

Biodiversity Assessment
PART 2 – Ground-truthing
Creswick Township Structure Plan



FINAL
Report prepared for Hepburn Shire Council

September 2022

FINAL *Creswick Township Structure Plan – Biodiversity Assessment*

PART2 – Ground-truthing

September 2022

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EXECUTIVE SUMMARY

Practical Ecology Pty Ltd was commissioned by Hepburn Shire Council to undertake a biodiversity assessment within three areas of the Creswick Township. A detailed desktop analysis followed by ground-truthing was undertaken to identify ecological values across Investigation Areas 1–3 (Figure 1) to inform the future Creswick Township Structure Plan.

Creswick is fortunate to have large areas of natural habitat including grassland, woodland, forest and wetlands. Some of these areas likely represent threatened ecological communities listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or *Flora and Fauna Guarantee Act 1988* (FFG Act), as well as supporting listed species under both of these Acts (See Section 3.2). Maps 6–7, Appendix 1, show ecological values across the Investigation areas.

Key areas identified with high ecological value recommended for retention (as shown on Maps 6 and 7) include:

- Extensive areas of moderate to high quality forest and woodland (primarily Ecological Vegetation Class (EVC) 20: Heathy Dry Forest) throughout Areas 2b, 3b, 3c and 3d.
- An area of EVC 71: Hills Herb-rich Woodland which extends into both Investigation Areas 3a and 3b, either side of Ascot-Creswick Rd, which may represent an EPBC listed ecological community (Section 3.2.1).
- Several areas of EVC 55: Plains Grassy Woodland, in its woodland form, again likely to represent EPBC and FFG listed ecological communities and to support listed species.
- Moderate to high quality grassland in Areas 2a and 3a likely representing FFG and EPBC listed ecological communities. Between these areas, some lower quality areas would also be beneficial to retain to ensure connectivity.
- Long Point Bushland Reserve (Area 3a).
- Creswick Creek Corridor (Area 3a). Both Creswick Creek and nearby waterbodies such as the sewerage ponds, are known to support the listed Growling Grass Frog *Litoria raniformis* as well as listed bird species (See Section 3.4.3).
- Creswick Broomfield Rail Line Nature Conservation Reserve (Area 2a).
- Large trees both within woodland areas and scattered in cleared areas, especially those with hollows and crevices.
- Areas of rocky outcrop, particularly those within moderate to high quality grassland areas which are likely to provide habitat for fauna species in these areas.
- Pine plantation firebreaks that are identified in future surveys to support high quality derived grasslands.

The Investigation Areas were also assessed to have 17 listed flora species and 22 listed fauna species with at least a moderate likelihood of occurrence, with the presence of several of these species such the Golden Sun Moth *Synemon plana* and Growling Grass Frog well documented in the area (See Section 3.4.3).

It is strongly recommended that any rezoning or redevelopment ensures that the high value areas listed above are protected, enhanced and that connectivity between them is improved where possible. There are a number of opportunities for enhanced connectivity across the landscape as discussed in Section 5.3.

The development of habitat areas representative of EPBC listed ecological communities or likely to support listed species, may require a referral and offsetting under the EPBC Act. Any unavoidable vegetation losses must also be offset under Clause 52.17 of the *Planning and Environment Act 1987*, which can include species-specific offsets, where listed species' habitats are impacted. Offsets for listed communities and species are typically both difficult to source and expensive. Hence consideration of this at early planning stages is strongly recommended to avoid impacts to and protect these ecological values in future rezoning or development. This is particularly relevant to Investigation Areas 2a, 3a and the western portion of 3b within the Victorian Volcanic Plain Bioregion. Due to its fertile soils, the Victorian Volcanic Plains Bioregion has been extensively cleared with remaining patches of the Plains Grassland and Plains Grassy Woodland communities of high ecological value. These communities also support listed species such as Golden Sun Moths and Striped Legless Lizards *Delmar impar*.

The other Investigation Areas such as 2b, 3c, 3d, and the eastern portion of 3b support less depleted ecological communities, which are generally lower cost per unit of offset. If however extensive areas are impacted, their development would likely have significant ecological impacts and offset costs. It is also noted that the development of Investigation Areas 2b and 3b-d are highly constrained by bushfire risk, as discussed in the Bushfire Risk Assessment report prepared by Practical Ecology alongside this ecological assessment.

For areas where rezoning does occur, increased development and densification will decrease the amount of permeable space across the Investigation Areas. An integrated approach to storm water, waste water, ground water and potable water is recommended in order to maintain a more natural water cycle and protect the area's waterways (Section 5.8).

Carefully planned lighting, especially for developments adjacent high ecological values is also strongly recommended to minimise light pollution impacts to native wildlife (Section 5.9)

Recognition and protection of culturally significant Flora and Fauna is of utmost importance. Unfortunately, collaboration with the Dja Dja Wurrung, the traditional owners of the land, was not possible within the timeframes of this project. However, it is hoped that the ecological values documented in this report can be useful for future engagement with the Dja Dja Wurrung. Some culturally significant plants and animals were identified during the field survey and desktop analysis. For example, large grasslands dominated by Kangaroo Grass *Themeda triandra*, one of the culturally significant plants documented in Section 3.5, were observed within Investigation Areas 2a and 3a. Moderate-high quality areas of all EVCs on site (with the exception of wetlands) are also likely to support culturally significant herbs such as Bulbine Lilies *Bulbine bulbosa* and Chocolate and Vanilla –lilies *Arthropodium* spp. among other species. Victorian Biodiversity Atlas (VBA) records also indicate past Brolga observations at St Georges Lake.

Overall, while there are large amounts of ecologically significant areas throughout Creswick, and with bushfire planning constrains throughout, it does appear possible to minimise the impacts of future development through careful strategic planning as discussed through the body of this report.

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1. INTRODUCTION

Practical Ecology Pty Ltd was commissioned by Hepburn Shire Council to undertake a biodiversity assessment within three areas of the Creswick Township.

It is understood that the Minister for Planning has approved Hepburn C80Hepb Planning Scheme Amendment and Hepburn Shire Council is now looking to progress township structure plans for its Townships, with Creswick the first of these. A biodiversity assessment was therefore sought to inform the Creswick Township Structure Plan and to avoid potential conflicts between urban development and ecological values. This biodiversity assessment aims to identify:

- Ecological values of the potential growth areas.
- Potential ecological constraints and opportunities.
- Important habitat corridors and opportunities to improve connectivity.
- Biodiversity values of importance to the Dja Dja Wurrung.

This report builds on and updates the results of the preliminary desktop report based on the ground-truthing undertaken.

1.1 Scope of works

Broadly, the scope of works includes three phases:

1. **Desktop Assessment** of the Investigation Areas 1–3 as identified in Figure 1 and Map 1.
2. **Ground Truthing** assessments from roadsides and public land to verify the Desktop Assessment results presented in the preliminary desktop report.
3. **Final Report** with a series of maps and written assessments. Mapping is to also be provided in a transferrable GIS format.

It is understood that Areas 4 and 5 (Figure 1) are not part of this investigation but should be considered to the extent that ecological processes within them interact with or impact adjacent Areas 1–3.

The preliminary desktop report has been completed. This report is the Final report and focuses on updating the preliminary desktop report based on ground truthing.

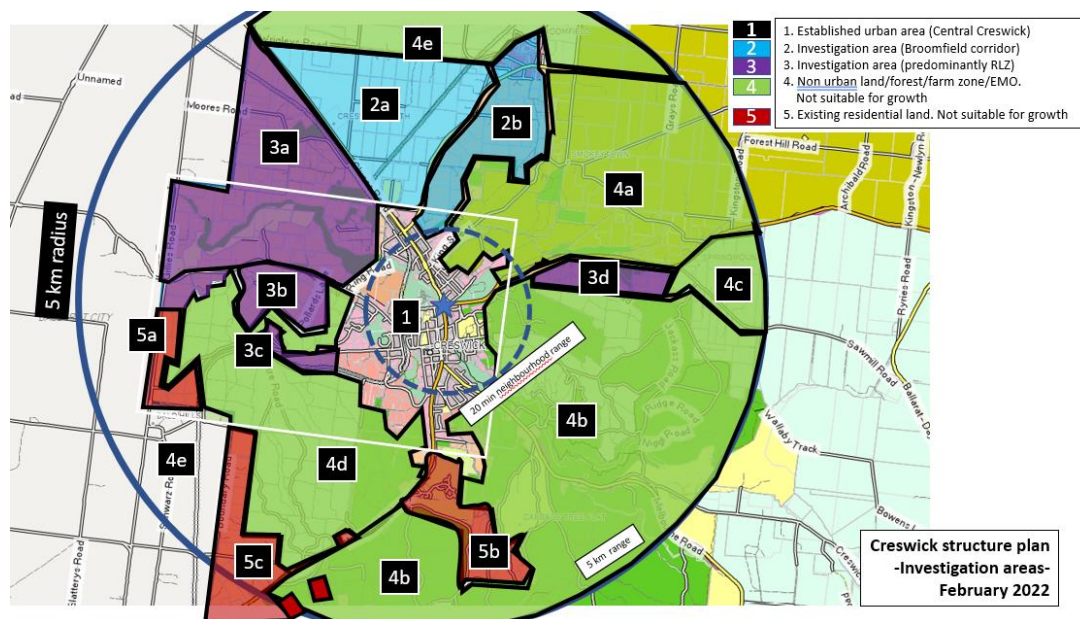


Figure 1. Creswick Structure Plan – Investigation Areas (taken directly from the supplied RfQ).

1.1.1 Final Report and Mapping

The final report:

- Identifies the assessment method used across the Investigation Areas (e.g., areas assessed on-ground, ‘over-the-fence’, or via desktop only).
- Documents the findings of the desktop and ground-truthing assessments including:
 - A list of the main characteristic flora and incidental fauna species recorded on site during site visits. Please note that all flora and fauna observations will be uploaded to the Victorian Biodiversity Atlas (VBA).
 - Mapping of land use as identified via ground truthing and desktop analysis.
 - The extent and general condition of native vegetation patches present within each Investigation Area, as collected during ground truthing and desktop analysis (displayed in tables and mapping).
 - Data, tables and mapping associated with native vegetation patches and Scattered Trees.
 - Ecological Vegetation Classes (EVC) associated with the indigenous vegetation identified.
 - Information on ecological communities and species listed at a State and/or Federal level known to, or likely to, occur within each Investigation Area.
 - The general ecological values present within each area, including overall significance and corridor links, inside and outside of each.
 - Areas with observed erosion or salinity issues.
 - Threats observed to biodiversity values.
- Highlights implications from a planning and approvals perspective associated with impacts on ecological values, including native vegetation and habitat for listed species communities known or expected to occur and associated FFG Act and EPBC Act approvals that would likely apply if these were impacted.

- Provides recommendations regarding:
 - Further investigations such as detailed ecological assessments and/or targeted surveys for flora and/or fauna species listed under the FFG Act and/or EPBC Act.
 - Available scope to avoid and minimise impacts to native vegetation and habitat.
 - Constraints and opportunities as they relate to the expansion of the Creswick Township.
- Provides concluding remarks and a summary of the overall outcomes of the project.

Mapping

Our report is accompanied by a series of maps to present our findings, including:

- The location of the Investigation Areas.
- The location of native vegetation patches, their condition.
- The location of Scattered Trees.
- EVCs and potential EPBC/FFG listed communities associated with mapped native vegetation.
- Rare or threatened flora and fauna records as documented on the VBA.
- Waterways, wetlands and water bodies (natural and constructed).

1.2 Investigation Areas

The three Investigation Areas and their respective sub-areas (1, 2 a–b and 3 a–d) are shown on Map 1 (Appendix 1) and described in Table 1 on Page 13. The applicable zoning and environmental overlays are also summarised in Table 1. The environmental overlays are discussed in turn below. It is noted that Area 3d has an Erosion Management Overlay indicating it is likely more susceptible to erosion should vegetation be removed.

1.2.1 Environmental Overlays

Environmental Significance Overlay – Schedule 1 (ESO1)

ESO1 applies across all of the Investigation Areas and is related to special water supply catchment protection. Its objective is *“to ensure all development is undertaken in a manner that protects, restores and enhances natural resources and environmental systems and seeks to eliminate detrimental impacts on the quality and quantity of water in the catchment, to ensure the long-term plentiful supply of quality water”*.

Vegetation Protection Overlay – Schedule 1 (VPO1)

VPO1 applies to parts of Areas 2a and 3a (along Clunes Rd) and within the western part of area 3b. It is related to native vegetation protection and includes the following objectives to be achieved:

- *“To protect depleted, rare or threatened foothill forest, grassland and grassy woodland vegetation.*
- *To protect Victorian rare or threatened flora and fauna species.*
- *To maintain and enhance roadside vegetation that provides linkages between significant remnant vegetation.*
- *To protect the remnant vegetation and the habitat it provides.*
- *To protect and enhance linkages between remnant vegetation on public and private land”*.

