tributaries whilst implementing Water Sensitive Urban Design whilst ensuring no off-site impacts;
- Incorporating drainage lines into habitat corridors and open public spaces;
- Interpret/educate residents about values of grasslands through signage;
- Undertaken feral pest animal and plant control;
- Retain native trees in urban active and passive open space areas;
- Feature waterways/landscaping combination of a series of smaller connected basins rather than one large isolated basin.
- Investigate methods to interconnect spaces through Open Space Links to create more complete habitat;
- Rehabilitate and protect significant native vegetation;
- Ensure stormwater treatment is designed to provide habitat(s) for significant flora and fauna species;
- Investigate options to achieve high canopy coverage on public and private land (for example 40-50%); and,
- Connect biodiversity sites with parks/open spaces so they are separated from development.

5.2 Best Practice Mitigation Measures

Recommended measures to mitigate impacts upon terrestrial and aquatic values present within the study area may include:

- Control of noxious weeds within the study area should be an immediate priority to reduce further degrading impacts to the existing remnant ecological values present within the study area and surrounds;
- Consideration of Water Sensitive Urban Design techniques such as stormwater treatment wetlands, bio-retention systems, porous paving or swales;
- Minimise impacts to native vegetation and habitats through construction and micro-siting techniques, including fencing retained areas of native vegetation. If indeed necessary, trees should be lopped or trimmed rather than removed. Similarly, soil disturbance and sedimentation within wetlands should be avoided or kept to a minimum, to avoid, or minimise impacts to fauna habitats;
- Tree Retention Zones (TRZs) should be implemented to prevent indirect losses of native vegetation during construction activities (DSE 2011). A TRZ applies to a tree and is a specific area above and below the ground, with a radius 12 x the DBH. At a minimum standard a TRZ should consider the following:
    - A TRZ of trees should be a radius no less than two metres or greater than 15 metres;
    - Construction, related activities and encroachment (i.e. earthworks such as trenching that disturb the root zone) should be excluded from the TRZ;
    - Where encroachment exceeds 10% of the total area of the TRZ, the tree should be considered as lost and offset accordingly;
    - Directional drilling may be used for works within the TRZ without being considered encroachment. The directional bore should be at least 600 millimetres deep;
    - The above guidelines may be varied if a qualified arborist confirms the works will not significantly damage the tree (including stags / dead trees). In this case the tree would be retained, and no offset would be required; and,
    - Where the minimum standard for a TRZ has not been met an offset may be required.
- Ensure that best practice sedimentation and pollution control measures are undertaken at all times, in accordance with Environment Protection Agency guidelines (EPA 1991; EPA 1996; Victorian Stormwater Committee 1999) to prevent offsite impacts to waterways and wetlands; and,
- As indigenous flora provides valuable habitat for indigenous fauna, it is recommended that any landscape plantings that are undertaken as part of the proposed works are conducted using indigenous species sourced from a local provenance, rather than exotic deciduous trees and shrubs.

In addition to these measures, the following documents should be prepared and implemented prior to any construction activities:

- Construction Environmental Management Plan (CEMP). The CEMP should include specific species/vegetation conservation strategies, daily monitoring, sedimentation management, site specific rehabilitation plans, weed and pathogen management measures, etc.;
- Growling Grass Frog Conservation Management Plan (GGFCMP). The GGFCMP should detail how aquatic and terrestrial habitat along Bruce Creek will be protected, and enhanced to ensure any potential impacts to the population are mitigated pre, during and post development; and,
- Conservation Management Plan (CMP). One or more CMP's are likely to be required to detail how areas of retained high value biodiversity are protected, managed and enhanced as part of the PSP process. Any conservation area is likely to contain one or more of Golden Sun Moth and the NTGVVP ecological community. The CMP should specify management actions and timeframes associated with the protection and enhancement of the retained values. Where more than one matter of NES is present within a conservation area, the management actions proposed must be complementary to all relevant matters.

5.3 Specific Mitigation Measures

5.3.1 Protection of the Bruce Creek corridor

The Bruce Creek corridor should excluded from development and retained due to the suite of ecological values present, including the nationally significant Golden Sun Moth, Growling Grass Frog and the Natural Temperate Grassland of the Victorian Volcanic Plain ecological community.

Retained ecological values should be enhanced and managed to assist in creating a more diverse, connected and resilient natural environment through improving ecosystem health, and develop a more ecologically connected urban landscape. It is important that the enhancement of ecological values within the study area are not undermined through unrestricted and uncontrolled public access throughout retained areas.

Public access should be restricted to clearly defined shared community facilities (i.e. BBQ areas, play equipment etc) that are accessible via a connected network of shared paths (walking and cycling shared paths). Access to all other areas of retained high value native vegetation, revegetated areas and/or wetlands should be discouraged, and demarcated with informal signage and/or fencing where practical.

A summary of practically achievable ecological enhancement opportunities available within areas of retained vegetation and fauna habitat is provided below. It should be noted that the below is not intended to be a detailed plan of the works that should be undertaken, but rather a discussion on the key principals and management activities that would guide the future restoration of flora and fauna values within the Bannockburn Growth Area that could be considered as part of the preparation of any future PSPs.

5.3.1.1 Revegetation and Enhancement

The ecological assessment of the vegetation and habitat along the Bruce Creek corridor recorded several species of birds and habitat features that are absent within the broader study area. Bruce Creek has the potential to act as a 'habitat' or 'biodiversity corridor' for fauna species, as it can provide a continuous link of suitable habitat through an otherwise largely modified landscape.

Through strategic revegetation activities, there is an opportunity to reintroduce habitat features to the degraded riparian corridor along Bruce Creek and increase the carrying capacity of this existing corridor, and over time, result in the re-introduction of suitable habitat for avian and arboreal fauna back into this area.

In order to ensure any revegetation activities most closely represents the indigenous Creekline Grassy Woodland EVC present along Bruce Creek, it is recommended that the following species list are reviewed (Table 29).

Table 29. Species associated with the Creekline Grassy Woodland EVC suitable for revegetation.

Life Form	Species Name	Common Name
T	*Eucalyptus camaldulensis*	River Red-gum
T	*Acacia melanoxylon*	Blackwood
T	*Acacia dealbata*	Silver Wattle
MS	*Melicytus dentatus*	Tree Violet
LTG	*Austrostipa bigeniculata*	Kneed Spear-grass
LTG	*Poa labillardierei*	Common Tussock-grass
MTG	*Rytidosperma caespitosa*	Common Wallaby-grass
MTG	*Lomandra filiformis*	Wattle Mat-rush

Note. T = Tree; MS = Medium Shrub; LTG = Large Tufted Graminoid; MTG = Medium Tufted Graminoid;

Several patches of Plains Grassland EVC are also present throughout the study area. Many of these patches exhibit a low diversity of native flora, and are homogenous throughout in terms of habitat features and species dominance. In areas of Plains Grassland proposed to be retained, there is an opportunity to enhance these grasslands through the reintroduction a wide variety of (formerly) common grasses and herbs, which in turn, will increase the diversity and structure of the grasslands, and result in an increase in habitat suitability for native fauna.

In order to ensure any revegetation activities most closely represents the indigenous Plains Grasslands EVC, it is recommended that the following species list are reviewed (Table 30).

Table 30. Species associated with the Plains Grassland EVC suitable for revegetation.

Life Form	Species Name	Common Name
SS	*Pimelea curviflora*	Curved Rice-flower
PS	*Atriplex semibaccata*	Berry Saltbush
MH	*Maireana enchylaenoides*	Wingless Bluebush
MH	*Calocephalus citroides*	Lemon Beauty-heads
MH	*Acaena echinata*	Sheep's Burr
SH	*Goodenia pinnatifida*	Cut-leaf Goodenia
LTG	*Austrostipa bigeniculata*	Kneed Spear-grass
MTG	*Austrostipa scabra*	Rough Spear-grass
MTG	*Rytidosperma caespitosa*	Common Wallaby-grass
MTG	*Themeda triandra*	Kangaroo-grass

Note. SS = Small Shrub; PS = Prostrate Shrub; MH = Medium Herb; SH = Small Herb; LTG = Large Tufted Graminoid; MTG = Medium Tufted Graminoid.

5.3.2 Habitat Creation

Many species of wildlife rely on natural tree hollows for nesting, breeding and shelter. Hollows provide a safe home away from the weather and predators. In eucalypt trees, small hollows may take over 70 years to develop and large hollows many decades longer. The range of hollow sizes and types is matched by the range of wildlife able to use them – small species such as the Feathertail Glider use small hollows, large parrots such as the Sulphur-crested Cockatoo use large, deep hollows.

Nest boxes of varying types and sizes are an important aspect to wildlife conservation in that they provide additional habitat for hollow-dependant fauna in areas where hollows are in short supply, and in addition, support the persistence or reintroduction of a species in any areas where natural nesting hollows are not available.

Logs also provide an excellent habitat and food for many species and are extremely important for the proper function of a healthy ecosystem. Frogs, reptiles and small mammals use logs with hollows for shelter and a food resource. It is recommended that any trees that are proposed to be impacted by any future development within the Bannockburn Growth Area are repurposed for use as habitat logs within the Bruce Creek riparian corridor.

5.3.3 Riparian Corridor Enhancement

Given the degraded condition of the Bruce Creek corridor, an opportunity exists to revegetate and naturalise the vegetation adjacent to the Creekline (Table 7).

Further, within the existing creek corridor, there are opportunities to modify stream banks, introducing minor turbulence within stream, aeration and areas of slower calmer flows. Where possible, modification of stream banks should be located outside of areas supporting patches of native vegetation to avoid and minimise impacts to existing native vegetation as identified in Figure 2.

5.3.3.1 Growling Grass Frog

Growling Grass Frog habitat enhancement activities should be undertaken at strategic locations across the study area (e.g. along and adjacent to Bruce Creek) Detailed habitat design standards for Growling Grass Frog are outlined in the '*Growling Grass Frog Habitat Design Standards: Melbourne Strategic Assessment'* (DELWP 2017c). Although the study area is not within the area subjected to the Melbourne Strategic Assessment, these design standards are considered 'best practice', and where feasible, the standards should be used as a guideline when creating future habitats.

Additional mitigation measures should focus on:

- Maintenance of existing hydrological regimes;
- Enhancement of habitat quality through:
    - Weed removal;
    - Planting of native submergent, floating and emergent vegetation;
    - Maintenance of some areas of open (unvegetated) water;

- Exotic fish management; and,
- Improvement of terrestrial habitat through the provision of logs, rocks and riparian habitats.

The proposed nature of the development means that the areas adjacent to the development footprint may be subject to artificial lighting. If the development boundary is proposed to be located close to Bruce Creek, any potential impacts associated with light pollution should be appropriately mitigated to ensure there are not negative impacts to the existing Growling Grass Frog population and other fauna species. A Growling Grass Frog Conservation Management Plan (or similar) should be prepared to ensure that areas of confirmed habitat are retained, managed and enhanced appropriately.

5.3.4 Tussock Skink

To reduce the overall impacts to the species from proposed future development, areas of preferred habitat within the study area (i.e. the Plains Grassland, Creekline Grassy Woodland and Plains Grassy Woodland areas), should be retained and designated as No-Go Zones, and appropriate pre-clearance mitigation measures must be implemented to encourage Tussock Skink to move outside of impact areas into adjacent suitable habitat. These measures may include removing suitable habitat within the impact area by slashing grassland no more than 30 days or no less than 1 week prior to construction. Additionally, suitable habitat should not be removed during the breeding season for the species (October to January). If any Tussock Skink individuals are uncovered during construction, works should cease and the individual/s should be salvaged and relocated by an appropriately qualified ecologist.

6 SUMMARY OF ECOLOGICAL FEATURES

6.1 Flora

Detailed vegetation mapping completed across the study area recorded three Ecological Vegetation Classes (EVC) within the study area comprising 8.414 hectares of native vegetation, three Large Trees in patches and 87 scattered trees .

Sixty-six flora species (37 indigenous and 29 non-indigenous or introduced) were recorded within the study area during the field assessment. No nationally listed flora species were identified during the targeted surveys across study area. However, three Melbourne Yellow-gum, listed as endangered under the FFG-Act were recorded within the study area along Charlton Road as part of this ecological assessment (Figure 2). This is in addition to the four Melbourne Yellow-gum identified as during the previous biodiversity assessment (Figure 2). Common Onion-orchid and Cotton Fireweed, protected under the FFG-Act were also recorded throughout the study area.

6.2 Fauna

Ecological surveys of the study area recorded 21 species of fauna, comprising 16 native species (including two nationally significant and one State significant species) and five introduced species.

6.2.1.1 Striped Legless Lizard

Targeted surveys commenced on 2 October September and were completed on 26 November 2020, with a total of 12 tile grids checked eight times.

Habitat within the study area was considered suitable for Striped Legless Lizard, due to the presence of suitable tussock grass species which the species relies on for habitat and the extent of embedded rock.

However, despite targeted surveys being undertaken during optimal surveys conditions between October and November 2020, no individuals of the species were detected. Given the absence of the species during the surveys, a resident population is not likely within the study area.

However, Tussock Skink, listed as Endangered under the FFG Act, was recorded within the study area as part of the targeted Striped Legless Lizard surveys.

6.2.1.2 Growling Grass Frog

The results of the targeted surveys identified a small population of the nationally listed Growling Grass Frog that occurred throughout Bruce Creek within the study area. Individuals were recorded within areas of pooling water with fringing habitat. Although sections of Bruce Creek were dry, the entire extent of the creek within the study area is considered habitat for the species.

6.2.1.3 Golden Sun Moth

Eight individuals of the nationally listed Golden Sun Moth were recorded along the properties adjacent to Bruce Creek.

Patches of Plains Grassland within the study area generally displayed the most suitable habitat for Golden Sun Moth due to the presence of moderate quality vegetation and the increased abundance of the species' preferred food plant, Wallaby Grass, in combination with Chilean Needle Grass. In total, 6.324 hectares of confirmed habitat is present within the study area (Figure 5b).

6.3 Communities

6.3.1.1 Natural Temperate Grassland of the Victorian Volcanic Plain

A total of 6.37 hectares of *Natural Temperate Grassland of the Victorian Volcanic Plain* ecological community was recorded within the study area (Habitat Zones PG1, PG4 and PG5). These habitat zones also meet the description of the State significant vegetation community *Western (Basalt) Plains Grassland*.

Although areas of PG4 recorded on site qualified as the nationally listed community, the relative diversity and structure of the patches only met the minimum conditions of cover and were relatively low in species diversity typically being defined by a combination of Wallaby Grass and Spear Grass and lacking a herb component.

The Zones PG2, PG3 and PG6 did not qualify as the listed ecological community as it was dominated by exotic perennial species forming greater than 50% cover, and therefore failed to meet the criteria.

6.3.1.2 Western (Basalt) Plains Grassland

Areas of Plains Grassland within the study area (PG1, PG4 and PG5) meet the description of the FFG Act-listed vegetation community *Western (Basalt) Plains Grassland*. Although there are no specific condition thresholds that defines the community, its presence was based on species diversity and overall cover of native species within any particular area (i.e. areas defined as PG1, PG4 and PG5).

Furthermore, given that this community can also include degraded areas heavily invaded by introduced grasses and weed species ('Degraded Western (Basalt) Plains Grassland community'), Habitat Zones PG2, PG3 and PG6 are also considered part of this community.

As such, a total of 7.804 hectares of *Western (Basalt) Plains Grassland* was recorded within the study area.

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FIGURES

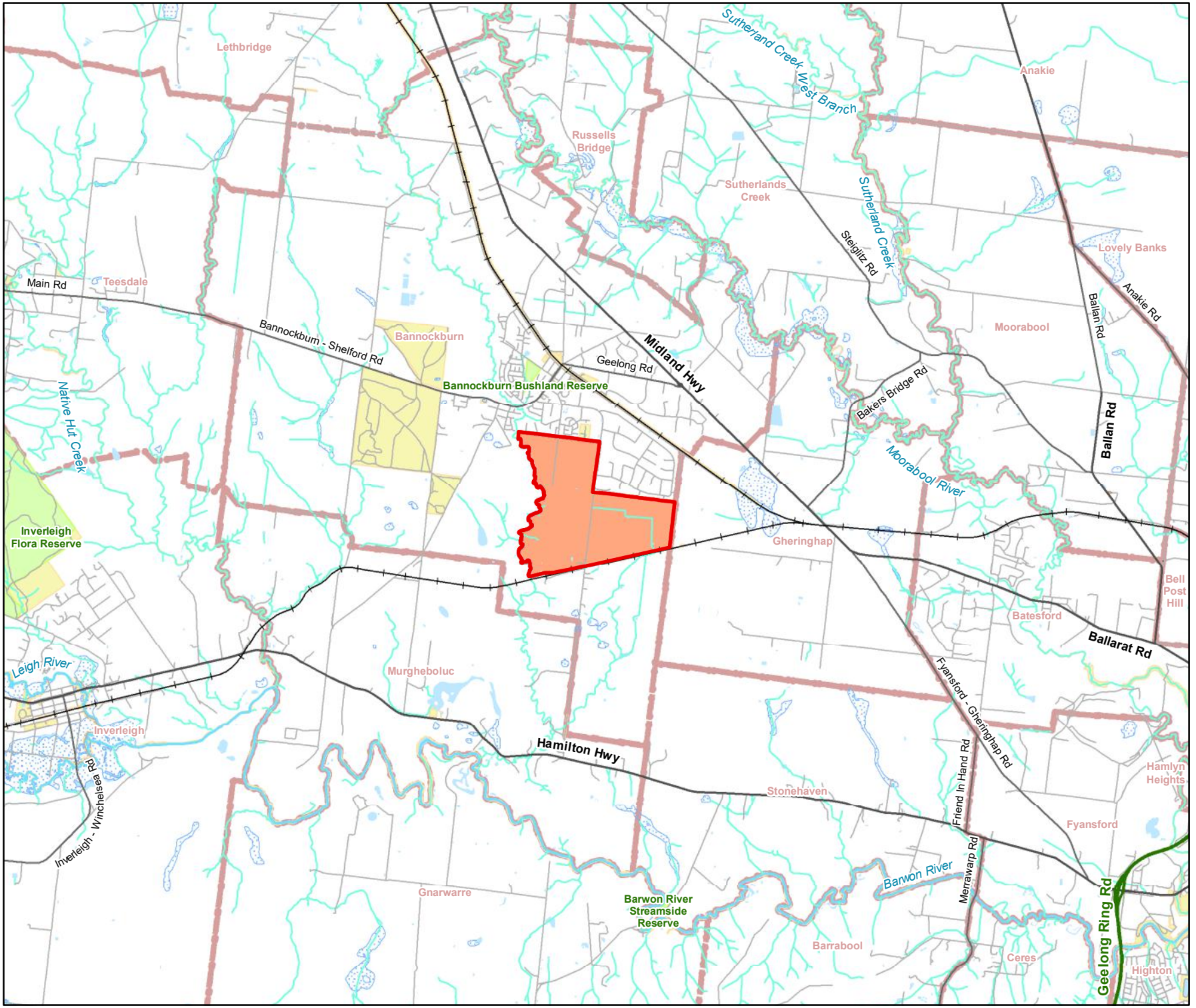


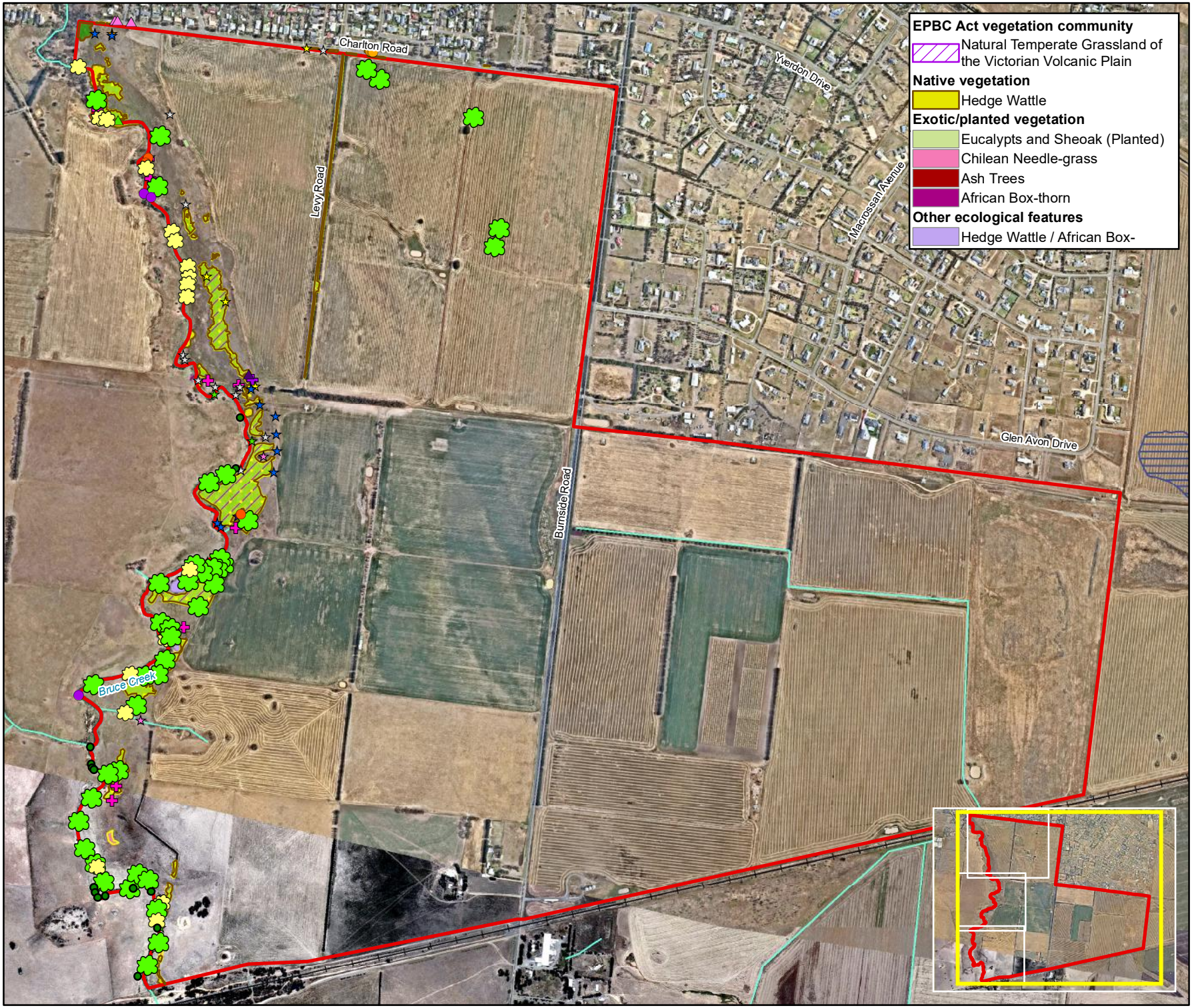
Figure 1

Location of the study area

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

ecology & heritage partners

14206_Fig01_StudyArea_f13226 3/09/2020 lroy



Legend

- Study Area
- Golden Sun Moth habitat
- <all other values>

Native vegetation

- Large Scattered Tree
- Small Scattered Tree
- Large Tree in patch
- Melbourne Yellow-gum
- River Red-gum (Recruit)
- Blackwood
- Bursaria
- Wallaby-grass (Scattered)

Exotic/planted vegetation

- African Box-thorn
- Artichoke Thistle
- Ash
- Serrated Tussock
- Spiny Rush
- Sweet Briar
- Willow

Other ecological features

- Fox Den
- Rabbit Warren

Ecological Vegetation Classes

- Plains Grassland (EVC 132_61)
- Plains Grassy Woodland (EVC 55)

Figure 2 Overview

Ecological features

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

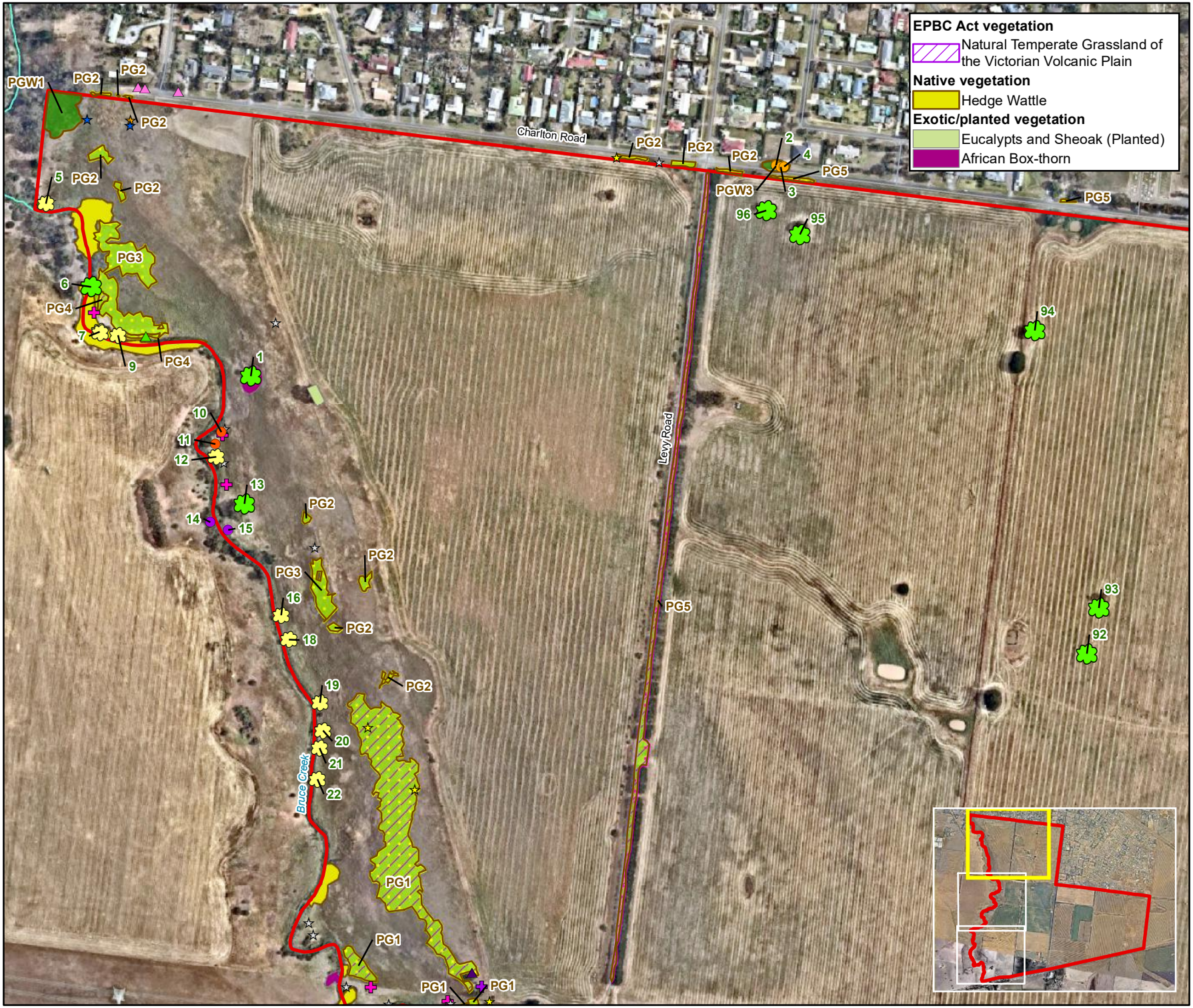
N

0 200 400

Metres

ecology & heritage partners

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Confirmed Golden Sun Moth habitat
- Potential Golden Sun Moth habitat

Native vegetation

- Large Scattered Tree
- Small Scattered Tree
- Large Tree in patch
- Melbourne Yellow-gum
- River Red-gum (Recruit)
- Blackwood
- Bursaria
- Wallaby-grass (Scattered)