Erosion Management Overlay (EMO)

The EMO applies only to Investigation Area 3d. It indicates that land in this area could be susceptible to erosion, which should be managed in any redevelopment. The purpose of the EMO is to “*protect areas prone to erosion, landslip, other land degradation or coastal processes by minimising land disturbance and inappropriate development*”.

1.2.2 Bioregions

Bioregions are a landscape-scale approach to classifying the environment using a range of attributes such as climate, geomorphology, geology, soils and vegetation. There are 28 bioregions identified within Victoria (DELWP 2015). The entire Investigation Area falls within two bioregions. The relatively flat land to the north is part of the Victorian Volcanic Plains (VVP) bioregion, which is characterised by its recent volcanic activity and basalt-derived soils and geology. The less fertile Ordovician (490–450 mya) hills to the south within which the urban area is nestled, are part of the Great Dividing Range (450 mya) and fall within the Central Victorian Uplands (CVU) Bioregion. Map 2 shows these the two bioregions across the Investigation Areas based on Department of Environment Land Water and Planning (DELWP) modelling.

The Geomorphology database from DELWP indicated that regions within the CVU bioregion have greater potential of erosion due to surface runoff, gullyng and wind. Hence Investigation Areas 2b, 3a (South of Creswick Creek), 3b, 3c and 3d may be more susceptible to erosion. However, no obvious evidence of erosion was observed during the field survey.

1.2.3 Catchment Management Authority

Under the *Catchment and Land Protection Act 1994* (CaLP Act), Victoria is divided into ten catchment regions with a Catchment Management Authorities (CMA) established for each region (Victorian Water Industry Association Inc 2015). The assessment area is within the North Central CMA.

1.2.4 Waterways

A number of tributaries run from the hills northward into Creswick Creek and Glendonald Creek as shown on Map 5 (Appendix 1). Both travel in a general north-west direction with Glendonald Creek eventually flowing into Creswick Creek. These creeks are key habitat corridors through the landscape, with Creswick Creek a key feature of Investigation Areas 1 and 3a. Creswick Creek is discussed in greater detail in Section 3.1.8. Dams are also scattered across the Investigation Areas.

1.2.5 Land-use history

The Dja Dja Wurrung people were the original inhabitants of the Creswick area and have cared for Country for countless generations. Creswick is located towards the southern boundary of Dja Dja Wurrung country which extends northward from the Creswick Area past Wedderburn, northwest past St Arnaud, and northeast to past Rochester. Prior to European settlement, the plains to the north would have supported vast areas of open River Red-gum *Eucalyptus camaldulensis* woodlands with grassy understoreys while the hilly areas to the south supported a mosaic of woodland and forest communities. The landscape was carefully managed by the Dja Dja Wurrung people for tens of thousands of years through practices such as cultural burning and an extensive knowledge of life-cycles, long-term patterns, customs and keeping a balance, to provide continued abundant wildlife and resources (Gammage 2012, NCCMA 2022).

Since European settlement, much of the Investigation Areas and surrounding landscape have undergone significant modification due to gold mining, forestry, agriculture and urban development. The first major

upheaval occurred in the 1850s gold rush era where much of the landscape was stripped of trees for timber and fire wood, and its creeks and gullies polluted due to the water-intensive gold mining methods such as puddling and hydraulic sluicing (Davies, Lawrence et al. 2015). Forestry activities have also since taken place such that much of the vegetation of the hills are a highly modified landscape (Davies, Lawrence et al. 2015).

Today, the majority of the landscape within areas 3a, 2a and 2b has been cleared for agriculture such as cropping and grazing, and for urban development within the townships (Area 1 and northern tip of Area 2b). This is typical of the broader Victorian Volcanic Plains bioregion with its fertile soil highly desirable for agriculture. Consequently, many of the historical vegetation communities that once occurred on the Victorian Volcanic Plains such as the Plains Grassy Woodlands are endangered. Areas 3b, 3c and 3d still retain a high percentage of native vegetation.

Table 1. Details of the three Investigation Areas

Investigation Area	Size (ha)	Zoning	Environmental Overlays	Character
1	630	General Residential Zone (GRZ1) <u>Outskirts:</u> Low Density Residential Zone (LDRZ1) Rural Living Zone (RLZ1) Industrial 1 Zone (IN1Z) Waste Station	Environmental Significance Overlay 1 (ESO1) Land Subject to Inundation Overlay (LSIO1 or LSIO2) along Creek.	Established urban area in the Creswick Township
2a	480	Farming Zone (FZ1) Public Use Zone (PUZ5 – Cemetery) Public Conservation Recreation Zone (PCRZ – Rail Line Nature Conservation Reserve)	ESO1 Vegetation Protection Overlay (VPO1) – along Clunes Rd	<ul style="list-style-type: none"> • Predominantly pasture/grazing but some areas of cropping and Mining (New Australasia No. 3 Mine) • It is largely cleared.
2b	290	RLZ1 Township Zone (TZ) in Bloomfield	ESO1	<ul style="list-style-type: none"> • Extensive areas of Woodland • Pasture/grazing • Rural living • Broomfield township
3a	810	RLZ1 PCRZ (Lead Mine, Creswick Creek Corridor) PUZ1 (Long Point Bushland Reserve and areas south of Creswick Ck)	ESO1 VPO1 – along Clunes Rd	<ul style="list-style-type: none"> • Pasture/grazing and rural living (Largely cleared) • Some forestry • Creswick Ck • Grassland areas (as per ground-truthing)
3b	135	RLZ1 LDRZ1	ESO1 VPO1 – covers some of the area to the West	<ul style="list-style-type: none"> • Pasture/grazing • Woodland • Rural living
3c	33	RLZ1	ESO1	<ul style="list-style-type: none"> • Predominately woodland • Cleared areas near property
3d	95	RLZ1 PCRZ (along tributary)	ESO1 Erosion Management Overlay (EMO)	<ul style="list-style-type: none"> • Predominantly woodland • Cleared areas near property

2. METHODS

2.1 Background and Database Reviews

This desktop analysis drew on a number of resources to develop maps and an understanding of potential ecological values and constraints within the Investigation Areas. These are summarised in Table 2 below.

A review of other relevant information was also undertaken to provide an understanding of ecological values occurring or potentially occurring in each Investigation Area and the wider locality. Relevant reports and information used as part of this Report, where required, are referenced throughout.

Table 2. Databases and resources reviewed for ecological values assessment

Resource	Purpose
Database layers associated with: <ul style="list-style-type: none"> • property boundaries • land tenure • contours • cadastre, along with zoning and relevant overlay This included: Planning Scheme overlays relevant to biodiversity on VicPlan and Planning Schemes online (DELWP 2022, DELWP 2022).	Determination of site boundaries, land tenure, applicable zones and overlays, and other relevant Planning Scheme clauses relevant to ecology.
Aerial photography, available via Google Earth and NearMap	To identify the presence of native vegetation and habitat and used as part of preliminary mapping prior to ground-truthing within each Investigation Area; also considered when determining likelihoods of State and Commonwealth listed communities and species.
NatureKit, Department of Environment, Land, Water and Planning (DELWP 2018) DELWP's Native Vegetation Information Management (NVIM) system	Access to maps and information relating Victoria's biodiversity, native vegetation, flora and fauna data. Used to determine EVCs, modelled habitat scores, location risk and ascertain biodiversity attributes of each Investigation Area.
Victorian Biodiversity Atlas (VBA) (DELWP 2022)	A web-based information system designed to manage information about flora and wildlife in Victoria. Used to compile a list of significant species records listed at a State and Federal level within and up to 5 kilometres of each Growth Area for determination of likelihoods of occurrence of such species.
Protected Matters Search Tool (PMST), managed by the Commonwealth Department of the Environment and Energy (DOEE 2019)	Used to compile a list of potentially occurring Matters of National Environmental Significance (MNES) listed under the EPBC Act to within 5 kilometres of the Investigation Areas.
DELWP data sources including: Geomorphology of Victoria (GMU250) (DELWP 2022) Victorian Wetland Inventory (Current) (DELWP 2018) Vicmap Hydro 1:25000 (DELWP 2016)	To identify the location of waterways, wetlands and lakes, as well as areas prone to erosion and salinity.

Documents supplied by Hepburn Shire Council included:

- Howard, J. and J. Muchan (2021). *Creswick Mountain Bike Trail: Flora and fauna assessment*. Prepared for Hepburn Shire Council, Biosis Pty. Ltd.
- Draper, R. (2013). *Fauna Impact Assessment – Growling Grass Frog Water Street bridge area to Clunes Road area, Creswick*. Prepared for Hepburn Shire Council, Central Highlands Environmental Consultancy.
- Draper, R. (2012). *Growling Grass Frog Distribution in the Creswick and Clunes area plus breeding season and froglet dispersal*. Prepared for Hepburn Flood Recovery project, Central Highlands Environmental Consultancy.

2.2 Desktop assessment of vegetation extent

Vegetation extent was mapped via a desktop assessment of aerial photography from Google Maps and NearMap. It focused on treed vegetation (due to the difficulty in discerning exotic pasture and indigenous grassland from aerial photography) and took a conservative approach, in which treed vegetation was assumed to be native, unless it was clearly discerned as otherwise (e.g., plantations). In some cases, mixed native and exotic species (e.g., stands of both Eucalypts *Eucalyptus* spp. and Pines *Pinus* spp.) occurred (as confirmed in the ground-truthing assessment), and these were considered as either patches of indigenous vegetation (i.e. EVCs) where the Eucalypts appeared to be remnant or ‘mixed patches’ where both Eucalypts and exotic species appeared to be planted (see Section 3.1).

Patches of treed vegetation were mapped as EVCs where it appeared from aerial photography that:

- (i) The canopies of three or more trees were touching; and/or
- (ii) Trees with separated canopies could potentially be connected by a continuous native understorey (>25% native species). This is typical of some EVCs such as Plains Grassy Woodland.

All other trees which appeared to be indigenous were recorded as Scattered Trees.

This follows the classification of vegetation according to clause 52.17 and *the Guidelines for the removal, destruction and lopping of native vegetation* (DELWP 2017) as discussed in Section 2.2.1 below.

This was then ground-truthed during the field survey and updated as necessary.

2.2.1 Categorisation and classification of Vegetation

Upon ground truthing, categorisation and classification of the vegetation observed within the Investigation Areas was undertaken where possible in accordance with the *Guidelines for the removal, destruction and lopping of native vegetation* (DELWP 2017). The following definitions will form the basis of this categorisation process:

- Native Vegetation
 - Native Vegetation as per the Victoria Planning Provisions (Clause 73.01): plants that are indigenous to Victoria, including trees shrubs, herbs and grasses.

- Native Vegetation Patch
 - A patch of native vegetation is either:
 - An area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native.
 - Any 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 layer available in the Department of Environment, Land, Water and Planning’s (DELWP) Native Vegetation Information Management tool and other DELWP systems.
- Native canopy tree
 - A native canopy tree is a mature tree (i.e. that is able to flower) that is greater than 3m in height and is normally found in the upper layer of the relevant vegetation type.
 - Trees are measured by diameter at breast height (DBH) at 1.3 metres above ground level.
- Scattered Tree
 - A Scattered Tree is a native canopy tree that does not form part of a patch.
 - Scattered Trees have two size classes, Large Trees and Small Trees, i.e. those that have a DBH that is less than the large tree benchmark for the species in the relevant EVC. As in many cases it was not possible to measure Scattered Trees (e.g., when they occurred in private properties), for consistency they were assigned a single category of ‘Scattered Tree’ and not assigned a size class.
- Large Tree
 - A Large Tree is either: a live tree that is equal to or greater than the large tree benchmark for the species in the relevant Ecological Vegetation Class (EVC); or a standing dead tree has a DBH measurement of 40 centimetres or greater.
 - As it was difficult to determine large tree presence via “over-the-fence” assessments, individual large trees were not mapped in the field.

2.3 Field survey

A field survey was undertaken by Daniel Miller and Kallista Sears between the 23rd and 26th May 2022 (late autumn). Assessments were made from roadsides and public land to verify the Desktop Assessment results. Roadside vegetation and vegetation on public land was surveyed by foot where possible. However, assessment of private properties was made solely by surveying “over-the-fence”. The survey involved:

- Verification of EVCs as modelled by DELWP
- Classification of vegetation as per the *Guidelines for the Removal, Destruction or Lopping of Native Vegetation* (DELWP 2017) into Vegetation Patches and Scattered Trees.

Please note that due to the many scattered trees and nature of the over-the-fence assessment, it was not possible to identify Large Trees.

- Assignment of a general quality to identified patches, where possible. The condition categories are explained in Table 3 below in Section 2.4. These were based on a comparison with what the vegetation would look like in a pristine state. Please note that this was not a full habitat hectares assessment.