Exotic/planted vegetation

- African Box-thorn
- Artichoke Thistle
- Serrated Tussock
- Sweet Briar

Other ecological features

- Fox Den
- Rabbit Warren

Ecological Vegetation Classes

- Plains Grassland (EVC 132_61)
- Plains Grassy Woodland (EVC 55)

Figure 2a

Ecological features

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

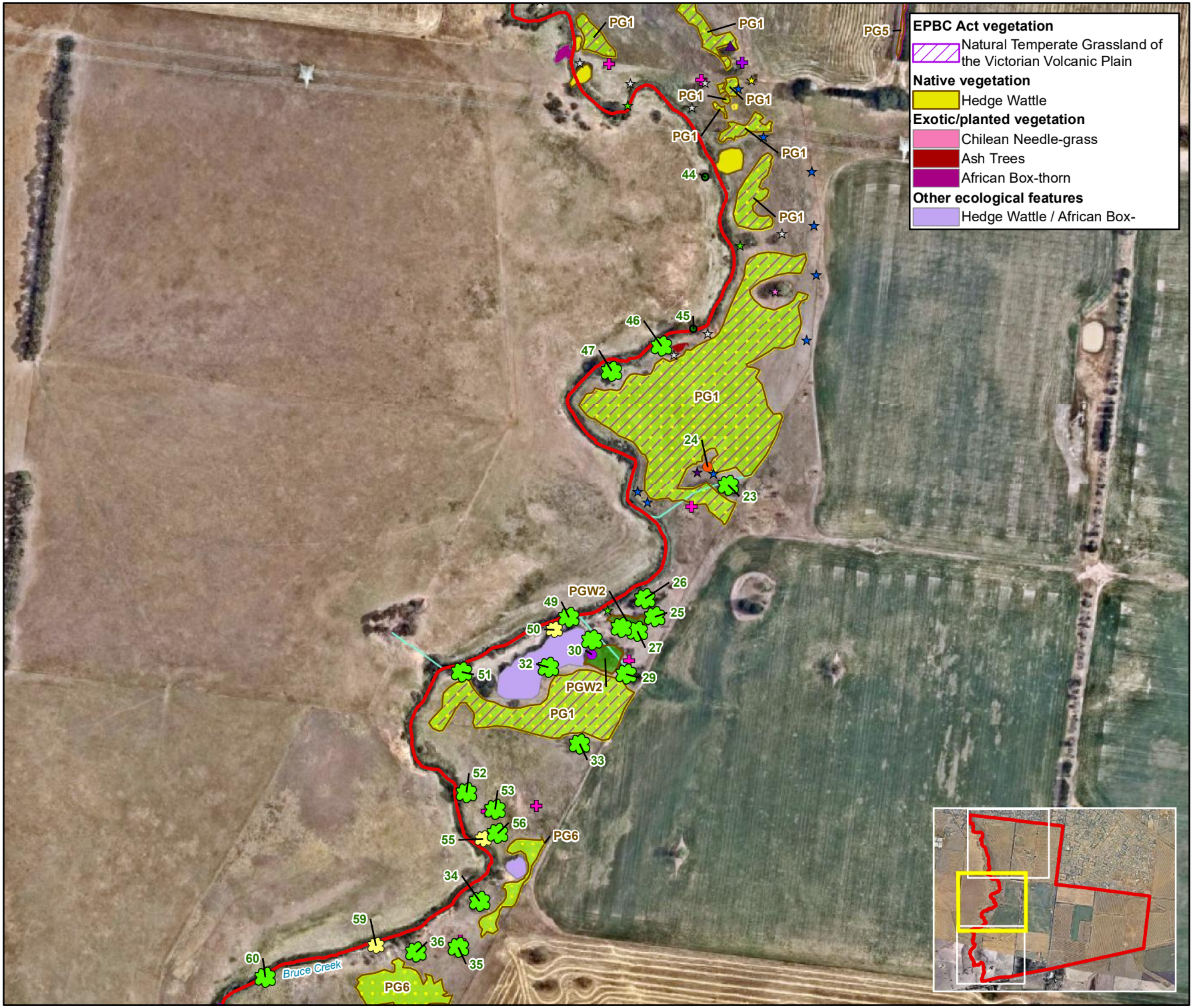
0 80 160

Metres

ecology & heritage partners

14206_Fig02_EcolFeat_MB 21/09/2022 melsley

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Confirmed Golden Sun Moth habitat
- Potential Golden Sun Moth habitat
- <all other values>

Native vegetation

- Large Scattered Tree
- Small Scattered Tree
- Large Tree in patch
- River Red-gum (Recruit)
- Bursaria

Exotic/planted vegetation

- African Box-thorn
- Ash
- Serrated Tussock
- Spiny Rush
- Sweet Briar
- Willow

Other ecological features

- Fox Den
- Rabbit Warren

Ecological Vegetation Classes

- Plains Grassland (EVC 132_61)
- Plains Grassy Woodland (EVC 55)

Figure 2b

Ecological features

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

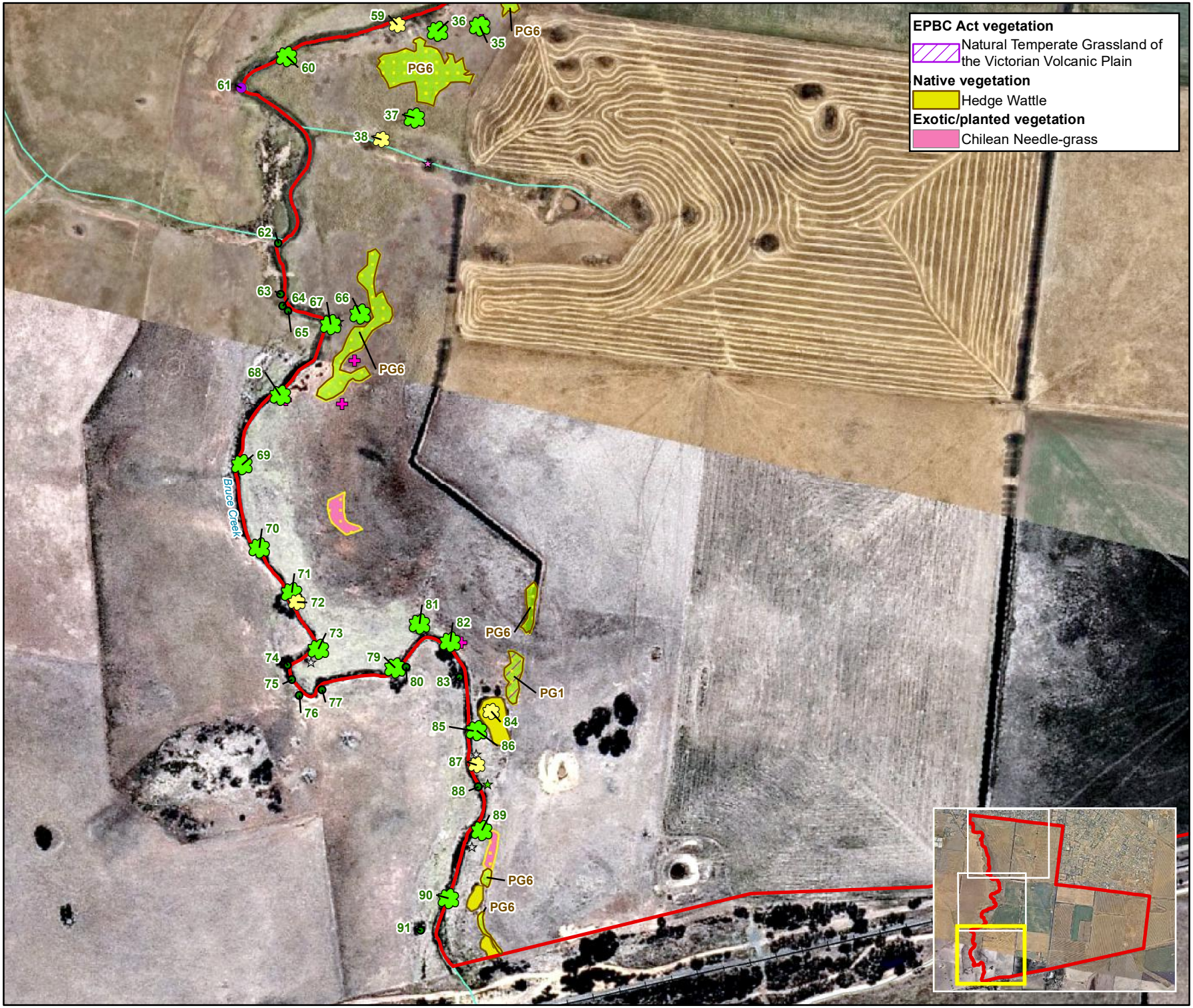
0 65 130

Metres

ecology & heritage partners

14206_Fig02_EcolFeat_MB 21/09/2022 melsley

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Confirmed Golden Sun Moth habitat
- <all other values>

Native vegetation

- Large Scattered Tree
- Small Scattered Tree
- Large Tree in patch

Exotic/planted vegetation

- African Box-thorn
- Ash
- Spiny Rush
- Willow

Other ecological features

- Rabbit Warren

Ecological Vegetation Classes

- Plains Grassland (EVC 132_61)

Figure 2c

Ecological features

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

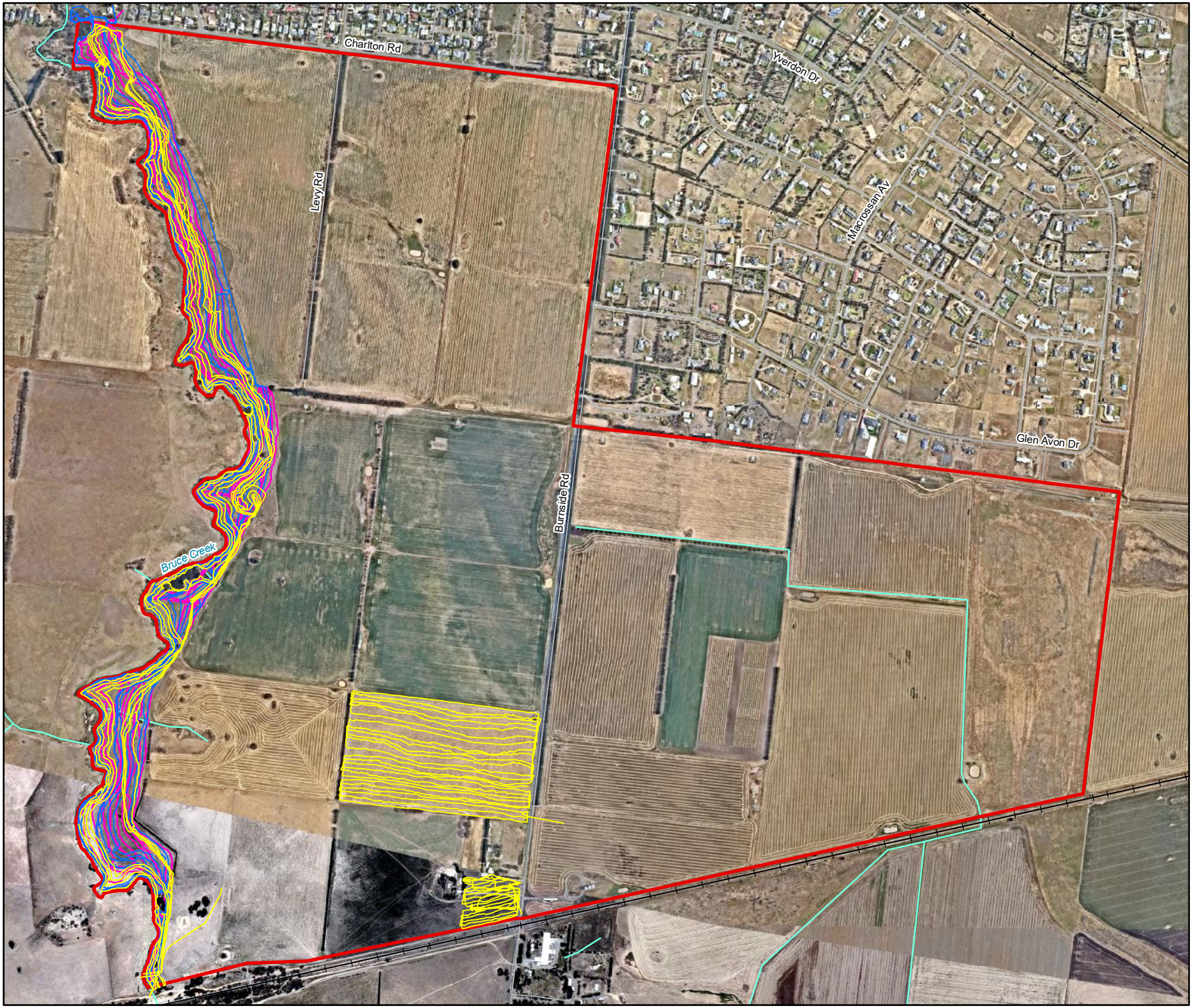
0 65 130

Metres

ecology & heritage partners

14206_Fig02_EcolFeat_MB 21/09/2022 melsley

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Spiny Rice-flower survey tracks
- Largeheaded Fireweed survey tracks
- Additional flora surveys (Button Wrinklewort, Matted Flax-lily, Adamson's Blown-grass, Cut-leaf Burr Daisy, Small Scurf-pea and Hairy Tails)

Figure 3

Flora surveys

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

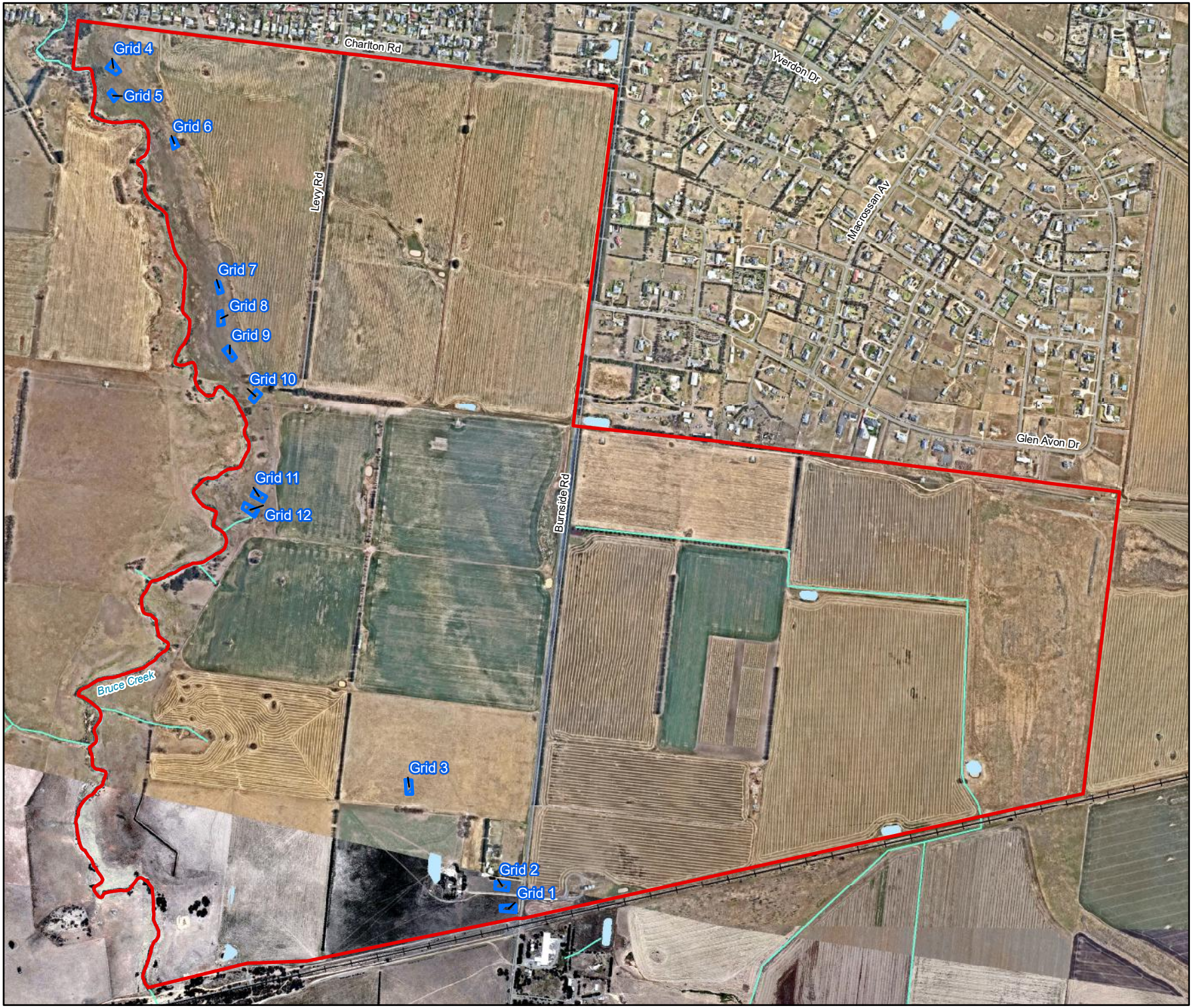
0 150 300

Metres

ecology & heritage partners

14206_Fig03_FloraSurveys 8/12/2020 melsley

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Striped Legless Lizard tile grids

Figure 4a

Striped Legless Lizard tile grid locations

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

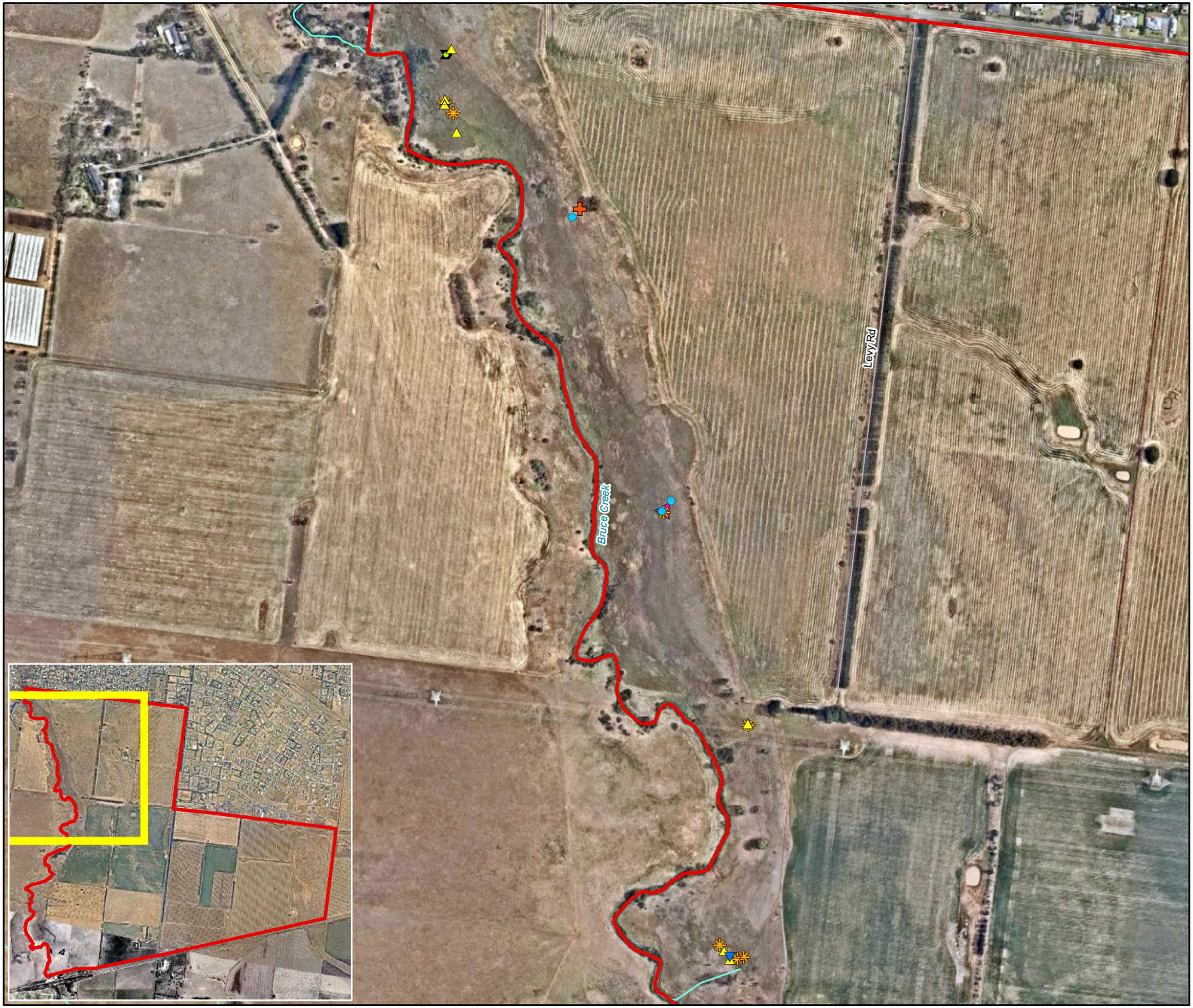
0 150 300

Metres

ecology & heritage partners

14206_Fig04a_TileGrid_Loc 8/12/2020 melsley

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area

Fauna recorded

- Eastern Blue-tongued Lizard
- Eastern Brown Snake (Juvenile)
- Frog (Unidentified)
- House Mouse
- Tussock Skink
- Snake (Unidentified)
- Tiger Snake and Eastern Blue-tongued Lizard

Figure 4b

Fauna recorded during the Striped Legless Lizard surveys

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

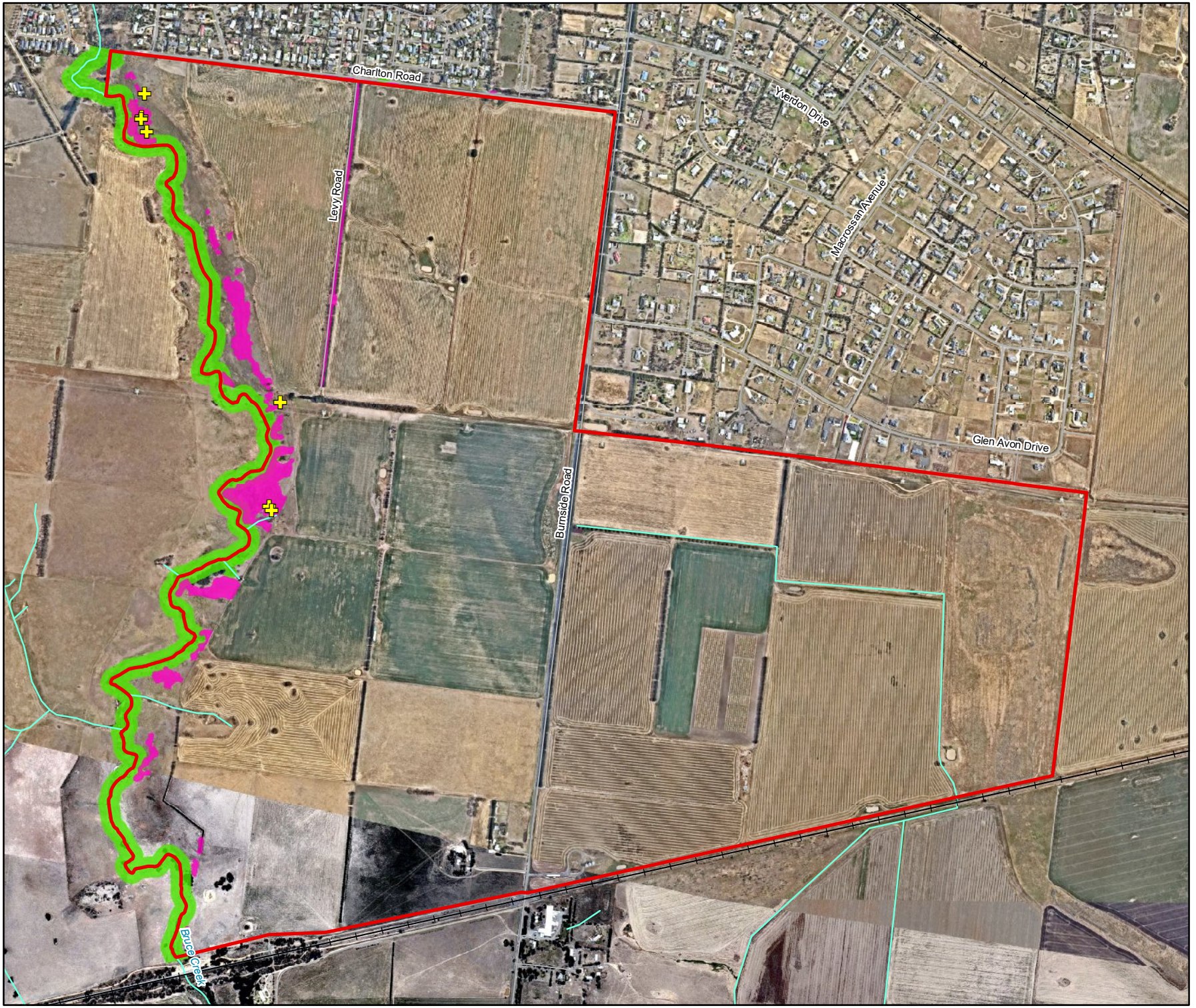
N

0 75 150

Metres

ecology & heritage partners

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Tussock Skink recorded

Tussock Skink habitat

- High quality
- Moderate quality

Figure 4c

Preferred Tussock Skink habitat

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

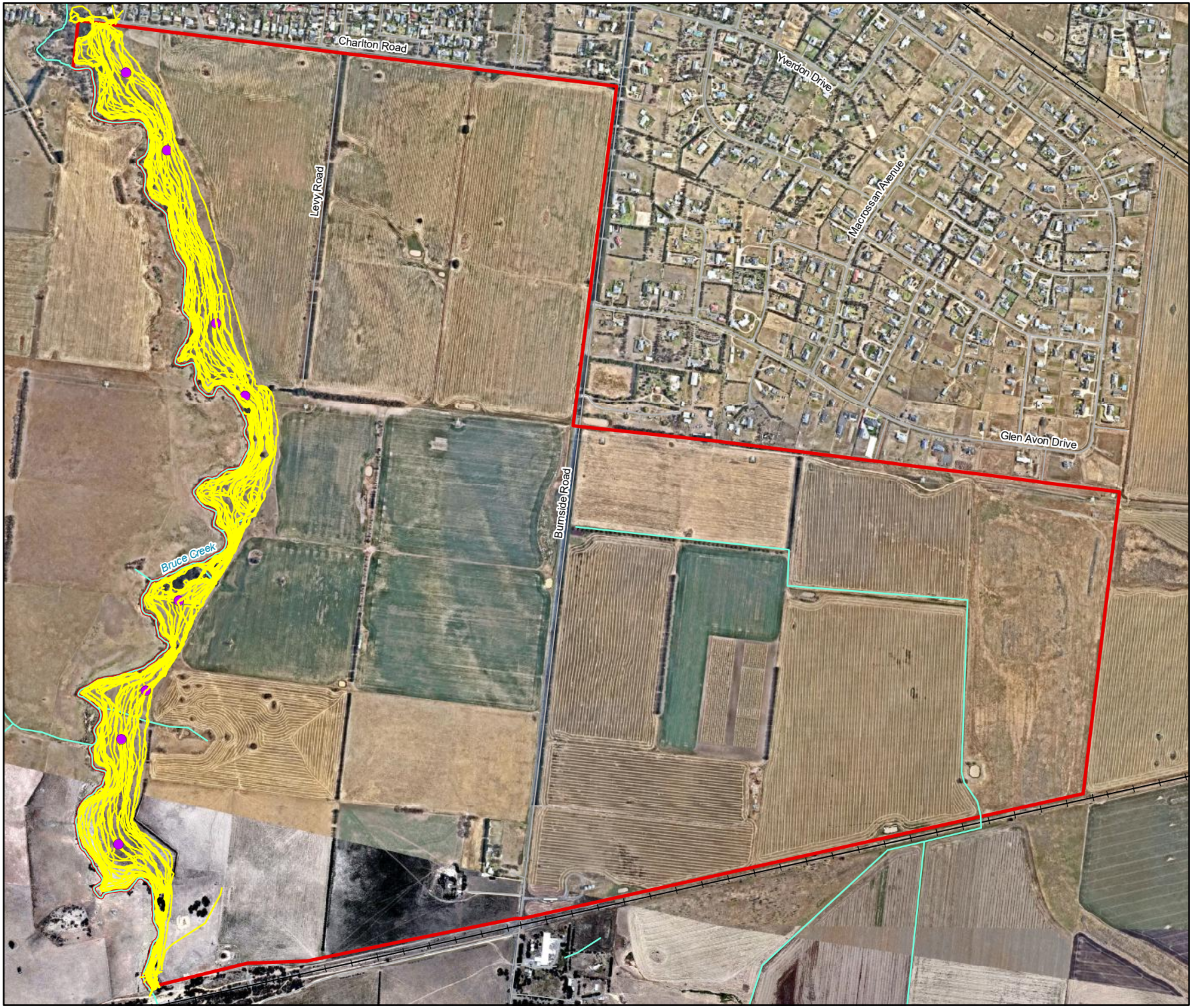
N

0 150 300

Metres

ecology & heritage partners

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Survey transects
- Golden Sun Moth records