- A list of the main characteristic terrestrial vascular plants observed (i.e. not a comprehensive species list).
- Documenting where possible observed culturally significant flora and fauna values of importance to the Dja Dja Wurrung.
- A review of habitat conditions and the potential for habitat to support local wildlife and significant flora and fauna species.
- Consideration of potential areas of indigenous vegetation deemed representative of National and State listed ecological communities that will require further consideration if impacted by the expansion of the Creswick Township.
- Verification of primary land management practices where possible (e.g., cropping, agriculture, forestry, industrial, urban).
- Documenting potential threats to biodiversity values observed.
- Documenting areas of wetlands, waterbodies and rocky outcrops with high habitat values.
- Documenting any observed evidence of salinity (e.g., salt tolerant plants) or erosion issues.

Incidental fauna was recorded within each Investigation Area. The main focus in regards to fauna however was to undertake a habitat assessment. The habitat assessment relied upon making judgements on the suitability of habitat present within the Investigation Areas for any significant species recorded in the database search.

2.3.1 Limitations of survey

The following considerations should be made regarding the limitations of the field survey:

- It was undertaken in late Autumn; hence some species may not have been in flower to facilitate identification to species level.
- It is expected that some other species, particularly orchid, lily and other herbaceous species that can only be observed for a limited period of time may not have been recorded during the present assessment.
- Flora surveys were undertaken over a moderate period of time and only the main characteristic species were recorded.
- Some sites were not accessible for surveying. Where possible these sites were assessed by looking over-the-fence. As such there is greater uncertainty regarding the vegetation, and habitat values may have been missed.
- Common indigenous tree species are given in Appendix 2. However, a list of all trees and their type is not provided because it could not be accurately determined for those surveyed over-the-fence or from aerial photographs.
- This was a high-level assessment and the boundary of patches may vary with a more detailed assessment and mapping.

Nonetheless the survey was considered an adequate representation of site condition and sufficient to determine areas of high ecological values and potential impacts associated with future rezoning and development, as well as guide land management across the site.

2.4 Vegetation Quality Categorisation

Patches of indigenous vegetation (EVCs) were classified into one of five condition categories as defined below in Table 3.



Figure 2. Photos showing from left to right: Low, medium and high-quality grasslands

Table 3. Description of the condition categories assigned to patches of indigenous vegetation.

Condition	Grassland and Derived Grasslands	Woodland and Forest
Low Quality? (LQ?)	Small scattered patches of indigenous understorey may be present but difficult to ascertain over-the-fence or due to conditions such as grazing or mowing.	n/a
Low Quality (LQ)	Some small patches of indigenous grasses with low diversity, high weed cover.	Canopy trees but little to no understorey, logs or leaf litter, and a high cover of environmental weeds; OR Few canopy trees but more than 25% ground cover of perennial indigenous understorey vegetation.
Moderate Quality (MQ)	Patches are present with high coverage of indigenous grasses, moderate diversity and moderate weed cover.	Canopy trees and some understorey but limited diversity. There may be some logs and leaf litter. Low-moderate cover of environmental weeds.
High Quality (HQ)	Patches are present with high coverage of indigenous grasses, good diversity, and low weed cover.	Canopy trees with a diverse understorey, and high cover of logs, leaf litter and other habitat components. Low environmental weed cover.
Very High Quality (HQ+)	Large areas of grassland with good coverage, high diversity and very low weed cover.	Large areas of canopy trees with a diverse understorey, and high cover of logs, leaf litter and other habitat components. Very low environmental weed cover.

2.5 Mapping

Slightly different mapping methodologies were implemented for grasslands/derived grasslands and woodlands/forests.

Grasslands and derived grasslands were typically mapped to a distance of ~80 m from the fenceline (i.e. to the distance at which it was possible to identify patches from roadsides) unless indigenous vegetation was clearly visible further in (e.g., large patches of Kangaroo Grass). Areas further into private properties which were not possible to confidently determine the presence or absence of indigenous plants are therefore left blank on Maps 6 and 7.

In many areas there was a substantial difference in grassland/derived grassland quality on roadsides compared to inside property boundaries. Because of this, roadsides adjacent to grasslands/derived grasslands were often mapped separately as shown on Maps 6 and 7. Where roadsides have not been mapped separately, they appeared to be similar in quality to vegetation inside the property boundaries.

Woodlands and forests were much easier to accurately determine the extent of from the desktop analysis, and ground truthing therefore focused on determining the characteristic flora species, EVC, and an indication of quality. While as mentioned above it was not possible to map grasslands more than ~80 from fencelines, this was made possible for woodlands and forests through aerial imagery. The qualities assigned were based on observations from the roadside (as with grasslands/derived grasslands), and it is likely that this varies further into private properties where access was not possible. Additionally, treeless areas in amongst woodland and forest areas were not possible to assess for quality where they were not visible from the roadside.

Compared to grasslands and derived grasslands, there was not such a stark difference in quality between roadsides and vegetation within property boundaries for woodlands and forests (although there was often somewhat higher cover of weeds on roadsides). Because of this, roadsides in woodland and forest areas were not mapped separately.

Spatial data collection was carried out using a combination of a handheld GPS enabled device and aerial photography. Determination of vegetation boundaries was undertaken using a combination of GPS data and ground-truthing with aerial photography. GPS data and mapping should be considered approximate only (e.g., +/- 1–5m).

Please note that mapping was conducted very rapidly, and while considered of sufficient detail and quality to consider the overall distribution and quality of indigenous vegetation across the Investigation Areas, will need to be refined with detailed mapping inside property boundaries if any future development occurs.

2.6 Ecological Vegetation Classes

EVCs were attributed to habitat within each Investigation Area where possible. Victoria has classified its vegetation using a system of broad Ecological Vegetation Classes (EVCs) that are prescribed on a bioregional basis. EVCs are a method of systematic organisation of plant communities into common types that occur in similar environmental conditions throughout Victoria. Each vegetation type is identified on the basis of its floristic composition (the plant species present), vegetation structure (woodland, grassland, saltmarsh), landform (gully, foothill, plain) and environmental characteristics (soil type, climate). DELWP provides benchmark descriptions for each EVC type to aid in their identification and assessment of vegetation (DELWP 2022).

Modelled EVC mapping was accessed to determine the EVCs likely to occur within the Investigation Areas (DELWP 2022). EVCs were then identified in the field based on observable attributes including the dominant

and characteristic species and their alignment with the EVC benchmark descriptions provided by DEWLP (DELWP 2022).

2.7 Threatened Ecological Communities

Threatened ecological communities are listed under the EPBC and FFG Acts.

To determine if the EPBC Act listed communities are likely to occur within the Investigation Area and immediate surrounds, the Protected Matters Search Tool (PMST) was used to generate a report for a 5km region around the Investigation Area. Under the EPBC Act, key diagnostic criteria and condition thresholds are defined by The Commonwealth Threatened Species Scientific Committee (TSSC). These define a benchmark to compare against and assist in identifying EPBC listed communities. To this end, the site's identified Habitat Values and Ecological Vegetation Classes were assessed against these key diagnostic criteria and relevant condition thresholds of the threatened communities identified by the PMST.

While there are no specific criteria which determine the presence of FFG Act communities, an informal method of comparing site characteristics and floristics with community descriptions in the document: *Characteristics of Threatened Communities – Flora and Fauna Guarantee Act 1988* (DELWP) was undertaken. This document summarises the characteristics of FFG Act threatened communities, to assist with field recognition. An evaluation of the Habitat Zones identified as part of this ecological assessment was made against the information in this document (DELWP).

2.8 Potentially occurring rare or threatened species

Nationally and state significant flora and fauna are listed under the EPBC Act and the FFG Act, respectively. A 'likelihood of occurrence' assessment was undertaken for all significant flora and fauna species, within a five-kilometre buffer search from the boundaries of the Investigation Area, that were either

- Recorded on the VBA since 1980; and/or
- Potentially occurring based on a report generated by the EPBC Act PMST.

The 'likelihood of occurrence' for each species was assessed as being Nil, Low, Moderate, High or Recorded, based on the criteria listed in Table 4.

In determining likelihood of occurrence and potential use of the Investigation Areas by these national or state significant flora and fauna species, the following factors were considered:

- Previous recordings of species in the local area.
- Date of last record.
- The habitat requirements of individual species.
- The physical attributes of the site, such as topography, geology, soils, aspect and other habitat features such as trees with hollows, the presence of rocks or boulders, logs on the ground.
- The history of land use at the Investigation Area.
- The ecological landscape context; i.e., the degree of connectivity, modification and fragmentation across the landscape.

A basic matrix that describes the justification for the likelihood of occurrence is presented below.

Table 4. Criteria for potential occurrence of significant species

Likelihood of occurrence	Criteria
Nil	Species known to be extinct in local area and/or absent from the site.
Low	Unsuitable habitat at Investigation Area; or habitat conditions intermediate and records very limited and dated; or if it were present, it is highly likely to have been observed on site.
Medium	Habitat conditions are intermediate, and/or optimal habitat conditions for species but local records limited or dated and/or if it were present, it is not likely to have been observed on site.
High	Optimal habitat conditions for species or species recorded at site, or intermediate habitat conditions but extensive local records and/or if it were present, it is not likely to have been observed on site.

2.9 Permits

Practical Ecology Pty Ltd staff are covered under *The Wildlife Act 1975* Permit and FFG Act permit (No. 10008906) to take/keep protected flora and hold a Wildlife and Small Institutions Ethics Committee approval (16.18).

3. RESULTS

3.1 Existing Site Conditions, Vegetation and Mapping

Maps 4 and 6, Appendix 1, give an overview of vegetation extent, type and ecological vegetation communities present across the Investigation Areas as determined from the desktop review and subsequent ground-truthing, respectively. As mentioned in Sections 2.3 and 2.5, the ground-truthing was undertaken from roadsides and public land with private property assessed over-the-fence. While the accuracy will diminish with distance from the fence-line, this assessment provides a useful indication of the likely vegetation present and areas where high quality vegetation is more likely.

As discussed in Section 1.2.5, Areas 2a and 3a are largely cleared. However, there is still a considerable extent of quality grasslands, particularly within Area 3a. This is discussed further in Section 3.1.1. Area 3 is also characterised by extensive plantings of native trees along the boundaries of fields and properties. Areas 2b and 3b-d were characterised by extensive areas of woodland and forest. These and other key landscape features such as Creswick Creek, wetlands, rocky outcrops, and ecological vegetation communities are discussed in the sections below.

3.1.1 Ecological Vegetation Communities

Where possible, EVCs were assigned to vegetation based on ground-truthing and reference to DELWP modelling of the pre-European EVCs (Map 3, Appendix 1). Descriptions for each of the EVCs observed across the Investigation Area are given in Table 5. This table also gives the bioregional conservation status of each EVC, with those associated with the VVP listed as endangered due to the extensive loss of native vegetation in this bioregion.

Heathy Dry Forest (EVC 20) was the dominant ecological vegetation community within areas Areas 2b, 3b, 3c and 3d, with many areas of high-quality (Figure 3). The Heathy Dry Forest extended much further into area 2b than predicted by DELWP pre-1750s modelling which maps the Plains Grassy Woodland ecological community over most of Area 2b. Smaller areas of the following Forest and Woodland communities were also present (Figure 4):

- Valley Grassy Forest (EVC 47) within a small area along Bald Hills Road.
- Grassy Dry Forest (EVC 22) in the southeast of Investigation Area 1 (Figure 4).
- Hills Herb-rich woodland (EVC 71) along Ascot-Creswick Road (Figure 4).
- Herb-rich Foothill Forest (EVC 23) along waterways mainly in gullies.
- Creek-line Herb-rich Woodland (EVC 164) along waterways towards the foothills (Figure 4).

Across the flatter Victorian Volcanic Plains (VVP) regions the following EVCs were clearly identified or considered potentially present:

- Plains Grassy Woodland (EVC 55) on the basalt plain to the north and west.
- Plains Grassland (EVC 132) (possibly also representing derived grasslands of Plains Grassy Woodland) across most of the west, northwest and north.
- Plains Sedgy Wetland (EVC 647) in lower lying areas and depressions throughout the basalt plain.
- Riparian Woodland (EVC 641) along waterways of the basalt plain.



Figure 3. Heathy Dry Forest.

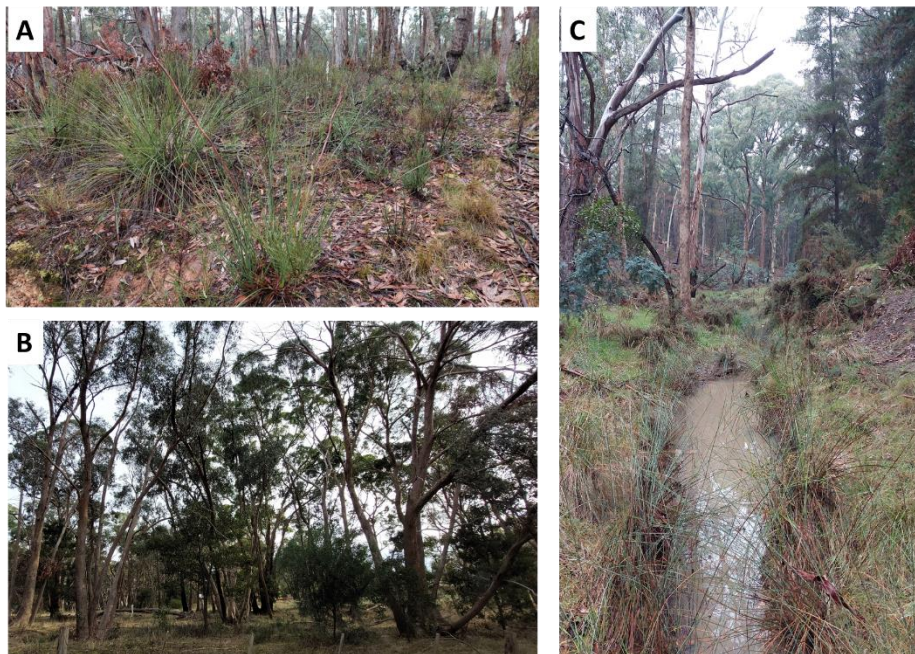


Figure 4. Examples of (A) Grassy Dry Forest (B) Hills Herb-rich Woodland and (C) Creekline Herb-rich Woodland.

Table 5. Ecological Vegetation Communities within the Investigation Areas based on Ground-truthing of DELWP modelling (DELWP 2022). The descriptions are adapted from their benchmark descriptions (DELWP 2022).

	EVC No. and Name	BCS [^]	Description within Subject site	Location
Victorian Volcanic Plains (VVP) (north of township)	EVC 55: Plains Grassy Woodland	Endangered	<p>According to its benchmark description, the Plains Grassy Woodland is an open, eucalypt woodland to 15 m tall. A key species is the River Red-gum. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. Typical shrub layer species are Golden Wattle <i>Acacia pycnantha</i>, and Hedge Wattle <i>Acacia paradoxa</i>.</p> <p>It occupies areas receiving approximately 500 – 700 mm annual rainfall on poorly drained, fertile soils on flat or gently undulating plains at low elevations (DELWP 2022).</p> <p>There was a large area to the west of Area 3b and two smaller patches off the Creswick Broomfield Railway Nature Conservation Reserve that were clearly representative of the Plains Grassy Woodland EVC, and of high ecological value. These patches supported River Red Gums and some shrubby understorey species such as Hedge Wattle and Golden Wattle, typical of the woodland version of this EVC. Figure 6 show photos of some of these medium-high quality areas. These areas are also likely to support significant species such as the Striped Legless Lizard and Golden Sun Moth.</p> <p>Many of the areas mapped as Plains Grassland likely represent derived grassland versions of Plains Grassy Woodland, where the tree and shrub layers have been removed but the ground storey remains intact.</p>	<p>2a, 3a, 3b (west side)</p> <p>There were two small patches of Plains Grassy Woodland (PGW) along the Creswick – Broomfield Rail Line Nature Conservation Reserve and an area to the west of 3b. These are of high conservation value.</p> <p>Areas of grassland were also present across areas 2a and 3a and may represent a derived grassland state of this EVC. These are of high conservation value and discussed in Section 3.2.8.</p>
	EVC 132: Plains Grassland	Endangered	<p>According to its benchmark description this EVC consists of treeless vegetation mostly less than 1 m tall dominated by largely graminoid and herb life forms. It occupies fertile cracking basalt soils prone to seasonal waterlogging.</p> <p>There were considerable areas of grassland present in areas 2a and 3a as shown in Map 6, Appendix 1. Many of these grasslands were of medium to high quality with dominant groundstorey species including:</p> <ul style="list-style-type: none"> • Tussock Grasses <i>Poa</i> spp. • Wallaby Grasses <i>Rytidosperma</i> spp. • Kangaroo Grass <i>Themeda triandra</i> • Wallaby Grasses <i>Rytidosperma</i> spp. 	<p>2a, 3a</p> <p>Areas of grassland were present across these two Investigation Areas and may represent this EVC.</p> <p>These are of high conservation value.</p>

EVC No. and Name	BCSA [^]	Description within Subject site	Location
		<p>Other species included:</p> <ul style="list-style-type: none"> • Crane’s Bills <i>Geranium</i> spp. • Rice-flowers <i>Pimelea</i> spp. • New Holland Daisy <i>Vittadinia</i> spp. • Cranberry heath <i>Styphelia humifusa</i> • Wattle Mat-rush <i>Lomandra filiformis</i> subsp. <i>filiformis</i> and <i>coriacea</i> <p>Figure 5 shows photos of medium-high quality grassland areas. Such areas are rare (Biodiversity conservation status of endangered) and likely to support significant species such as Striped Legless Lizards and Golden Sun Moths. As such they are of high ecological value.</p> <p>Please note that these grassland patches could also represent a derived grassland form of ECV 55: Plains Grassy Woodland, where the tree and shrub layer have been removed.</p>	
EVC 641: Riparian Woodland	Endangered	<p>According to its Benchmark description, Riparian Woodland occurs beside permanent streams, typically on narrow alluvial deposits. It is a woodland to 15 m tall generally dominated by River Red-gum over a tussock grass-dominated understorey. Blackwood <i>Acacia melanoxylon</i> and tall shrubs such as Sweet Bursaria <i>Bursaria spinosa</i>, Golden Spray <i>Viminaria juncea</i> and Small-leaf Bramble <i>Rubus parvifolius</i> may be present and amphibious herbs may occur in occasional ponds and beside creeks. While flooding may be common, sites are rarely inundated for lengthy periods (DELWP 2022).</p> <p>The Riparian Woodland along Creswick Creek was highly modified with significant levels of weeds, especially Gorse <i>Ulex europaeus</i>. Please see Section 3.1.8 for a more detailed description of Creswick Creek.</p>	Along the western part of Creswick Creek in Area 3a.
EVC 647: Plains Sedgy Wetland	Endangered	<p>According to its Benchmark description the Plains Sedgy Wetland community “occurs in seasonally wet depressions on volcanic and sedimentary plains, typically associated with fertile, silty, peaty or heavy clay paludal soils.</p> <p><i>Primarily sedgy-herbaceous vegetation, sometimes with scattered or fringing eucalypts or tea-tree/paperbark shrubs in higher rainfall areas. A range of aquatic herbs can be present, and species-richness is mostly relatively low to moderate, but higher towards drier margins</i>” (DELWP 2022).</p>	Wetlands are present in areas 2a and 3a which have potential to represent this community. Further detailed surveying on-foot is needed to confirm this.

	EVC No. and Name	BCS [^]	Description within Subject site	Location
			<p>Please see Section 3.1.7 for a description of wetlands in Areas 2a and 3a, some of which could potentially represent this community.</p>	
<p>CVU and WP Bioregions</p>	<p>EVC 20: Heathy Dry Forest</p>	<p>Least Concern (CVU and VVP)</p>	<p>According to its Benchmark description, Heathy Dry Forest occurs on shallow, rocky skeletal soils on a variety of geologies and on a range of landforms from gently undulating hills to exposed aspects on ridge tops and steep slopes at a range of elevations. The overstorey is a low, open eucalypt forest to 20 m tall, poor in form with an open crown cover.</p> <p>The understorey is dominated by a low, sparse to dense layer of ericoid-leaved shrubs including heaths and peas. Graminoids and grasses are frequently present in the ground layer, but do not provide much cover (DELWP 2022).</p> <p>Heathy Dry Forest is the dominant EVC across Areas 2b, 3b, 3c and 3d (Figure 3). Canopy tree species observed within the Investigation area were typical of this EVC consisting of:</p> <ul style="list-style-type: none"> • Broad-leaf Peppermint <i>Eucalyptus dives</i> • Long-leaf Box <i>Eucalyptus goniocalyx s.s.</i> • Red Stringybark <i>Eucalyptus macrorhyncha</i> • Red Box <i>Eucalyptus polyanthemos</i> <p>The Ground layer included species such as:</p> <ul style="list-style-type: none"> • Black-anther Flax-lily <i>Dianella admixta</i> • Scented Sundew <i>Drosera aberrans</i> • Purple Coral-pea <i>Hardenbergia violacea</i> • Wattle Mat-rush • Common Rice-flower <i>Pimelea humilis</i> • Grey Tussock-grass <i>Poa sieberiana</i> • Wallaby Grasses 	<p>1, 2b, 3b, 3c (east), 3d</p> <p>This was the dominant EVC across these Investigation Areas, except for areas 1 which is highly urbanised.</p>

	EVC No. and Name	BCSA [^]	Description within Subject site	Location
Central Victorian Uplands (CVU) Bioregion (Township and hilly areas)	EVC 22: Grassy Dry Forest	Depleted	<p>According to its Benchmark description, Grassy Dry Forest occurs on a variety of gradients and altitudes and on a range of geologies. The overstorey is dominated by a low to medium height forest of eucalypts to 20m tall, sometimes resembling an open woodland with a secondary, smaller tree layer including a number of Acacia species. The understorey usually consists of a sparse shrub layer of medium height.</p> <p>Grassy Dry Forest is characterised by a ground layer dominated by a high diversity of drought-tolerant grasses and herbs, often including a suite of fern species (DELWP 2022).</p> <p>Canopy tree species observed within the Investigation Areas were typical of this EVC consisting of:</p> <ul style="list-style-type: none"> • Long-leaf Box • Messmate Stringybark <i>Eucalyptus obliqua</i> • Broad-leaf Peppermint <p>Silver Wattle <i>Acacia dealbata</i> was frequently observed as an understorey tree. It had a diverse ground-story including Wattle Mat-rush <i>Lomandra filiformis</i>, Small Grass-trees <i>Xanthorrhoea minor</i>, Scented Sundew <i>Drosera aberrans</i>, Pink Bells <i>Tetradlea</i> spp., and Narrow-leaf Bitter-pea <i>Daviesia leptophylla</i> (Figure 4).</p>	A small high-quality patch is present at the southern tip of Area 1.
	EVC 23: Herb-rich Foothill Forest	Depleted	<p>According to its Benchmark description, Herb-rich Foothill Forest occurs “on relatively fertile, moderately well-drained soils on an extremely wide range of geological types and in areas of moderate to high rainfall. Occupies easterly and southerly aspects mainly on lower slopes and in gullies. A medium to tall open forest or woodland to 25m tall with a small tree layer over a sparse to dense shrub layer. A high cover and diversity of herbs and grasses in the ground layer characterise this EVC” (DELWP 2022).</p> <p>Character Eucalypt species include:</p> <ul style="list-style-type: none"> • Eurabbie <i>Eucalyptus globulus</i> subsp. <i>bicostata</i> (although this is less common around Creswick and more common in the east of the state and in the Grampians) • Messmate Stringybark • Broad-leaved Peppermint <p>Within the Investigation Areas, Messmate Stringybark, Swamp Gum and Manna Gum species were observed along with understorey species such as Austral Bracken <i>Pteridium esculentum</i> subsp. <i>esculentum</i>, Sedges <i>Carex</i> spp. and Weeping Grass <i>Microlaena stipoides</i> var.</p>	<p>Small areas of this were present along gullies in Areas 1 and 3d.</p> <p>This is also mapped along the eastern part of Creswick Creek in Area 3a.</p> <p>Please see Section 3.2.12 for more details about Creswick Creek.</p>

	EVC No. and Name	BCSA [^]	Description within Subject site	Location
Central Victorian Uplands Bioregion (Township and hilly areas)			<p><i>stipoides</i>. However, these were found amongst a dominant suite of weeds such as Hawthorn *<i>Crataegus monogyna</i>, English Broom *<i>Cytisus scoparius</i>, Broom *<i>Genista spp.</i>, Ivy *<i>Hedera spp.</i>, Radiata Pine *<i>Pinus radiata</i>, Gorse, Blackberry *<i>Rubus fruticosus</i> spp. agg. and Blue Periwinkle *<i>Vinca major</i>.</p>	
	EVC 71: Hills Herb-rich Woodland	Vulnerable	<p>According to its Benchmark description, Hills Herb-rich Woodland is a dry, open eucalypt woodland to 15 m tall often with a sparse shrub layer. The understorey is dominated by a carpet of herbs and grasses. Soils are generally shallow but fertile, and outcropping rock is not uncommon. This seasonally dry environment is favourable for annual herbs, with the fertile nature of the various geologies also supporting perennial herbs.</p> <p>Character Eucalypt species include:</p> <ul style="list-style-type: none"> • Grey Box <i>Eucalyptus microcarpa</i> • Yellow Box <i>Eucalyptus melliodora</i> • River Red-gum <p>Within the Investigation Area, this EVC consisted Grey Box and Yellow Box along with Cherry Ballart <i>Exocarpos cupressiformis</i> and Blackwood <i>Acacia melanoxylon</i>, with an understorey of Black-anther Flax-lily, Wattle Mat-rush, Drooping Cassinia, Groundsel <i>Senecio</i> spp. and Bluebell <i>Wahlenbergia</i> spp.</p>	There is an area of this EVC that straddles across Ascot-Creswick Rd into Areas 3a and 3b.
	EVC 164: Creekline Herb-rich Woodland	Vulnerable	<p>According to its Benchmark description, this EVC is a “Woodland or open forest to 15m tall occurring on creek terraces and along shallow drainage lines with ephemeral flows. Soils are mostly alluvial deposits of seasonally wet sands and silts. Characterised by a sparse shrub layer above a grassy/sedgy understorey, often rich in herbs within the inter-tussock spaces.” (DELWP 2022)</p> <p>Character eucalypt species include:</p> <ul style="list-style-type: none"> • Swamp Gum <i>Eucalyptus ovata</i> • Manna Gum <i>Eucalyptus viminalis</i> • Narrow-leaf Peppermint <i>Eucalyptus radiata</i> subsp. <i>radiata</i> <p>Within the Investigation Area, this EVC consisted of Eucalypt species including Manna Gum along with Blackwood and Black Wattle. Understorey species included Rushes <i>Juncus</i> spp. Wallaby Grasses and Kangaroo Grass (See Figure 4).</p>	A small area within Investigation Areas 3c and 3b.