Figure 5a

Golden Sun Moth surveys

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

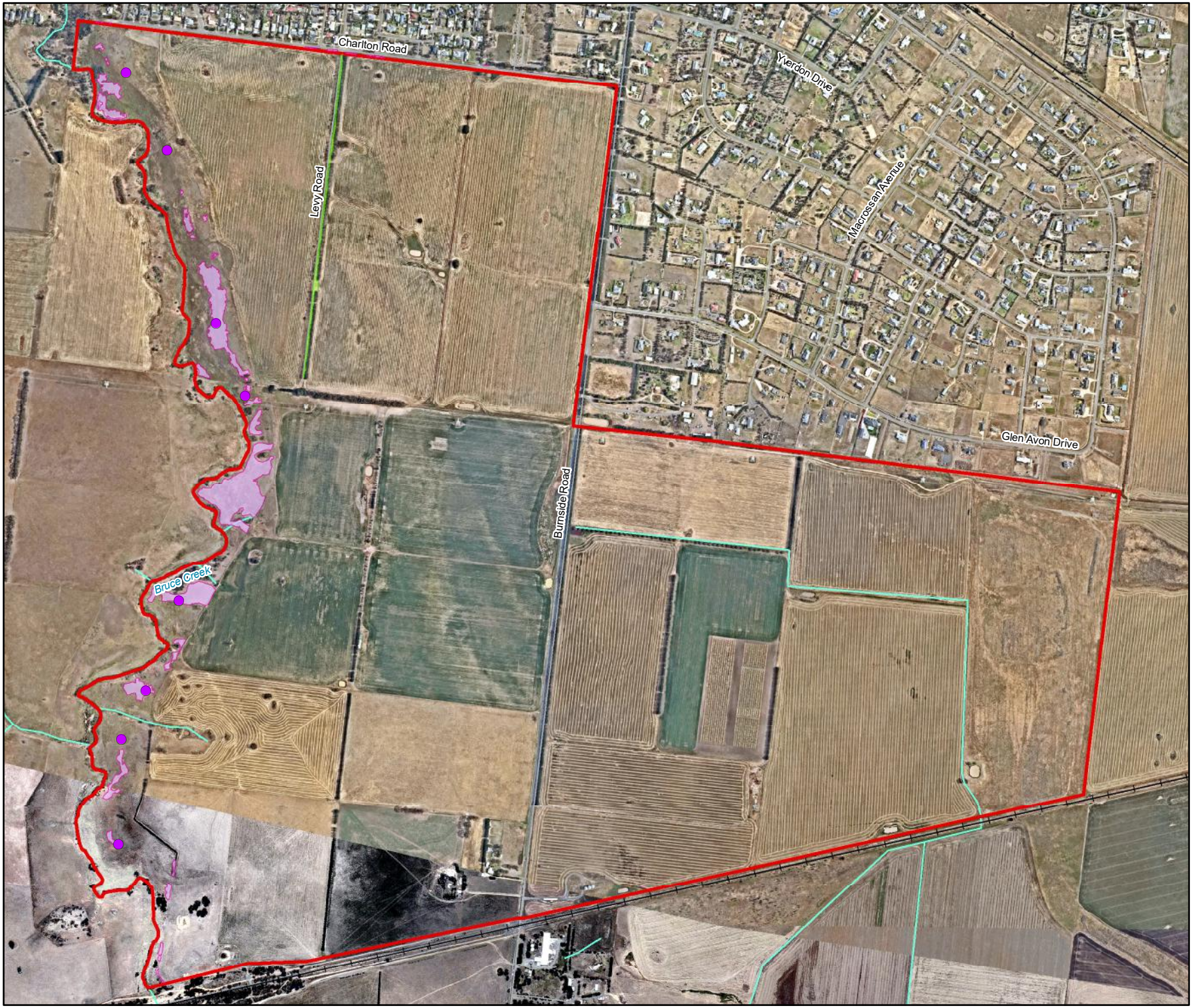
N

0 150 300

Metres

ecology & heritage partners

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Confirmed Golden Sun Moth habitat
- Potential Golden Sun Moth habitat
- Golden Sun Moth records

Figure 5b

Confirmed Golden Sun Moth habitat

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

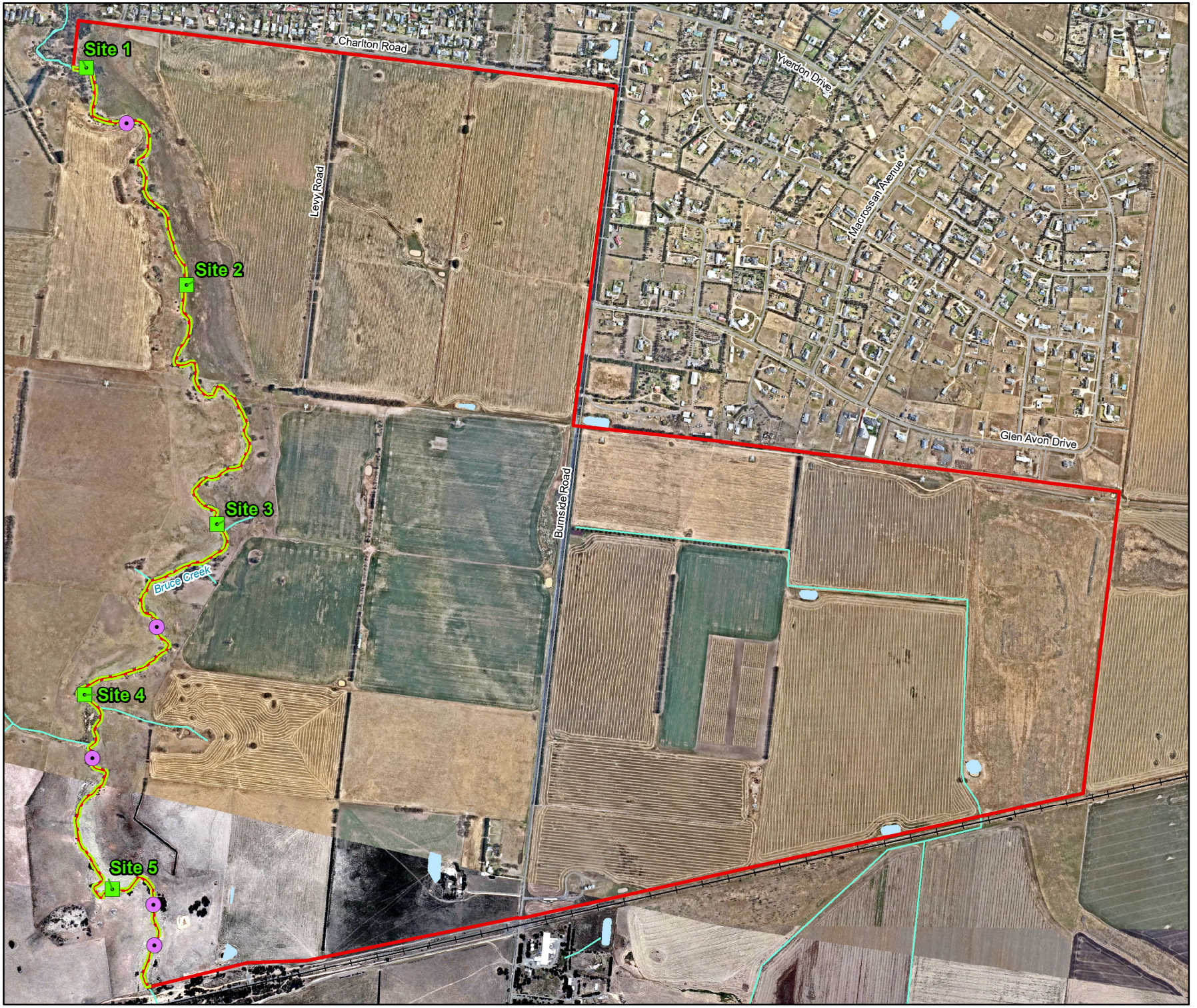
0 150 300

Metres

ecology & heritage partners

14206_Fig05b_GSM_Habitat 25/06/2024 melsley

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area
- Survey sites
- Growling Grass Frog records
- Confirmed Growling Grass Frog habitat

Figure 6

Growling Grass Frog surveys and confirmed habitat

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

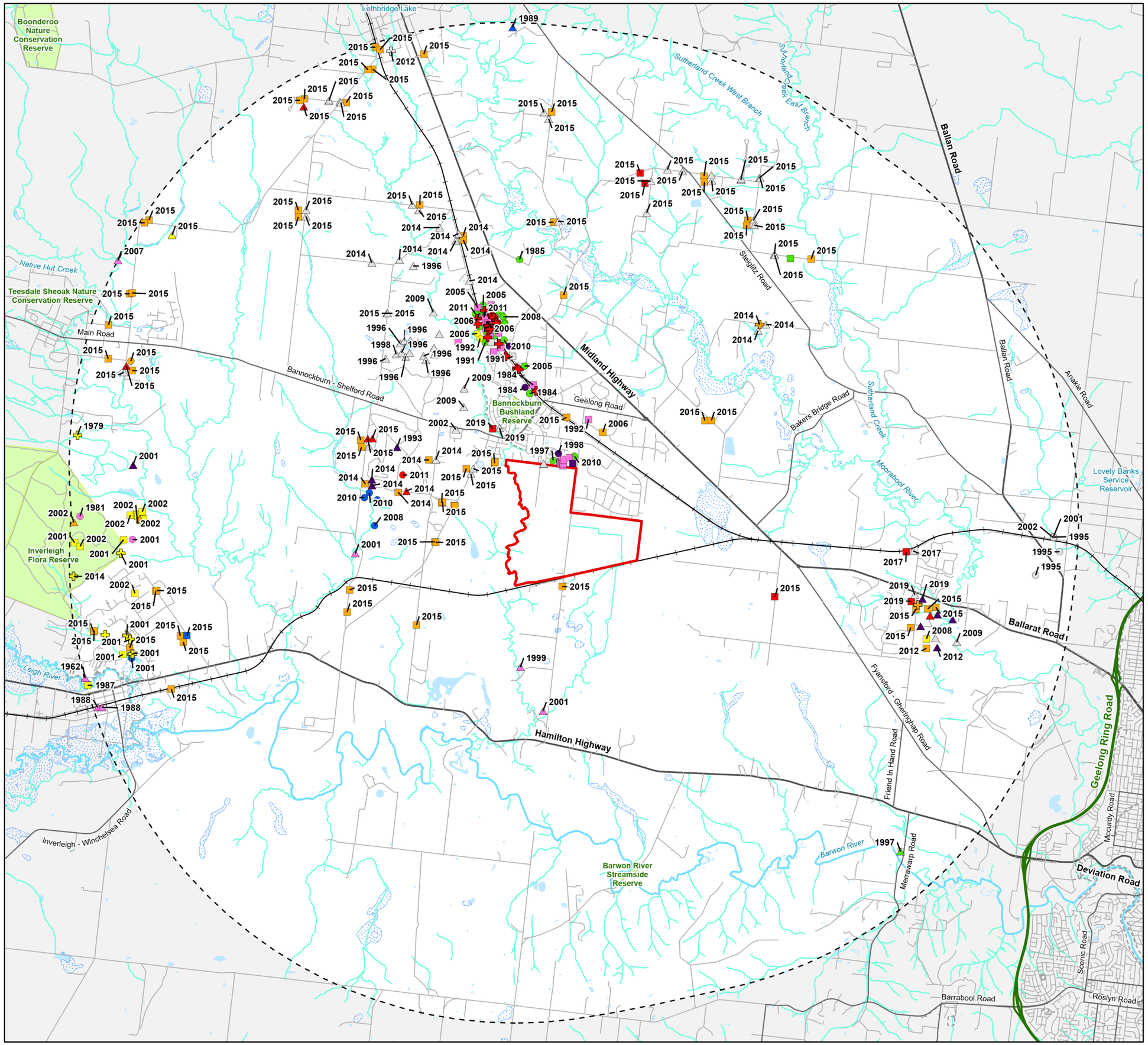
0 150 300

Metres

ecology & heritage partners

14206_Fig06_GGF_Surv_Hab 22/02/2021 psorensen

Aerial source: Nearmap 2019 (sourced 2020)