EVC No. and Name	BCS [^]	Description within Subject site	Location
EVC47: Valley Grassy Forest		<p>According to its Benchmark Description, Valley Grassy Forest occurs on fertile well-drained colluvial or alluvial soils on gently undulating lower slopes and valley floors. It is an open forest to 25 m tall may carry a variety of eucalypts, usually species that prefer more moist or more fertile conditions over a sparse shrub cover. In season, a rich array of herbs, lilies, grasses and sedges dominate the ground layer but at the drier end of the spectrum the ground layer may be sparse and slightly less diverse, but with the moisture-loving species still remaining.</p> <p>Character eucalypt species include:</p> <ul style="list-style-type: none"> • Yellow Box • Narrow-leaf Peppermint • Messmate Stringybark • Candlebark <i>Eucalyptus rubida</i> <p>The patch within Area 3c is highly modified with a high proportion of Pines. The ground was also densely pitted from historical gold mining (Figure 15).</p>	A small patch of this exists within Area 3c.

[^] BCS: Bioregional Conservation Status; * denotes exotic species



Figure 5. High quality grassland/derived grassland in Investigation Area 3a (top) Clunes–Creswick Rd, (middle) and a driveway off 55C Liddicoat Rd looking towards Creswick Creek, (bottom and right) along Australasia Dr.



Figure 6. Plains Grassy Woodland in Area 3b adjacent to Gillies Rd (top) and two River Red Gums off the Creswick Broomfield Rail Line Nature Conservation Reserve (bottom).

3.1.2 Mixed patches

The mixed patch designation is mapped quite extensively across the Investigation Areas. It was created to represent vegetation of varied composition consisting of a mixture of indigenous and native species, that did not fit a defined EVC but provide good habitat which in many cases appeared to be planted. These could for example consist of larger indigenous trees amongst planted natives with a grassy understory or indigenous plantings (Figure 7).



Figure 7. Examples of Mixed Patches in Area 3a along Australasia Drive (top) and Parkes Road (bottom).

3.1.3 Scattered trees

Scattered Trees were present in all of the Investigation Areas both along roadsides and within land parcels amongst otherwise cleared land (Figure 10). It was beyond the scope and ability of this Investigation to identify all of the large scattered trees. However, many large indigenous trees were observed as shown by the examples in Figure 8. These scattered trees provide important nesting sites (both in the canopy foliage, and in hollows in the case of Large Scattered Trees) and refuge for a variety of birds and other species as well as shade for species such as Eastern Grey Kangaroo *Macropus giganteus*. This is especially the case in areas 2a and 3a which no longer support woodland ecological communities across much of their extent.



Figure 8. Large Scattered Trees observed throughout the Investigation Areas.

3.1.4 Rocks

There were a few areas with scattered basalt rock and rocky outcrops as shown in Figure 9. Some of these were also within moderate to high quality grassland areas. Rocky outcrops are rare given a tendency for owners to de-rock properties and are of high ecological value for supporting, in particular, reptile species potentially including the listed Pink-tailed Worm-lizard *Aprasia parapulchella*.

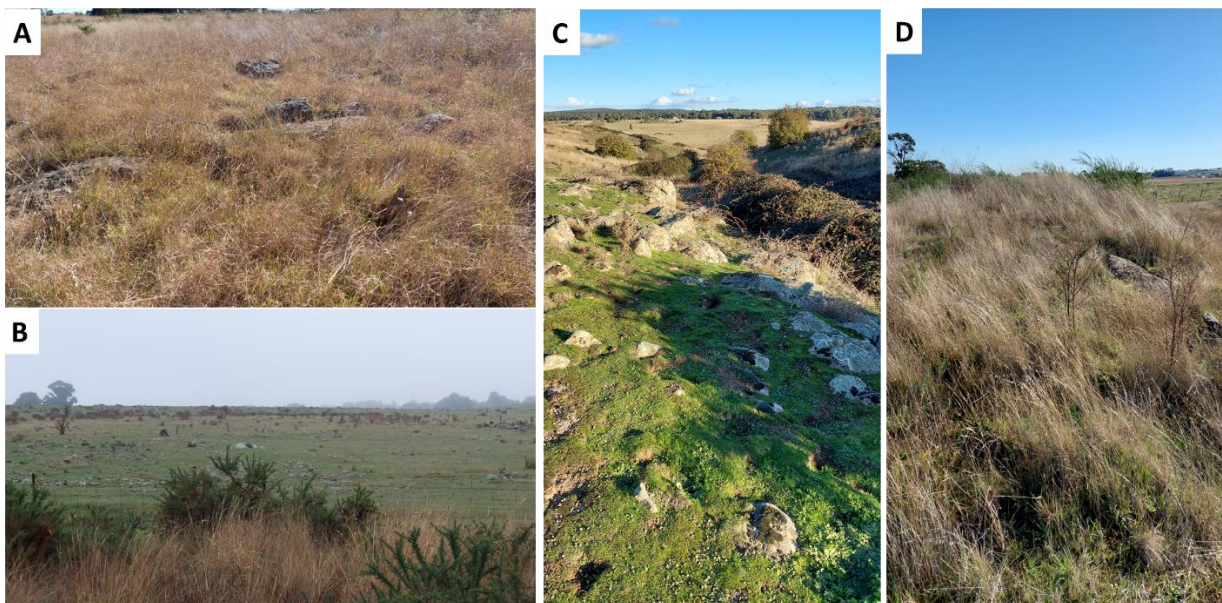


Figure 9. Areas with rocky outcrops and scattered basalt: (A) Clunes–Creswick Rd (B) Wrigleys Rd (C) near Liddicoat Rd (D) Clunes Rd.

3.1.5 Long-Point Bushland Reserve

Long Point Conservation Reserve is a historical mining site that contains remnant vegetation and has had significant restoration works to protect and enhance it driven by the Bald Hills Landcare Group (Figure 10). Of special note is the natural regeneration of Silver Banksia *Banksia marginata*. For a good overview of the site and its history please see Goldfields Guide (2022).



Figure 10. Long Point Flora Reserve.

3.1.6 Creswick–Broomfield Rail Line Nature Reserve

The Creswick–Broomfield Rail Line Nature Reserve is a narrow reserve that serves as a key habitat corridor through Investigation Area 2a, which is otherwise largely devoid of native vegetation, although Clunes–Creswick Rd also supports good quality native vegetation. Creswick–Broomfield Rail Line Nature Reserve consists of high-quality areas of grassland and Heathy Dry Forest with a diverse understorey layer (Figure 11). Observation of ditches along the rail reserve in December 2021 identified areas of diverse ephemeral wetland plant assemblages potentially including elements of remnant wetlands. (B. Bainbridge pers. Comm. 25.08.22) There were also two small areas of high-quality Plains Grassy Woodland adjacent to the Rail Line Nature Reserve, and two very large Candlebarks were observed in the northern Heathy Dry Forest section. There were some areas with a considerable amount of Gorse in the understorey that would be worthwhile controlling in this high value area.



Figure 11. Creswick–Broomfield Rail Line Nature Reserve: (A) Common Rice-flower and (B) an area of Heathy Dry Forest.

3.1.7 Wetlands

A number of wetlands areas were observed:

- Along small tributaries that flow north–west into Glendonald Creek within Area 2a.
- Along tributaries leading to Creswick Ck in Area 3a.
- Along Creswick Ck near Ring Rd in Area 3a.
- Near McMillan Road in Area 2b.
- In depressions along the Creswick–Broomfield Rail Reserve in Area 2a (B. Bainbridge pers. comm. 25.08.22)

These varied in their vegetation but often included Spike–rushes *Eleocharis* spp., Rushes, Sedges, Common Reed *Phragmites australis*, and Bulrush *Typha* spp. It was not possible to confidently assign an EVC to the wetlands based on the over–the–fence survey and further surveys are recommended if this is desired. Some may be representative of EVC 647: Plains Sedgy Wetland. However, the wetlands may also be characteristic of other EVCs upon further on–foot surveying such as EVC 125: Plains Grassy Wetland. These may provide important habitat for a variety of species such as waterbirds and frogs including the listed Brolga and Growling Grass Frog (see Section 3.4).

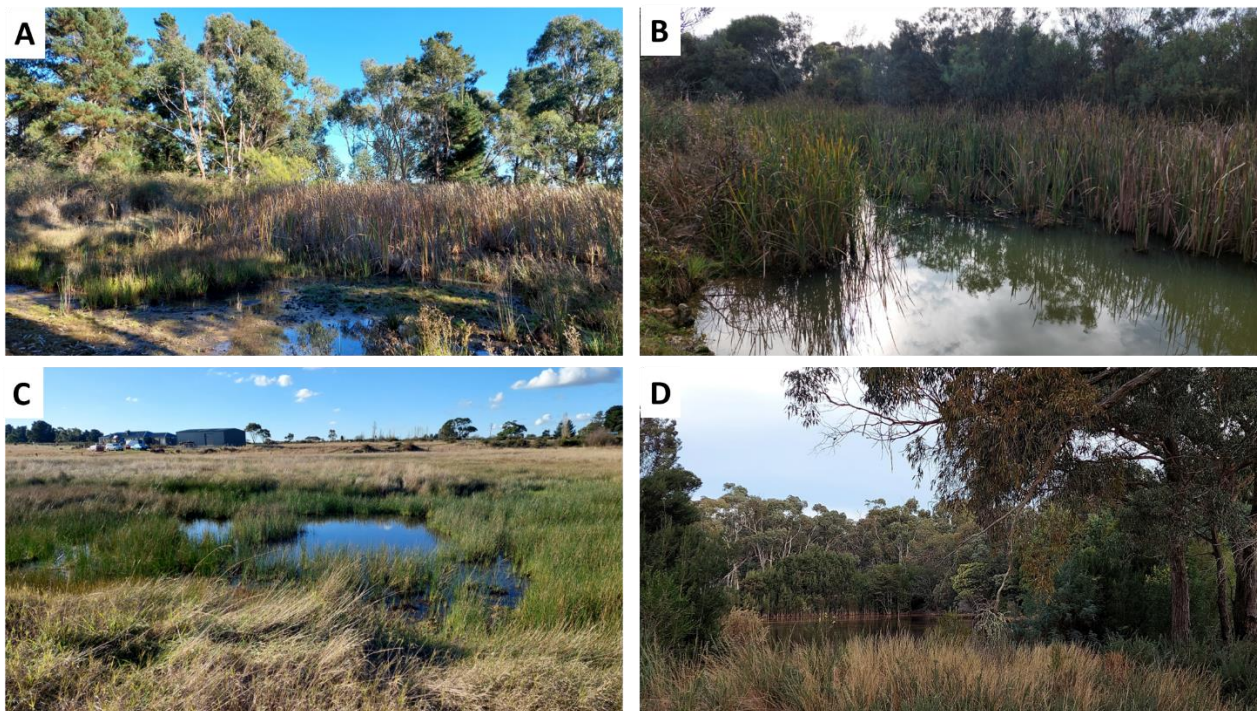


Figure 12. Wetlands: (A) Along Clunes–Creswick Rd – with Creepline Herb–rich Woodland around it (B) along a tributary to Creswick Creek near Ring Rd, dominated by Common Reed (C) wetland dominated by Spike–rush on 20 Four Star Rd (D) Dam/wetland off McMillan Rd (Area 2b). The vegetation around this was possibly Hills Herb–rich Woodland.

3.1.8 Creswick Creek

Creswick Creek is a key wildlife corridor through Areas 3a and the urban township, Area 1. According to DELWP pre-1750s modelling, the pre-colonisation vegetation was Riparian Woodland to the east of Gillies Road eventually transitioning to Hills Herb-rich Foothill Forest and is mapped as such in Map 6, Appendix 1. The creek was surveyed from two access points adjacent Gillies Road and Ring Road. These showed a high level of woody weeds such as Gorse, Hawthorn and Blackberry, especially near Ring Road. Analysis of aerial images also indicated that between Gillies Road and Ring Road stretches either side of the creek are likely dominated by Gorse and Blackberry. There were stretches of planted Eucalypts and wattles (most likely dating from the extensive 1998 Creswick Creek Care Project) set back from creek banks that were mapped as having a higher quality than other vegetation along the Creek. Despite the abundance of weeds, Creswick Creek likely provides good refuge and cover for small birds and mammals, and acts as an important wildlife corridor. It is understood that an echidna has been observed along the Creek near the Ring Road and that mistletoe-dependant fauna such as the Mistletoe Moth *Comocrus behri* and Amaryllis Azure Butterfly *Ogyris amaryllis* are using the abundant natural regeneration of Wire-leaf Mistletoe *Amyema preissii* that has colonised these plantings (B. Bainbridge pers. comm. 25.08.2022).