Legend

- Study Area

Significant flora

- Adamson's Blown-grass
- Bellarine Yellow-gum
- Bog Gum
- Branching Groundsel
- Button Wrinklewort
- Clover Glycine
- Crimson Sun-orchid
- Cut-leaf Burr-daisy
- Derrinallum Billy-buttons
- Fragrant Saltbush
- Giant Honey-myrtle
- Hairy Tails
- Hoary Rapier-sedge
- Large-fruit Yellow-gum
- Large-headed Fireweed
- Matted Flax-lily
- Melbourne Yellow-gum
- Mugga
- Purple Diuris
- Rough Wattle
- Salt Blown-grass
- Scented Bush-pea
- Small Scurf-pea
- Snowy Mint-bush
- Southern Blue-gum
- Spiny Rice-flower
- Spotted Gum
- White Sunray

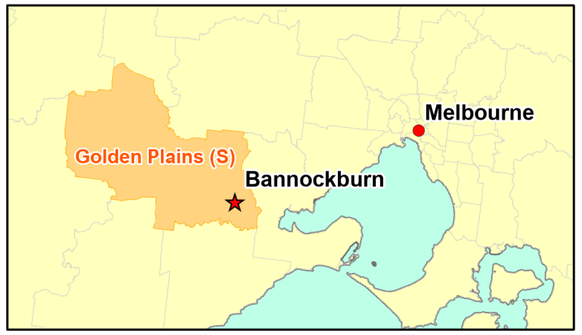


Figure 3

Previously documented significant flora within 10km of the study area

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

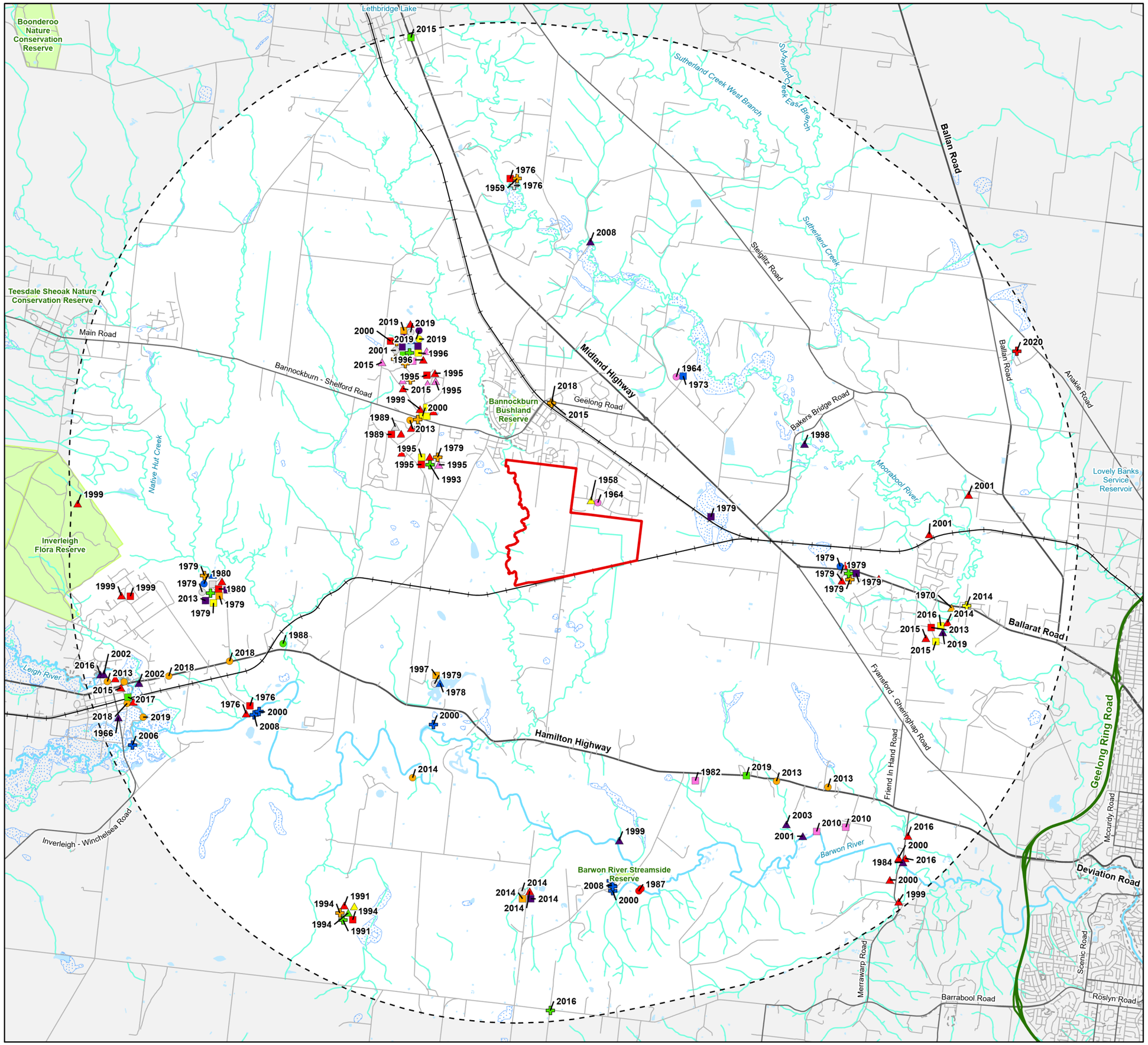
N

0 2 4

Kilometres

Map Scale: 1:83,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

ecology & heritage partners



Legend

- Study Area

Significant fauna

- Australasian Shoveler
- Australian Grayling
- Black Falcon
- Blue-billed Duck
- Brolga
- Caspian Tern
- Common Dunnart
- Common Greenshank
- Curlew Sandpiper
- Diamond Firetail
- Freckled Duck
- Gang-gang Cockatoo
- Grey Goshawk
- Grey-headed Flying-fox
- Growling Grass Frog
- Hardhead
- Hooded Robin
- Little Eagle
- Macquarie Perch
- Major Mitchell's Cockatoo
- Masked Owl
- Musk Duck
- Painted Honeyeater
- Platypus
- Speckled Warbler
- Striped Legless Lizard
- Swift Parrot
- White-bellied Sea-Eagle
- White-throated Needletail
- Yarra Pygmy Perch

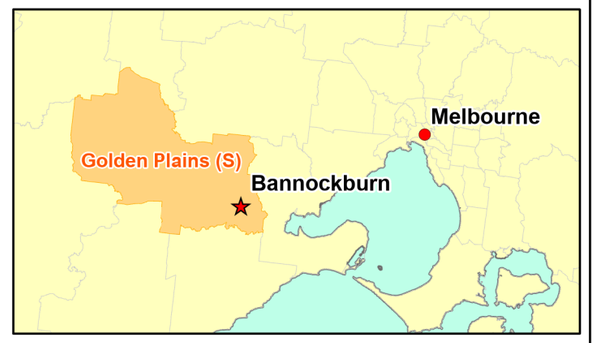


Figure 4

Previously documented significant flora within 10km of the study area

Targeted Surveys for the Bannockburn Growth Area (Southeast Section)

N

0 2 4

Kilometres

Map Scale: 1:83,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

ecology & heritage partners

APPENDICES

APPENDIX 1

Appendix 1.1 – Significance Categories for Nationally listed Taxa

Table A1.1. Significance categories for nationally significant taxa.

Rare or Threatened Categories
Conservation Status in Australia (Based on the EPBC Act)
EX - Extinct: Extinct is when there is no reasonable doubt that the last individual of the species has died.
CR - Critically Endangered: A species is critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
EN - Endangered: A species is endangered when it is not critically endangered but is facing a very high risk of extinction in the wild in the near future.
VU - Vulnerable: A species is vulnerable when it is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future.
R* - Rare: A species is rare but overall is not currently considered critically endangered, endangered or vulnerable.
K* - Poorly Known: A species is suspected, but not definitely known, to belong to any of the categories extinct, critically endangered, endangered, vulnerable or rare.

Appendix 1.2 – Defining Ecological Significance

Table A1.2. Criteria for defining Ecological Significance ratings for significant flora, fauna and communities.

National Significance
Flora: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. extinct, critically endangered, endangered, vulnerable).
Fauna: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. Extinct, Critically Endangered, Endangered, Vulnerable). Fauna listed as Extinct, Critically Endangered, Endangered, Vulnerable, or Rare under National Action Plans for terrestrial taxon prepared for DoE: threatened marsupials and monotremes (Maxwell et al. 1996), rodents (Lee 1995), bats (Duncan et al. 1999), birds (Garnett and Crowley 2000), reptiles (Cogger et al. 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).
Communities: Vegetation communities considered critically endangered, endangered or vulnerable under the EPBC Act and considering vegetation condition.
State Significance
Flora: Threatened taxa listed under the provisions of the FFG Act.
Fauna: Threatened taxon listed under Schedule 2 of the FFG Act. Listed as Lower Risk (Near Threatened, Conservation Dependent or Least concern) or Data Deficient under National Action Plans for terrestrial species prepared for the DoE: threatened marsupials and monotremes (Maxwell et al. 1996), rodents (Lee 1995), bats (Duncan et al. 1999), birds (Garnett and Crowley 2000), reptiles (Cogger et al. 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).
Communities: Ecological communities listed as threatened under the FFG Act. EVC listed as threatened (i.e. endangered, vulnerable) or rare in a Native Vegetation Plan for a particular bioregion (DSE 2013c) and considering vegetation condition.

Appendix 1.3 – Defining Site Significance

Table A1.3. Criteria for defining Site Significance ratings.

National Significance
A site is of National significance if: • It regularly supports, or has a high probability of regularly supporting individuals of a taxon listed as 'Critically Endangered' or 'Endangered' under the EPBC Act and/or under National Action Plans for terrestrial taxon prepared for the DoE. • It regularly supports, or has a high probability of supporting, an 'important population' as defined under the EPBC Act of one or more nationally 'vulnerable' flora and fauna taxon. • It is known to support, or has a high probability of supporting taxon listed as 'Vulnerable' under National Action Plans. • It is known to regularly support a large proportion (i.e. greater than 1%) of a population of a taxon listed as 'Conservation Dependent' under the EPBC Act and/or listed as Rare or Lower Risk (near threatened, conservation dependent or least concern) under National Action Plans. • It contains an area, or part thereof designated as 'critical habitat' under the EPBC Act, or if the site is listed under the Register of National Estate compiled by the Australian Heritage Commission. • It is a site which forms part of, or is connected to a larger area(s) of remnant native vegetation or habitat of national conservation significance such as most National Park, and/or a Ramsar Wetland(s).
State Significance
A site is of State significance if: • It occasionally (i.e. every 1 to 5 years) supports, or has suitable habitat to support taxon listed as 'Critically Endangered' or 'Endangered' under the EPBC Act and/or under National Action Plans. • It regularly supports, or has a high probability of regularly supporting (i.e. high habitat quality) taxon listed as 'Vulnerable', 'in Victoria (DELWP 2022b), or species listed as 'Data Deficient' or 'Insufficiently Known' under National Action Plans. • It contains an area, or part thereof designated as 'critical habitat' under the FFG Act. • It supports, or likely to support a high proportion of any Victorian flora and fauna taxa. • It contains high quality, intact vegetation/habitat supporting a high species richness and diversity in a particular bioregion. • It is a site which forms part of, or connected to a larger area(s) of remnant native vegetation or habitat of state conservation significance such as most State Parks and/or Flora and Fauna Reserves.
Regional Significance
A site is of Regional significance if: • It regularly supports, or has a high probability of regularly supporting regionally significant fauna as defined in Table 1.2. • Is contains a large population (i.e. greater than 1% or 5%) of flora considered rare in any regional Native Vegetation Plan for a particular bioregion. • It supports a fauna population with a disjunct distribution, or a particular taxon that has an unusual ecological or biogeographical occurrence. • It is a site which forms part of, or is connected to a larger area(s) of remnant native vegetation or habitat of regional conservation significance such as most Regional Parks and/or Flora and Fauna Reserves.
Local Significance
Most sites are considered to be of at least local significant for conservation, and in general a site of local significance can be defined as: • An area which supports indigenous flora species and/or a remnant EVC, and habitats used by locally significant fauna species. • An area which currently acts, or has the potential to act as a wildlife corridor linking other areas of higher conservation significance and facilitating fauna movement throughout the landscape.

Appendix 1.4 – Vegetation Condition and Habitat Quality

Table A1.4.1 Defining Vegetation Condition ratings.

Criteria for defining Vegetation Condition
High Quality: Vegetation dominated by a diversity of indigenous species, with defined structures (where appropriate), such as canopy layer, shrub layer, and ground cover, with little or few introduced species present.
Moderate Quality: Vegetation dominated by a diversity of indigenous species, but is lacking some structures, such as canopy layer, shrub layer or ground cover, and/or there is a greater level of introduced flora species present.
Low Quality: Vegetation dominated by introduced species, but supports low levels of indigenous species present, in the canopy, shrub layer or ground cover.

Table A1.4.2 Defining Habitat Quality.

Criteria for defining Habitat Quality
High Quality: • High degree of intactness (i.e. floristically and structurally diverse), containing several important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • High species richness and diversity (i.e. represented by a large number of species from a range of fauna groups). • High level of foraging and breeding activity, with the site regularly used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing low levels of disturbance and/or threatening processes (i.e. weed invasion, introduced animals, soil erosion, salinity). • High contribution to a wildlife corridor, and/or connected to a larger area(s) of high quality habitat. • Provides known, or likely habitat for one or more rare or threatened species listed under the EPBC Act or FFG Act.
Moderate Quality: • Moderate degree of intactness, containing one or more important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • Moderate species richness and diversity - represented by a moderate number of species from a range of fauna groups. • Moderate levels of foraging and breeding activity, with the site used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing moderate levels of disturbance and/or threatening processes. • Moderate contribution to a wildlife corridor, or is connected to area(s) of moderate quality habitat. • Provides potential habitat for a small number of threatened species listed under the EPBC Act or FFG Act
Low Quality: • Low degree of intactness, containing few important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • Low species richness and diversity (i.e. represented by a small number of species from a range of fauna groups). • Low levels of foraging and breeding activity, with the site used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing high levels of disturbance and/or threatening processes. • Unlikely to form part of a wildlife corridor, and is not connected to another area(s) of habitat. • Unlikely to provide habitat for rare or threatened species listed under the EPBC Act or FFG Act

Appendix 1.5 – *Flora and Fauna Guarantee Act 1988* Protected Species

Protected flora and fauna under the *Flora and Fauna Guarantee Act 1988* (FFG Act) are defined as those that have legal protection under the Act. Protected taxa, includes plants and animals from three sources:

- plant or animal taxa (species, subspecies or varieties) listed as threatened under the FFG Act;
- plant taxa belonging to communities listed as threatened under the FFG Act; and,
- plant taxa which are not threatened but require protection for other reasons.