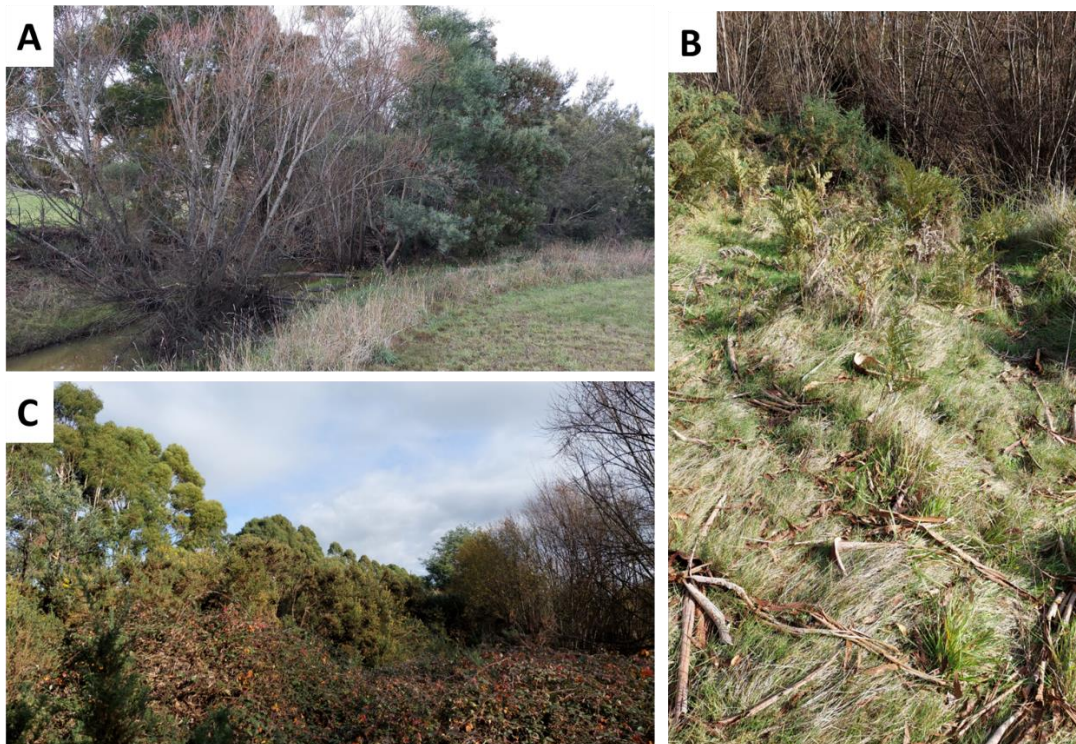


Figure 13. Creswick Creek: (A) near Gillies Road and (B) (C) along Ring Rd. The Creek near Gillies Road supported a high level of woody weeds although areas of native grasses and Bracken were present in areas. Indigenous trees had been planted further back from the Creek banks along the Creek.

3.1.9 Planted Native Vegetation

Areas mapped as Planted Native Vegetation represent areas of planted trees and vegetation that are a combination of native and locally indigenous to the area but were clearly not remnant. This formed the dominant treed vegetation within Area 3a. These were often characterised by rows of even-aged trees along property boundaries, fields and roadways. While the Planted Native Vegetation is not remnant, it still provides valuable habitat and landscape connectivity. Figure 14 provides some examples of this type of vegetation. It is also likely that indigenous, remnant scattered trees are present amongst the planted ones but were not identified within the limits of this Investigation.



Figure 14. Areas of planted native vegetation in Area 3a (Top) Moores Rd (Bottom) 106 Spittle Rd.

3.1.10 Exotic patches and trees

Exotic patches and trees typically represented areas dominated by Pine and Cypress but could also include other non-native species not considered environmental weeds. While these often provide limited habitat values compared to indigenous vegetation, they can still aid in increasing landscape connectivity and can be valuable nesting and feeding sites for some indigenous fauna species.

3.1.11 Pine plantation firebreaks – derived grasslands

While pine plantation firebreaks were not surveyed or mapped as part of this project, it is understood that they may support valuable derived grasslands, where the trees have been removed but a diverse groundstorey remains. The management of fire breaks with regular annual biomass removal for decades can promote ideal conditions for a diverse ground flora including wildflowers. As such they may also provide important habitat connectivity, around exotic pine-plantations which have limited habitat value for many indigenous fauna. It is understood that a high value example of a firebreak with derived grassland exists adjacent Alfred Street, also supporting important invertebrate such as Golden Sun Moth *Synemon plana* and the Yellow Ochre Butterfly *Trapezites luteus* (Brian Bainbridge pers. comm. 25.08.22). Others are likely present along Bald Hills Road and south of Ascot Road (Brian Bainbridge pers. comm. 25.08.22). It is recommended that firebreaks in the Creswick area are surveyed during spring, when forbs and grasses are in flower, or at times appropriate for invertebrate observation, to identify other high quality firebreak grasslands.

3.1.12 High ecological values for retention

In summary, Creswick is fortunate to still retain extensive areas with high habitat value. Those recommended for retention and enhancement include:

- Extensive areas of moderate to high quality woodland (primarily EVC 20: Heathy Dry Forest) throughout Areas 2b, 3b, 3c and 3d.
- An area of Hills Herb-rich Woodland extending into both Area 3a and 3b either side of Ascot-Creswick Rd. As discussed in later sections this may also represent an EPBC listed ecological community.
- Moderate to high quality grassland in Area 3a. These occur both within private property and roadside vegetation. Some lower quality areas may also be important to retain for connectivity across these (see Section 5.3).
- Several areas of EVC 55: Plains Grassy Woodland, in its woodland form.
- Long Point Bushland Reserve (Area 3a).
- Creswick Creek Corridor (Area 3a).
- Creswick Broomfield Rail Line Nature Conservation Reserve.
- Large trees both within woodland areas and scattered in other wise cleared areas.
- Areas of rocky outcrop, particularly those within moderate to high quality grassland areas.

3.1.13 Key threats

Key threats observed during the field survey included

- Pine invading woodland and forest areas, particular in areas with nearby pine plantations such as 3c and 3d (See Figure 15)
- Gorse, especially in Areas 2a and 3a (Figure 16)
- Woody weeds along drainage lines and creeks (particularly along Creswick Creek and areas of EVC 23: Herb-rich Foothill Forest)

It is also noted that many of the identified high-quality grassland and woodland areas are within private ownership, with no environmental overlays or mechanisms to protect them from future land management changes or change in ownership. Implementation of mechanisms to further protect these areas are recommended, such as environmental overlays, collaboration with land-owners and encouragement of covenants. Additionally, roadside grassland could be clearly identified and managed accordingly to enhance their biodiversity values and connectivity.

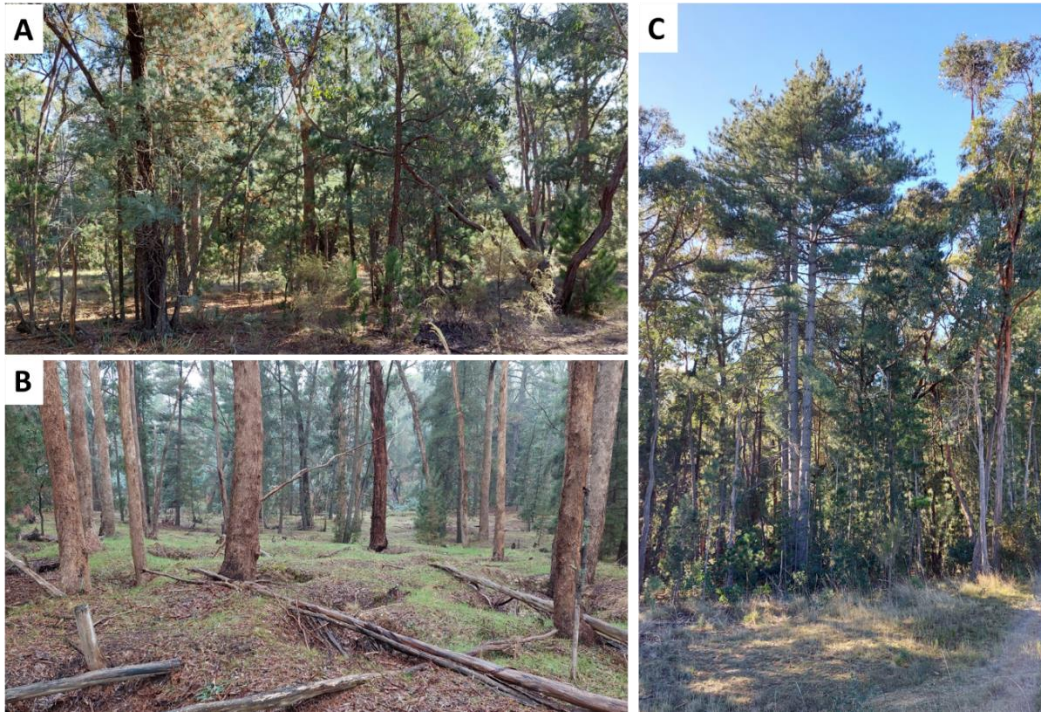


Figure 15. Pines invading into woodland areas (A) Area 3b (B) Area 3c and (C) Area 3d. Photo (B) also shows a densely pitted ground from historical gold mining.



Figure 16. Gorse along a road side in area 3a (left) and near Creswick Ck (right).

3.2 Threatened Ecological Communities

3.2.1 EPBC Act Listed Communities

A report generated by the EPBC Act Protected Matters Search Tool (PMST) identified five Threatened Ecological Communities that could potentially be present in the Investigation Areas. Table 6 gives a description of each and identifies the Investigation Areas where they have potential to be present. All are critically endangered.

Table 6. Nationally significant vegetation communities with potential to occur within the Investigation Area according to the PMST.

Ecological Community	Status	Description	Present
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	This grassland is mainly associated with Quaternary basalt soils within the Victorian Volcanic Plain IBRA bioregion. It includes typical species: Kangaroo-grass, Wallaby-grasses, Spear-grasses and/or Tussock-grasses. Wildflowers and herbs grow among the tussocks, including daisies, lilies, peas and orchids (DoE 2015a).	Likely Some of the moderate to high quality grassland in areas 2a and 3a, are likely to meet the Key Diagnostic Characteristics and Condition Thresholds for this community. However more detailed site assessment is needed to confirm this. Further analysis is also needed to determine if the grasslands are natural or derived from the Grassy Eucalypt Woodland of the VVP ecological community.
White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Box–Gum Grassy Woodlands and Derived Grasslands are characterised by a species-rich understorey of native tussock grasses, herbs and sparse, scattered shrubs, and the dominance, or prior dominance, of White Box, Yellow Box or Blakely's Red Gum trees. The tree–cover is generally discontinuous and consists of widely–spaced trees of medium height in which the canopies are clearly separated (Yates and Hobbs 1997). This ecological community occurs in areas where rainfall is between 400 and 1200 mm per annum, on moderate to highly fertile soils at altitudes of 170 metres to 1200 metres.	Possible Some areas of Hills Herb–rich Woodland and Valley Grassy Forest had codominance of Yellow Box. While White Box and Blakely's Red Gum were not observed, a detailed survey of all Eucalypts was not conducted and instead only character species were recorded. Although the area does not appear to be ideal for the community, there is potential for pockets of this community to still occur within areas with forest and woodland within Investigation Areas 2b, 3b–d.

Ecological Community	Status	Description	Present
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	<p>This is an open eucalypt woodland often dominated by River Red-gum with a predominantly grassy understorey (DoE 2015b).</p> <p>At sites that receive higher rainfall, typically more than 700 mm per annum. Swamp Gum and Manna Gum) may replace River Red Gum as the dominant species in the canopy layer. Other tree species that may be present in the canopy layer include Lightwood <i>Acacia implexa</i>, Black Wattle <i>Acacia mearnsii</i>, Blackwood, Drooping Sheoak <i>Allocasuarina verticillata</i> and Silver Banksia.</p>	<p>Likely</p> <p>Some of the areas mapped as either grassland or EVC 55: Plains Grassy Woodland (areas 2a, 3a and 3b), which are of moderate to high quality are likely to meet Diagnostic Characteristics and Condition Thresholds for this community. However more detailed site assessment is needed to confirm this.</p> <p>Further analysis is also needed to determine if the grassland areas are derived grasslands of this ecological community or representative of the Natural Temperate Grassland of the Victorian Volcanic Plain.</p>
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Critically Endangered	<p>The community generally occurs in landscapes of low-relief such as flat to undulating plains, low slopes and rises and, to a lesser extent, drainage depressions and flats. The mean annual rainfall associated with the distribution of the ecological community lies in the range 375–700 mm/year.</p> <p>The tree canopy is dominated ($\geq 50\%$ canopy crown cover) by Grey Box <i>Eucalyptus microcarpa</i> or in some circumstance other species may be co-dominant (but never dominant).</p>	<p>Likely</p> <p>Areas mapped as EVC 71: Hills Herb-rich Woodland could meet the Diagnostic Characteristics and Condition Thresholds for this community, although more detailed site assessment is needed to confirm this.</p> <p>It is noted again that the survey was conducted solely from the roadside, and there could be potential for pockets of this community to occur within other areas of woodland such as 2b, 3b–d.</p>
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Critically Endangered	<p>These are isolated, freshwater wetlands that are usually inundated on a seasonal basis through rainfall, then dry out, so surface water is not permanently present. Rainfall is the main water source for this community.</p> <p>They occur on the lowland plains of temperate south-eastern Australia and have a vegetation structure that is open, i.e. woody cover is absent to sparse, and the ground layer is dominated by herbs (grasses, sedges and forbs) adapted to seasonally wet or waterlogged conditions.</p> <p>It typically includes one or more of the following: Wallaby Grasses spp. Swamp Wallaby-grasses (particularly Brown-back Wallaby-grass <i>Rytidosperma duttonianum</i>) <i>Amphibromus</i> spp., Poong'ort <i>Carex tereticaulis</i>, Bent Grasses <i>Deyeuxia</i> spp., Sweet Grasses <i>Glyceria</i> spp., Blown-grasses <i>Lachnagrostis</i> spp., and Common Tussock-grass <i>Poa labillardierei</i> (DoE 2015d).</p>	<p>Possible</p> <p>Wetlands were identified over-the-fence within in Areas 2a and 3a. However, a more detailed on-foot assessment is needed to determine if they could meet the Key Diagnostic Characteristics and Condition Thresholds of this ecological community</p> <p>The listing advice identifies the Victorian EVC 647: Plains Sedgy Wetland as a Victorian EVC that most likely corresponds with the Seasonal Herbaceous Wetlands community. This EVC is mapped by NatureKit within Investigation Area 2a and 3a (See Map 4, Appendix 1).</p> <p>Note that the wetlands near Ring Rd near Creswick Creek are not considered part of this community as they likely rely on overbank flooding from the creek/tributary.</p>

3.2.2 FFG Act Communities

Listed threatened communities of flora and fauna under the FFG Act and their characteristics were consulted to determine their potential to occur within the Investigation Area (DELWP 2022).

Based on this three State listed (FFG Act) threatened communities were identified with potential to occur within the Investigation Area. These are listed in Table 7. The Western Basalt Plains (River Red Gum) Grassy Woodland and Western (Basalt) Plains Grasslands Community communities are considered likely to occur based on ground-truthing and desktop analysis. It is also possible that the Butterfly community could occur within woodland areas.

Table 7. FFG listed communities with potential to be present

Community Name	Description ^	Present
Butterfly Community No. 1	<p>Butterfly Community No.1 is a community characterized by the presence of several species of butterfly. The most important of these are the Small Ant-blue <i>Acrodipsas myrmecophii</i> and the Large Ant-blue <i>Acrodipsas brisbanensis cyrilus</i> but the list also includes other species, such as the Southern Purple <i>Genoveva Azure Ogyris genoveva araxes</i>, Northern Dusky Blue <i>Candalides hyacinthus simplex</i> and Miskin's or Wattle Blue <i>Theclines miskini miskini</i>, together with the ant <i>Iridomyrex nitidus</i> on which the ant-blues depend.</p> <p>Characteristic vegetation is a mosaic of dry open forest and woodland of eucalypts, such as Broad-leaved Peppermint, Long-leaf Box, Messmate Stringybark and Red Stringybark with an understorey with both grasses and shrubs. Typical understorey species are Poa grasses, Rock-ferns <i>Cheilanthes</i> spp., Common Heath <i>Epacris impressa</i>, Groundsels <i>Senecio</i> spp. and Mountain Grevillea <i>Grevillea alpina</i>. The main food plants on which these butterflies lay their eggs are tree lichens, rock lichens and fungi (DELWP 2022).</p>	<p>Possibly</p> <p>This community could occur in areas of Woodland in Investigation Areas 1, 2b 3b-d, which are characteristic of the vegetation used by this Butterfly community. However further targeted butterfly surveying would be needed to confirm this.</p> <p>There were no VBA records of these butterfly species within a 5km radius of the Investigation Areas. Currently, the only known area of this community is Mt Piper, which is a considerable distance, approximately 50 km from Creswick.</p>
Western Basalt Plains (River Red Gum) Grassy Woodland	<p>This grassy woodland community has a clearly-recognizable structure made up of an open canopy of River Red-gum, a middle layer chiefly of scattered wattles such as Golden Wattle and Hedge Wattle <i>Acacia paradoxa</i> but including a few other shrubs as well, such as Tree Violet <i>Melicytus dentatus</i>, and a ground layer dominated by grasses. In its least disturbed state, the ground layer is predominantly tussock grasses such as Common Tussock Grass and Wallaby Grasses, together with Kangaroo Grass and various forbs in the spaces between the tussocks. The composition of the ground layer varies greatly from site to site, being heavily influenced locally by the amount of tree cover, soil characteristics and the site's grazing and fire histories. More disturbed sites have a high proportion of introduced grasses and forbs in the ground layer (DELWP 2022).</p>	<p>Likely</p> <p>This community aligns closely with EVC 55: Plains Grassy Woodland, which is mapped in Investigation Areas 2a and 3b.</p> <p>Mapped areas of Grassland within Investigation areas 2a and 3a may also correspond to a derived grassland version of this community.</p>

Community Name	Description [^]	Present
Western (Basalt) Plains Grasslands Community	<p>The Western (Basalt) Plains Grasslands Community is an open grassland community found mainly on undisturbed, poorly-drained heavy clay soils on the basalt plains of western Victoria. The vegetation is characteristically dominated by perennial native grasses, with very few eucalypts and shrubs.</p> <p>Perennial native plants predominate. On drier sites, the community is usually dominated by Kangaroo Grass, together with composites such as Common Everlasting <i>Chrysocephalum apiculatum</i> and Lemon Beauty-heads <i>Calocephalus citreus</i>. On moister sites tussock grasses, particularly Wallaby Grasses, Spear Grasses and Tussock Grasses tend to predominate, often with Common Onion Orchid <i>Microtis unifolia</i> and Pale Sundew <i>Drosera peltata</i> in spaces between the tussocks (DELWP 2022).</p>	<p>Likely</p> <p>Mapped areas of Grassland within Investigation Areas 2a and 3a may correspond to this ecological community.</p> <p>Further analysis is also needed to determine if the grasslands are natural or derived from the Western Basalt Plains (River Red Gum) Grassy Woodland ecological community.</p>
Victorian Temperate Woodland Bird Community	<p>The Victorian Temperate Woodland Bird Community has been defined as a suite of bird species, mainly associated with drier woodlands on the slopes and plains north of the Great Dividing Range, that seem to have declined markedly in numbers since records began.</p> <p>There are a total of 24 bird species associated with this community. The distributions of these birds differ between species. Many are closely associated with (but not exclusive to) northern Victorian drier woodlands dominated by Box, Stringybark, Ironbark, Yellow Gum or River Red-gum Eucalypts, or by Buloke or Cypress-pine (DELWP 2022).</p>	<p>Unlikely</p> <p>VBA records do not indicate the presence of these woodland bird species.</p>

[^] Taken from Flora and Fauna Guarantee Characteristics of threatened Communities.

3.3 Flora

3.3.1 Flora species recorded onsite

A total of 98 plant taxa were recorded during the site visit, of which 74 were indigenous (76%) and 24 were introduced or naturalised outside their natural range (24%). Appendix 2 lists the flora recorded across the Investigation Areas ground according to the EVCs in which they were recorded. Please note that this was not a comprehensive list of species across the Investigation Areas as the survey was only undertaken from road-side, public land and over-the-fence, and due to time limitations, the list is only an observation of the main character species.

Table 8. Summary of plant taxa recorded

Flora Status	Number of Taxa
Indigenous vascular taxa	74
Exotic taxa	23
Naturalised	1
TOTAL	98

3.3.2 State (FFG Act) or Nationally (EPBC Act) Significant flora taxa

Field Survey

No nationally state significant flora species were observed during the site visit.

Database records

Nationally and state significant flora and fauna are listed under the EPBC Act and the FFG Act, respectively. A search was undertaken to identify all observations of significant flora and fauna species, within a five-kilometre buffer of the Investigation Area, that were either:

- Recorded on the VBA since 1980, and/or
- Potentially occurring based on a report generated by the EPBC Act PMST.

It is noted that the number of species records was fewer than expected. This highlights the importance of the ground-truthing assessment, and the need for detailed assessments before any developments occur.

A search of the VBA found 873 flora species, 275 introduced or naturalised, within a 5 km buffer of the Investigation Area. Of these 22 were significant flora species. The location of these are shown in Map 8 (Appendix 1). It is noted that only 4 of the VBA records of these significant species occurred within the Investigation Area itself. The PMST tool identified a further 18 significant flora species with potential to occur in the area but without records within a 5 km buffer of the Investigation Area. Of the 40 significant species, 17 were considered to have at least a moderate likelihood of occurring within the Investigation Area, mainly within areas of woodland, forest or grassland, and are listed in Table 9. Details of these species and reasoning for their likelihood of presence are given in Appendix 2. Please note that the field survey was rapid, and of limited access and coverage, hence significant flora species may still have potential to occur within the Investigation areas as detailed in Appendix 2, despite not being observed during the field survey.

Table 9. Significant Flora species with at least a moderate likelihood of presence in the Investigation Area. Vu – vulnerable, En – Endangered, Cr – Critically Endangered.

Source	Scientific Name	Common Name	EPBC	FFG
VBA, PMST	<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	VU	-
VBA	<i>Bossiaea cordigera</i>	Wiry Bossiaea	-	En
VBA	<i>Comesperma polygaloides</i>	Small Milkwort	-	Cr
VBA	<i>Coronidium gunnianum</i>	Pale Swamp Everlasting	-	Cr
PMST	<i>Dianella amoena</i>	Matted Flax-lily	EN	Cr
VBA	<i>Dianella sp. aff. longifolia (Benambra)</i>	Arching Flax-lily	-	Cr
VBA	<i>Dipodium pardalinum</i>	Spotted Hyacinth-orchid	-	En
VBA	<i>Eucalyptus brookeriana</i>	Brooker's Gum	-	En
VBA	<i>Eucalyptus yarraensis</i>	Yarra Gum	-	Cr
VBA	<i>Levenhookia sonderi</i>	Slender Stylewort	-	En
PMST	<i>Pimelea spinescens subsp. spinescens</i>	Spiny Rice-flower	CR	Cr
VBA	<i>Prasophyllum suaveolens</i>	Fragrant Leek-orchid	EN	Cr
PMST	<i>Pterostylis chlorogramma</i>	Green-striped Greenhood	VU	En
PMST	<i>Rutidosia leptorhynchoides</i>	Button Wrinklewort	EN	En
VBA	<i>Senecio campylocarpus</i>	Floodplain Fireweed	-	En
VBA	<i>Senecio microbasis</i>	Slender Fireweed	-	Vu
PMST	<i>Xerochrysum palustre</i>	Swamp Everlasting	VU	Cr

3.3.3 Declared weeds

The declared noxious weeds under the *Catchment and Land Protection (CaLP) Act 1994* observed on site are listed in Table 10. Six CaLP listed species were observed during the Site Survey. However, please note again that this was not a comprehensive survey and was only an observation of the character species.

Table 10. Declared noxious weeds observed during the Field Survey.

Scientific Name	Common Name	Control Category (Goulburn)
<i>Chrysanthemoides monilifera subsp. monilifera</i>	Boneseed	P
<i>Crataegus monogyna</i>	Hawthorn	R
<i>Cytisus scoparius</i>	English Broom	R
<i>Rosa rubiginosa</i>	Sweet Briar	C
<i>Rubus fruticosus spp. agg.</i>	Blackberry	C
<i>Ulex europaeus</i>	Gorse	C

3.4 Fauna

3.4.1 Incidental Fauna sightings

A number of species, predominantly birds were observed as presented in Table 11.