Note that representative plants of a given community are protected as well as the community itself (for example scattered Wallaby-grasses *Rytidosperma* spp. are protected in degraded areas previously supporting the listed Western [Basalt] Plains Grassland Community.

Table A1.6 provides a list of plant groups protected under the FFG Act. For threatened plant species likely to occur within the study area refer to Appendix and for listed communities (or representative species) likely to occur within the study area refer to Section 3.4.

Table A1.6. Plant groups (Families, Genera and Kingdom Divisions) protected under the FFG Act (DELWP 2019).

Family/Genera	Common Name	Exclusions
Pteridophyta	Clubmosses, ferns and fern allies	Austral Bracken *Pteridium esculentum*
Asteraceae	Daisies	N/A
Ericaceae (formerly *Epacridaceae)*	Heaths	N/A
Orchidaceae	Orchids	N/A
Acacia	Wattles	*Acacia dealbata, Acacia decurrens, Acacia implexa, Acacia melanoxylon* and *Acacia paradoxa*
Baeckea	Baeckeas	N/A
Boronia	Boronias	N/A
Calytrix	Fringe-myrtles	N/A
Correa	Correas	N/A
Darwinia	Darwinias	N/A
Eremophila	Emu-bushes	N/A
Eriostemon	Wax-flowers	N/A
Gompholobium	Wedge-peas	N/A
Grevillea	Grevilleas	N/A
Prostanthera	Mint-bushes	N/A
Sphagnum	Sphagnum mosses	N/A
Stylidium	Trigger-plants	N/A
Thryptomene	Thryptomenes	N/A
Thysanotus	Fringe-lilies	N/A
Xanthorrhoea	Grass-trees	N/A

APPENDIX 2 - FLORA

Appendix 2.1 – Flora Results

Legend:

cr/en/vu Listed as critically endangered/endangered/vulnerable under the FFG Act (DELWP 2022b)
I Protected under the FFG Act (DELWP 2019);
***** Listed as a noxious weed under the CaLP Act;
w Weed of National Significance;
Planted Victorian and non-Victorian species;
****** Planted indigenous species in the study area.

Table A2.1. Flora within the study area.

Scientific Name	Common Name	Notes
INDIGENOUS SPECIES		
Acacia melanoxylon	Blackwood	-
Acacia paradoxa	Hedge Wattle	-
Acaena echinata	Australian Sheep's Burr	-
Allocasuarina sp.	Sheoak	**
Anthosachne scabra	Common Wheat-grass	-
Austrostipa bigeniculata	Kneed Spear-grass	-
Austrostipa nodosa	Knotty Spear-grass	-
Austrostipa scabra	Rough Spear-grass	-
Austrostipa sp.	Spear Grass	-
Bursaria spinosa subsp. *spinosa*	Sweet Bursaria	-
Convolvulus erubescens spp. agg.	Pink Bindweed	-
Dichelachne crinita	Long-hair Plume-grass	-
Drosera auriculata	Tall Sundew	-
Eryngium ovinum	Blue Devil	-
Eucalyptus camaldulensis	River Red-gum	-
Eucalyptus leucoxylon subsp. *connata*	Melbourne Yellow-gum	en
Eucalyptus sp.	Eucalypt	-
Geranium sp.	Crane's Bill	-
Juncus sp.	Rush	-
Microlaena stipoides var. *stipoides*	Weeping Grass	-
Microtis unifolia	Common Onion-orchid	I

Scientific Name	Common Name	Notes
Lachnagrostis filiformis s.l.	Common Blown-grass	-
Linum marginale	Native Flax	-
Lomandra filiformis	Wattle Mat-rush	-
Phragmites australis	Common Reed	-
Pimelea glauca	Smooth Rice-flower	-
Pimelea humilis	Common Rice-flower	-
Plantago gaudichaudii	Narrow Plantain	-
Poa labillardierei	Common Tussock-grass	-
Poa sp.	Tussock Grass	-
Rumex dumosus	Wiry Dock	-
Rytidosperma caespitosum	Common Wallaby-grass	-
Rytidosperma duttoniana	Brown-back Wallaby-grass	-
Senecio quadridentatus	Cotton Fireweed	I
Themeda triandra	Kangaroo Grass	-
NON-INDIGENOUS OR INTRODUCED SPECIES		
Acetosella vulgaris	Red Sorrel	-
Aira sp.	Hair Grass	-
Anthoxanthum odoratum	Sweet Vernal-grass	-
Arctotheca calendula	Cape Weed	-
Avena fatua	Wild Oat	-
Brassica sp.	Turnip	-
Briza maxima	Large Quaking-grass	-
Bromus sp.	Brome	-
Carduus acanthoides	Plumeless Thistle	-
Carthamus lanatus	Saffron Thistle	*
Cenchrus clandestinus	Kikuyu	-
Cynara cardunculus subsp. *flavescens*	Artichoke Thistle	*
Cynodon dactylon	Couch	-
Disa bracteata	South African Orchid	-
Eucalyptus cladocalyx	Sugar Gum	#
Fraxinus sp.	Ash	-
Holcus lanatus	Yorkshire Fog	-
Hypochaeris radicata	Flatweed	-
Juncus acutus subsp. *acutus*	Spiny Rush	*
Lolium sp.	Rye Grass	-

Scientific Name	Common Name	Notes
Lycium ferocissimum	African Box-thorn	*W
Nassella neesiana	Chilean Needle-grass	*W
Nassella trichotoma	Serrated Tussock	*W
Phalaris aquatica	Toowoomba Canary-grass	-
Plantago lanceolata	Ribwort	-
Rosa rubiginosa	Sweet Briar	*
Salix sp.	Willow	*W
Sonchus oleraceus	Common Sow-thistle	-
Trifolium sp.	Clover	-

Appendix 2.2 – Habitat Hectare Assessment

Table A2.2. Habitat Hectare Assessment

Vegetation Zone		PG1	PG2	PG3	PG4	PG5	PG6	CGW1	PGW1	PGW2	PGW3
Bioregion		VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC / Tree		PG(HS)	PG(HS)	PG(HS)	PG(HS)	PG(HS)	PG(HS)	CGW	PGW	PGW	PGW
EVC Number		132_61	132_61	132_61	132_61	132_61	132_61	68	55_61	55_61	55_61
EVC Conservation Status		En	En	En	En	En	En	Vu	En	En	En
Patch Condition	Large Old Trees /10	N/A	N/A	N/A	N/A	N/A	N/A	3	0	9	0
	Canopy Cover /5	N/A	N/A	N/A	N/A	N/A	N/A	4	2	2	2
	Under storey /25	5	5	5	5	5	5	5	5	5	0
	Lack of Weeds /15	4	0	4	9	9	4	2	4	9	4
	Recruitment /10	3	3	3	6	6	3	0	0	0	0
	Organic Matter /5	4	0	4	0	5	2	4	3	5	5
	Logs /5	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
	Treeless EVC Multiplier	1.36	1.36	1.36	1.36	1.36	1.36	1.00	1.00	1.00	1.00
	Subtotal =	21.76	10.88	21.76	27.20	34.00	19.04	18.00	14.00	30.00	11.00
Landscape Value /25		3	3	3	3	3	3	3	3	3	3
Habitat Points /100		25	14	25	30	37	22	21	17	33	14
Habitat Score		**0.25**	**0.14**	**0.25**	**0.30**	**0.37**	**0.22**	**0.21**	**0.17**	**0.33**	**0.14**

Appendix 2.3 – Scattered Trees and Large Trees in Patches

Table A2.3. Scattered Trees and Large Trees in Patches

Tree # (Figure 2)	Species Name	Common Name	DBH (cm)	Size Class	Scattered / Patch	Comments
1	*Eucalyptus camaldulensis*	River Red-gum	149	Large	Scattered	-
2	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	34.5	Small	Patch	Endangered under FFG Act
3	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	36	Small	Patch	Endangered under FFG Act
4	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	60	Small	Patch	Endangered under FFG Act
5	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
6	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
7	*Eucalyptus camaldulensis*	River Red-gum	67	Small	Scattered	-
8	*Eucalyptus camaldulensis*	River Red-gum	44	Small	Scattered	-
9	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
12	*Eucalyptus camaldulensis*	River Red-gum	33	Small	Scattered	-
13	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
14	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Patch	-
15	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Patch	-
16	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
17	-	Dead Stag	-	Small	Scattered	-
18	*Eucalyptus camaldulensis*	River Red-gum	36	Small	Scattered	-
19	*Eucalyptus camaldulensis*	River Red-gum	23	Small	Scattered	-
20	*Eucalyptus camaldulensis*	River Red-gum	23	Small	Scattered	-
21	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
22	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
23	*Eucalyptus camaldulensis*	River Red-gum	182	Large	Scattered	Eagles nest present

Tree # (Figure 2)	Species Name	Common Name	DBH (cm)	Size Class	Scattered / Patch	Comments
25	-	Dead Stag	97	Large	Scattered	-
26	*Eucalyptus camaldulensis*	River Red-gum	88	Large	Scattered	-
27	-	Dead Stag	-	Large	Scattered	-
28	-	Dead Stag	-	Large	Scattered	-
29	-	Dead Stag	-	Large	Scattered	-
30	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Patch	-
31	-	Dead Stag	105	Large	Scattered	-
32	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
33	*Eucalyptus camaldulensis*	River Red-gum	117	Large	Scattered	-
34	-	Dead Stag	122	Large	Scattered	Australian Wood Duck nesting in hollow
35	-	Dead Stag	137	Large	Scattered	-
36	-	Dead Stag	171	Large	Scattered	-
37	-	Dead Stag	123	Large	Scattered	-
38	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
39	-	Dead Stag	-	Small	Scattered	-
40	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
41	-	Dead Stag	-	Large	Scattered	-
42	-	Dead Stag	-	Small	Scattered	-
43	-	Dead Stag	-	Large	Scattered	-
44	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
45	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
46	-	Dead Stag	-	Large	Scattered	Beehive present
47	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
48	-	Dead Stag	-	Small	Scattered	-

Tree # (Figure 2)	Species Name	Common Name	DBH (cm)	Size Class	Scattered / Patch	Comments
49	*Eucalyptus camaldulensis*	River Red-gum	84	Large	Scattered	-
50	*Eucalyptus camaldulensis*	River Red-gum	49	Small	Scattered	-
51	-	Dead Stag	-	Large	Scattered	-
52	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
53	-	Dead Stag	110	Large	Scattered	-
54	*Eucalyptus camaldulensis*	River Red-gum	49	Small	Scattered	-
55	-	Dead Stag	79	Small	Scattered	-
56	-	Dead Stag	113	Large	Scattered	-
57	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
58	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
59	-	Dead Stag	-	Small	Scattered	-
60	-	Dead Stag	-	Large	Scattered	-
61	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
62	-	Dead Stag	-	Large	Scattered	-
63	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
64	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
65	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	
66	-	Dead Stag	-	Large	Scattered	-
67	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
68	-	Dead Stag	87	Large	Scattered	-
69	-	Dead Stag	-	Large	Scattered	-
70	-	Dead Stag87	-	Large	Scattered	-
71	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
72	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-

Tree # (Figure 2)	Species Name	Common Name	DBH (cm)	Size Class	Scattered / Patch	Comments
73	-	Dead Stag	-	Large	Scattered	-
74	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
75	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
76	-	Dead Stag	-	Large	Scattered	-
77	-	Dead Stag	-	Small	Scattered	-
78	-	Dead Stag	-	Large	Scattered	-
79	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
80	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
81	*Eucalyptus camaldulensis*	River Red-gum	118	Large	Scattered	-
82	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
83	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
84	*Eucalyptus camaldulensis*	River Red-gum	-	Small	Scattered	-
85	*Eucalyptus camaldulensis*	River Red-gum	74	Small	Scattered	-
86	*Eucalyptus camaldulensis*	River Red-gum	85	Large	Scattered	-
87	-	Dead Stag	-	Small	Scattered	-
88	-	Dead Stag	-	Large	Scattered	-
89	-	Dead Stag	82	Large	Scattered	-
90	-	Dead Stag	-	Large	Scattered	-
91	*Eucalyptus camaldulensis*	River Red-gum	-	Large	Scattered	-
92	-	Dead Stag	63	Small	Scattered	-
93	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	71	Small	Scattered	-
94	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	85	Large	Scattered	-
95	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	92	Large	Scattered	-
96	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	112	Large	Scattered	-

Appendix 2.4 – Significant Flora Species

Significant flora within 10 kilometres of the study area is provided in the Table A2.4.3 at the end of this section, with Tables A2.4.1 and A2.4.2 below providing the background context for the values in Table 2.4.3.

Table A2.4.1 Conservation status of each species for each Act. The values in this table correspond to Columns 5 and 6 in Table A2.4.3.

EPBC (*Environment Protection and Biodiversity Conservation Act 1999*):		FFG (*Flora and Fauna Guarantee Act 1988*):	
EX	Extinct	EX	Extinct
CR	Critically endangered	CR	Critically endangered
EN	Endangered	EN	Endangered
VU	Vulnerable	VU	Vulnerable
#	Listed on the Protected Matters Search Tool		

Table A2.4.2 Likelihood of occurrence rankings: Habitat characteristics assessment of significant flora species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area to determine their likelihood of occurrence. The values in this table correspond to Column 7 in Table A2.4.3.

1	Known Occurrence	• Recorded within the study area recently (i.e. within ten years).
2	High Likelihood	• Previous records of the species in the local vicinity; and/or, • The study area contains areas of high-quality habitat.
3	Moderate Likelihood	• Limited previous records of the species in the local vicinity; and/or • The study area contains poor or limited habitat.
4	Low Likelihood	• Poor or limited habitat for the species, however other evidence (such as lack of records or environmental factors) indicates there is a very low likelihood of presence.
5	Unlikely	• No suitable habitat and/or outside the species range.

Table A2.4.3 Significant flora recorded within 10 kilometres of the study area.

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	Likely occurrence in study area (post assessment)
NATIONAL SIGNIFICANCE						
Amphibromus fluitans #	River Swamp Wallaby-grass	-	-	VU	-	4
Caladenia pumila #	Dwarf Spider-orchid	-	-	CR	cr	4
Dianella amoena	Matted Flax-lily	1	2012	EN	cr	3
Dodonaea procumbens #	Trailing Hop-bush	-	-	VU	-	4
Glycine latrobeana	Clover Glycine	5	2010	VU	vu	4
Lachnagrostis adamsonii	Adamson's Blown-grass	9	2002	EN	en	4
Lepidium aschersonii #	Spiny Pepper-cress	-	-	VU	en	4
Lepidium hyssopifolium #	Basalt Pepper-cress	-	-	EN	-	4
Leucochrysum albicans subsp. *tricolor #*	White Sunray	10	2014	EN	en	4
Pimelea spinescens subsp. *spinescens*	Spiny Rice-flower	35	2015	CR	cr	3
Prasophyllum spicatum #	Dense Leek-orchid	-	-	VU	cr	5
Prasophyllum validum #	Sturdy Leek-orchid	-	-	VU	-	4
Pterostylis chlorogramma #	Green-striped Greenhood	-	-	VU	en	4
Pterostylis cucullate #	Leafy Greenhood	-	-	VU	-	4
Rutidosis leptorhynchoides	Button Wrinklewort	52	2011	EN	en	3
Senecio macrocarpus	Large-headed Fireweed	54	2016	VU	cr	3
Senecio psilocarpus #	Swamp Fireweed	-	-	VU	-	4
Thelymitra epipactoides #	Metallic Sun-orchid	-	-	EN	en	4
Thelymitra matthewsii #	Spiral Sun-orchid	-	-	VU	en	4

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	Likely occurrence in study area (post assessment)
Xerochrysum palustre #	Swamp Everlasting	-	-	VU	cr	5
STATE SIGNIFICANCE						
Acacia aspera subsp. *parviceps*	Rough Wattle	1	2015	-	en	4
Calotis anthemoides	Cut-leaf Burr-daisy	4	1998	-	cr	3
Corymbia maculata	Spotted Gum	2	2019	-	vu	4
Craspedia basaltica	Derrinallum Billy-buttons	2	1991	-	en	4
Cullen parvum	Small Scurf-pea	10	2007	-	en	3
Diuris punctata var. *punctata*	Purple Diuris	3	2002	-	en	4
Eucalyptus globulus subsp. *globulus*	Southern Blue-gum	1	2012	-	en	4
Eucalyptus kitsoniana	Bog Gum	1	2015	-	cr	4
Eucalyptus leucoxylon subsp. *bellarinensis*	Bellarine Yellow-gum	1	2011	-	cr	4
Eucalyptus leucoxylon subsp. *connata*	Melbourne Yellow-gum	68	2019	-	en	1
Eucalyptus leucoxylon subsp. *megalocarpa*	Large-fruit Yellow-gum	1	2015	-	cr	4
Eucalyptus sideroxylon subsp. *sideroxylon*	Mugga	6	2015	-	en	4
Lachnagrostis robusta	Salt Blown-grass	1	1997	-	en	5
Lepidosperma canescens	Hoary Rapier-sedge	1	2007	-	en	4
Melaleuca armillaris subsp. *armillaris*	Giant Honey-myrtle	64	2015	-	en	4
Prostanthera nivea var. *nivea*	Snowy Mint-bush	9	2019	-	vu	5
Ptilotus erubescens	Hairy Tails	19	2008	-	cr	3
Pultenaea graveolens	Scented Bush-pea	1	1989	-	en	4
Rhagodia parabolica	Fragrant Saltbush	6	2019	-	vu	4
Senecio cunninghamii var. *cunninghamii*	Branching Groundsel	2	2005	-	en	4
Thelymitra X macmillanii	Crimson Sun-orchid	3	2001	-	vu	4

Data source: Victorian Biodiversity Atlas (DELWP 2022a); Protected Matters Search Tool (DCCEEW 2022).

APPENDIX 3 - FAUNA

Appendix 3.1 – Fauna Results

Legend:

***** Introduced Species
H Heard
S Seen
en Listed as Endangered under the FFG Act
VU Listed as Vulnerable under the EPBC Act

Table A3.1. Fauna recorded within the study area

Common name	Scientific name	Notes
MAMMALS		
Eastern Grey Kangaroo	*Macropus giganteus*	S
European Rabbit	*Oryctolagus cuniculus*	*S
House Mouse	*Mus musculus*	*S
Sheep	*Ovis aries*	*S
Red Fox	*Vulpes vulpes*	*S
BIRDS		
Australian Magpie	*Cracticus tibicen*	S
Australian Wood Duck	*Chenonetta jubata*	S
Eastern Rosella	*Platycercus eximius*	S

Common name	Scientific name	Notes
Galah	*Eolophus roseicapilla*	S
House Sparrow	*Passer domesticus*	*S
Rainbow Lorikeet	*Trichoglossus haematodus*	S
Sulphur-crested Cockatoo	*Cacatua galerita*	S
Superb Fairy-wren	*Malurus cyaneus*	S
Willie Wagtail	*Rhipidura leucophrys*	S
AMPHIBIANS		
Growling Grass Frog	*Litoria raniformis*	H VU
Eastern Pobblebonk Frog	*Limnodynastes dumerilii*	H
REPTILES		
Eastern Blue-tongued Lizard	*Tiliqua scincoides*	S
Eastern Brown Snake	*Pseudonaja textilis*	S
Tiger Snake	*Notechis scutatus*	S
Tussock Skink	*Pseudemoia pagenstecheri*	S en
INVERTEBRATES		
Golden Sun Moth	*Synemon plana*	S VU

Appendix 3.2 – Significant Fauna Species

Significant fauna within 10 kilometres of the NGGA study area is provided in the Table A3.2.3 at the end of this section, with Tables A3.2.1 and A3.2.2 below providing the background context for the values in Table 3.2.3.

Table A3.2.1 Conservation status of each species for each Act/Plan. The values in this table correspond to Columns 5 to 7 in Table A3.2.3.

EPBC (*Environment Protection and Biodiversity Conservation Act 1999*):		FFG (*Flora and Fauna Guarantee Act 1988*):	
EX	Extinct	EX	Extinct
CR	Critically endangered	CR	Critically endangered
EN	Endangered	EN	Endangered
VU	Vulnerable	VU	Vulnerable
CD	Conservation dependent	CD	Conservation dependent
#	Listed on the Protected Matters Search Tool		

Table A3.2.2 Likelihood of occurrence rankings: Habitat characteristics assessment of significant fauna species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area to determine their likelihood of occurrence. The values in this table correspond to Column 7 in Table A3.2.3.

1	High Likelihood	• Known resident in the study area based on site observations, database records, or expert advice; and/or, • Recent records (i.e. within five years) of the species in the local area (DELWP 2018); and/or, • The study area contains the species' preferred habitat.
2	Moderate Likelihood	• The species is likely to visit the study area regularly (i.e. at least seasonally); and/or, • Previous records of the species in the local area (DELWP 2021); and/or, • The study area contains some characteristics of the species' preferred habitat.
3	Low Likelihood	• The species is likely to visit the study area occasionally or opportunistically whilst en route to more suitable sites; and/or, • There are only limited or historical records of the species in the local area (i.e. more than 20 years old); and/or, • The study area contains few or no characteristics of the species' preferred habitat.
4	Unlikely	• No previous records of the species in the local area; and/or, • The species may fly over the study area when moving between areas of more suitable habitat; and/or, • Out of the species' range; and/or, • No suitable habitat present.

Table A3.2.3 Significant fauna recorded within 10 kilometres of the NGGA study area.

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	Likely occurrence in study area (post assessment)
NATIONAL SIGNIFICANCE						
Australasian Bittern #	*Botaurus poiciloptilus*	-	-	EN	cr	4
Australian Fairy Tern #	*Sternula nereis nereis*	-	-	VU	-	4
Australian Grayling	*Prototroctes maraena*	3	1987	VU	en	3
Australian Painted Snipe #	*Rostratula australis*	-	-	EN	cr	4
Curlew Sandpiper	*Calidris ferruginea*	1	1977	CR	cr	4
Eastern Curlew #	*Numenius madagascariensis*	-	-	CR	cr	4
Dwarf Galaxias #	*Galaxiella pusilla*	-	-	VU	en	3
Gang-gang Cockatoo	*Callocephalon fimbriatum*	22	2016	EN	-	3
Golden Sun Moth #	*Synemon plana*	-	-	VU	vu	1
Grassland Earless Dragon #	*Tympanocryptis pinguicolla*	-	-	EN	cr	4
Grey Falcon #	*Falco hypoleucos*	-	-	VU	vu	3
Grey-headed Flying-fox	*Pteropus poliocephalus*	1	1973	VU	vu	3
Growling Grass Frog	*Litoria raniformis*	4	2010	VU	vu	1
Macquarie Perch	*Macquaria australasica*	1	1970	EN	en	4
Painted Honeyeater	*Grantiella picta*	19	2015	VU	vu	3
Pink-tailed Worm-lizard #	*Aprasia parapulchella*	-	-	VU	en	4

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	Likely occurrence in study area (post assessment)
Plains-wanderer #	*Pedionomus torquatus*	-	-	CR	cr	3
Regent Honeyeater #	*Anthochaera phrygia*	-	-	CR	cr	4
Southern Brown Bandicoot (eastern) #	*Isoodon obesulus obesulus*	-	-	EN	en	4
Spot-tailed Quoll #	*Dasyurus maculatus maculatus (SE mainland population)*	-	-	EN	-	4
Striped Legless Lizard	*Delma impar*	1	2020	VU	en	3
Swamp Antechinus (mainland) #	*Antechinus minimus maritimus*	-	-	VU	vu	4
Swift Parrot	*Lathamus discolor*	17	2017	CR	cr	4
White-throated Needletail	*Hirundapus caudacutus*	12	2016	VU	vu	4
Yarra Pygmy Perch	*Nannoperca obscura*	34	2008	VU	vu	3
Yellow-bellied Glider (south-eastern) #	*Petaurus australis australis*	-	-	VU	-	4
STATE SIGNIFICANCE						
Australasian Shoveler	*Spatula rhynchotis*	22	2019	-	vu	**3**
Black Falcon	*Falco subniger*	14	2019	-	cr	**3**
Blue-billed Duck	*Oxyura australis*	29	2019	-	vu	**4**
Brolga	*Antigone rubicunda*	1	1988	-	en	**4**
Caspian Tern	*Hydroprogne caspia*	5	1980	-	vu	**4**
Common Dunnart	*Sminthopsis murina murina*	2	1964	-	vu	**4**
Common Greenshank	*Tringa nebularia*	1	2019	-	en	**4**
Diamond Firetail	*Stagonopleura guttata*	38	2013	-	vu	**3**
Freckled Duck	*Stictonetta naevosa*	6	2019	-	en	**4**
Grey Goshawk	*Accipiter novaehollandiae*	8	2019	-	en	**3**

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	Likely occurrence in study area (post assessment)
Hairy Burrowing Crayfish	*Engaeus sericatus*	1	2008	-	vu	3
Hardhead	*Aythya australis*	46	2019	-	vu	3
Hooded Robin	*Melanodryas cucullata*	1	1989	-	vu	3
Little Eagle	*Hieraaetus morphnoides*	62	2016	-	vu	3
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	2	1979	-	cr	3
Masked Owl	*Tyto novaehollandiae*	2	1994	-	cr	3
Musk Duck	*Biziura lobata*	9	2019	-	vu	4
Platypus	*Ornithorhynchus anatinus*	11	2019	-	vu	3
Speckled Warbler	*Pyrrholaemus sagittatus*	2	2019	-	en	3
Tussock Skink	*Pseudemoia pagenstecheri*	1	2020	-	en	1
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	1	2014	-	en	3

Data source: Victorian Biodiversity Atlas (DELWP 2022a); Protected Matters Search Tool (DCCEEW 2022).

Appendix 3.3 – Striped Legless Lizard Survey Data

Table A3.3. Survey data and weather conditions for the Striped Legless Lizard Tile Checks

Check	Date	Weather Conditions				SLL	Other species
		Temp (°C)	Relative Humidity (%)	Above Tile Temp (°C)	Under Tile Temp (°C)		
1	2/10/2020	24.3	54	29.7	17.8	0	1x (Unidentified) Snake; 1x (Unidentified) Frog
2	9/10/2020	12.0	69	19.1	14.5	0	1x Tussock Skink; 1x Eastern Brown Snake
3	16/10/2020	11.9	64	24.5	16.6	0	1x Eastern Blue-tongued Lizard
4	22/10/2020	11.9	84	34.4	24.4	0	1x Tiger Snake; 2x Eastern Blue-tongued Lizard; 3x Tussock Skink; 1x Eastern Brown Snake
5	30/10/2020	16.5	76	30.7	22.1	0	1x Tussock Skink; 1x House Mouse; 1x Eastern Blue-tongued Lizard; 1x Eastern Brown Snake
6	6/11/2020	13.3	68	24.3	21.3	0	3x Tussock Skink; 2x Eastern Brown Snake; 1x Eastern Blue-tongued Lizard
7	18/11/2020	21.4	58	30.2	21.2	0	1x Eastern Brown Snake
8	26/11/2020	16.7	79	24.2	21.7	0	0