Table 11. Incidental fauna list recorded during site visit

Family	Origin	Scientific Name	Common Name	Record Type
Ardeidae		<i>Ardea</i> sp.	Egret	Observed
Cacatuidae		<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	Observed
Cacatuidae		<i>Cacatua</i> spp.	Corella	Observed
Anatidae		<i>Chenonetta jubata</i>	Australian Wood Duck	Observed
Corcoracidae		<i>Corcorax melanorhamphos</i>	White-winged Chough	Observed
Corvidae		<i>Corvus coronoides</i>	Australian Raven	Observed
Alcedinidae		<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Heard
Ardeidae		<i>Egretta novaehollandiae</i>	White-faced Heron	Observed
Cacatuidae		<i>Eolophus roseicapilla</i>	Galah	Observed
Falconidae		<i>Falco cenchroides</i>	Nankeen Kestrel	Observed
Dicruridae		<i>Grallina cyanoleuca</i>	Magpie-lark	Observed
Artamidae		<i>Gymnorhina tibicen</i>	Australian Magpie	Observed
Macropodidae		<i>Macropus giganteus</i>	Eastern Grey Kangaroo	Observed
Maluridae		<i>Malurus cyaneus</i>	Superb Fairy-wren	Observed
Phalacrocoracidae		<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	Observed
Leporidae	*	<i>Oryctolagus cuniculus</i>	European Rabbit	Observed
Psittacidae		<i>Platycercus elegans</i>	Crimson Rosella	Observed
Psittacidae		<i>Platycercus eximius</i>	Eastern Rosella	Observed
Scincidae		<i>Tiliqua scincoides</i>	Common Blue-tongued Lizard	Observed (dead)
Muscicapidae	*	<i>Turdus merula</i>	Common Blackbird	Observed
Vanellinae		<i>Vanellus miles</i>	Masked Lapwing	Observed
Macropodidae		<i>Wallabia bicolor</i>	Black-tailed Wallaby	Observed (dead)

3.4.2 Fauna habitat

The main focus of the fauna assessment was to consider the site's potential to provide habitat for rare or threatened fauna species.

As described earlier in section 3.1, key fauna habitat components observed within the Investigation Area are:

- Extensive areas of quality woodlands/forest across Areas 2b, 3b, 3c and 3d. These woodland areas provide habitat for many species in the form of flowering Eucalypts and mistletoe as a food resource, and trees with hollows and fissures for roosting and nesting.
- Extensive areas of grassland in Areas 2a and 3a, many of moderate to high quality.
- Scattered trees.
- Native plantings particularly in Area 3a.
- Areas with rocky outcrops of importance for reptiles and lizards.
- Wetlands.
- Creswick Creek and drainage lines

3.4.3 State (FFG Act) and nationally (EPBC Act) threatened fauna

Overall, 234 Fauna species were identified within a 5 km radius of the Investigation Area on the VBA database. Seventeen of these were introduced species while 24 were listed as significant species under either state or national legislation. The location of the listed fauna records is shown in Map 9 (Appendix 1). There was a concentration of observations around certain areas as shown in Table 12, but this may also reflect greater surveying time in these locations.

The PMST tool identified a further 20 significant species with potential to occur in the area but without records within a 5 km buffer of the Investigation Area. It is also understood that Hepburn Shire's Biodiversity Officer, Brian Bainbridge has observed Yellow Ochre butterfly within firebreaks in the Creswick Area (adjacent Alfred Street), hence this species was also considered (B Bainbridge pers. comm., 25.08.22). Of the total 45 significant species identified, 23 were considered to have at least a moderate likelihood of occurring within the Investigation Area. These are listed in Table 13. Details and reasoning for their likelihood of presence are given in Appendix 4.

The majority of significant species were birds (17), which are highly mobile and can more readily navigate the cleared and fragmented landscapes and tap into a range of habitat resources. For example, there were a number of water birds and duck species that can take advantage of farm dams, lakes and sewerage ponds across the landscape, as well as raptors and owls that can forage above farmland and woodlands. Swift Parrots *Lathamus discolor* may occasionally forage in flowering Eucalypts and Mistletoes in the more wooded areas of Investigation Areas 2b, 3b, 3c and 3d. Other species included the Growling Grass Frog *Litoria raniformis*, Southern Toadlet *Pseudophryne semimarmorata*, Pink-tailed Worm-Lizard *Aprasia parapulchella*, Golden Sun Moth *Synemon plana* and Striped Legless Lizard *Delma impar*. The latter three are dependent on grassland habitats such as those identified in Investigation Areas 2a and 3a. The Growling Grass Frog and Golden Sun Moth are discussed in sections below in regards to specific past surveys undertaken within the Creswick area.

In summary, the main habitats likely to be used by the listed fauna species included:

- Waterbodies including Creswick Creek, sewerage ponds, farm dams, wetlands and St Georges Lake.
- Treed habitats such as Woodlands and Forested areas including flowering eucalypts (Investigation Areas 2b, 3b–d) as well as Scattered Trees throughout the Investigation Areas.
- Grasslands (Areas 2a, 3a, 3b).

Table 12. Features/Areas with higher density of listed fauna species records

Location	Species
Western evaporation sewerage ponds (Investigation Area 3a)	<ul style="list-style-type: none"> • Reed–Warbler <i>Acrocephalus australis</i> • Hardhead <i>Athya australis</i> • Musk Duck <i>Biziura lobata</i> • Double–banded Plover <i>Charadrius bicinctus</i> • Latham’s snipe <i>Gallinago hardwickii</i> • Little Eagle <i>Hieraaetus morphnoides</i> • Growling Grass Frog <i>Litoria raniformis</i> • Blue–billed duck <i>Oxyura australis</i> • Australasian Shoveler <i>Spatula rhynchotis</i>
Creswick Creek (Area 3a)	<ul style="list-style-type: none"> • Growling Grass Frog • Musk duck
St Georges Lake (1–2km from Investigation Areas 1 and 3d)	<ul style="list-style-type: none"> • Grey Goshawk <i>Accipiter novaehollandiae</i> • Hardhead • Brolga <i>Antigone rubicunda</i> • Platypus (1981 record) <i>Ornithorhynchus anatinus</i>
Cosgrove reservoir (~3 km from Investigation Area 1 and 3d)	<ul style="list-style-type: none"> • Musk Duck • Powerful Owl
Creswick Regional Park	<ul style="list-style-type: none"> • Powerful Owl • Satin Flycatcher (There is also a record adjacent in Investigation Area 3b).

Table 13. Significant fauna species with at least a moderate likelihood of occurring within the Investigation Area. Vu – vulnerable, En – Endangered, Cr – Critically Endangered. B – Bonn treaty, R – ROKAMBA treaty, J – JAMBA treaty C – CAMBA treaty

Source	Scientific Name	Common Name	EPBC	FFG	Treaty
VBA	<i>Accipiter novaehollandiae</i>	Grey Goshawk	–	En	–
VBA	<i>Acrocephalus australis</i>	Reed-Warbler	–	–	B
VBA	<i>Antigone rubicunda</i>	Brolga	–	En	–
PMST	<i>Aprasia parapulchella</i>	Pink-tailed Worm-Lizard	VU	En	–
VBA	<i>Aythya australis</i>	Hardhead	–	Vu	–
VBA	<i>Biziura lobata</i>	Musk Duck	–	Vu	–
PMST	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	EN	–	–
VBA, PMST	<i>Delma impar</i>	Striped Legless Lizard	VU	En	–
VBA	<i>Egretta garzetta</i>	Little Egret	–	En	–
PMST	<i>Falco hypoleucos</i>	Grey Falcon	–	Vu	–
VBA	<i>Falco subniger</i>	Black Falcon	–	Cr	–
VBA	<i>Gallinago hardwickii</i>	Latham's Snipe	–	–	B R J C
VBA	<i>Hieraaetus morphnoides</i>	Little Eagle	–	Vu	–
VBA, PMST	<i>Hirundapus caudacutus</i>	White-throated Needletail	VU	Vu	C R J
PMST	<i>Lathamus discolor</i>	Swift Parrot	CR	Cr	–
VBA, PMST	<i>Litoria raniformis</i>	Growling Grass Frog	VU	Vu	–
VBA	<i>Lophoictinia isura</i>	Square-tailed Kite	–	Vu	–
VBA	<i>Ninox strenua</i>	Powerful Owl	–	Vu	–
VBA	<i>Oxyura australis</i>	Blue-billed Duck	–	Vu	–
VBA	<i>Pseudophryne semimarmorata</i>	Southern Toadlet	–	En	–
VBA	<i>Spatula rhynchotis</i>	Australasian Shoveler	–	Vu	–
VBA, PMST	<i>Synemon plana</i>	Golden Sun Moth	CR	Vu	–
*	<i>Trapezites luteus luteus</i>	Yellow Ochre Butterfly	–	En	–

*B. Bainbridge pers. comm. 25.08.22

3.4.4 Previous Species-specific Surveys

This section briefly summarises past surveys undertaken in the area for Growling Grass Frog and Golden Sun Moth. Based on previous surveys, The Golden Sun Moth is present within Investigation Areas 2a, 2b, 3a and 3b while the Growling Grass Frog is present within Investigation Areas 1 and 3a.

Growling Grass Frogs

The Growling Grass Frog (GGF) is a large frog (up to 104 mm in length for females) with a bright to olive-green colour, gold, brown or bronze spotting and a warty back. It was once widespread across Victoria but has declined rapidly from 1991. They are now listed as Vulnerable under National (EPBC Act) and State (FFG Act) legislation.

A 2012 report by Ray Draper gives evidence of GGF presence in water bodies within the Investigation Area, particularly in the southern part of Investigation Area 3a in still waterbodies with proximity to Creswick Creek including (Draper 2012, Draper 2013):

- Sewerage treatment ponds.
- Farm dams and ponds along informal drainage lines to the Creeks.
- Calembeen Park.

VBA records for GGF are shown on Map 10, Appendix 1. The maps from Ray Draper's report are given in Appendix 5 which show further recorded locations.

GGF require water bodies with still or slow-moving water such as lagoons, swamps, lakes pond and farm dams, with a combination of dense emergent vegetation around the edges and mats of floating and submerged plants (SWIFFT 2022). Typical vegetation includes Pondweed *Potamogeton tricarinatus*, Water Ribbons *Triglochin procerum*, Common Reed, Spike-rushes and Common Rush *Juncus usitatus* but can include a range of other vegetation. Submerged vegetation is important for breeding success between October to November. GGF have been recorded 200 m from water and can readily migrate from one area to another in search of more suitable habitat if needed (DEWHA 2009, SWIFFT 2022).

Waterbodies with habitat features similar to those describe above, especially within Investigation Area 3a, should be considered potential GGF habitat, with further surveying recommended. For example, Wetlands with Common Rush were observed to the west of Ring Road along a tributary of Creswick Creek while wetlands with Spike-rushes were also present north of Creswick Creek in Investigation Area 3a, and could support GGF.

Golden Sun Moth

The Golden Sun Moth (GSM) is a small diurnal moth found in grassland habitat dominated by species of Wallaby Grass, in particular *Rytidosperma carphoides*, *R. auriculata*, *R. eriantha*, and *R. setacea* but can also thrive in exotic grasses such as Chilean Needle-grass **Nassella neesiana* (SWIFFT 2022). They are considered Vulnerable under the EPBC and FFG Acts.

There are recent VBA records from three sites within Investigation Area 2a. Hepburn Shire's Biodiversity officer, Brian Bainbridge, also conducted roadside surveys for GSM in December 2021, which found significant GSM activity in areas of suitable habitat within Investigation Areas 3a, 2a and 2b (Bainbridge 2022). These records are shown on Map 10, Appendix 1.

Based on the above, moderate to high quality grasslands, particularly in Areas 2a and 3a, should be considered potential GSM habitat, with further surveying recommended prior to redevelopment.

3.5 Culturally Significant Flora and Fauna

Plants and animals may also be culturally-significant for Traditional Owners, spiritually and as a source of food, medicine, shelter and fibre. Some of these may now be rare, regionally extinct or at numbers that cannot sustain their continued cultural use (NCCMA 2022). Table 14 below lists some of the culturally significant flora and fauna to the Dja Dja Wurrung, obtained from a number of sources including the Dja Dja Wurrung Country Plan 2014–2034 (Dja Dja Wurrung Clans Aboriginal Corporation) and North Central Regional Catchment Strategy (Haw and Munro 2010, NCCMA 2022). Some of these culturally significant plants and animals were identified during the field survey or from desktop analysis. For example, grasslands dominated by Kangaroo Grass, one of the culturally significant plants, were observed within Investigation Areas 2a and 3a. These are also likely to support culturally significant herb species such as Chocolate, Vanilla and Bulbine Lilies, although surveys are needed in spring to confirm this. VBA records also indicate past Brolga observations at St Georges Lake. It is hoped that the ecological values documented in this report can be useful for future engagement with the Dja Dja Wurrung to begin recognising culturally significant flora and fauna within the Creswick region, and ways to apply cultural land management practices such as Wi (fire) to promote these.

Table 14. Table that lists some of the culturally important flora and fauna for the Dja Dja Wurrung. Information drawn from (Haw and Munro 2010, NCCMA 2022).

Name	Likelihood of presence	Potential for retention, enhancement and/or re-introduction
Food, Medicine and Fibre plants:		
<ul style="list-style-type: none"> Kangaroo Grass 	<p>Present</p> <p>Kangaroo Grass was a dominant species within the majority of the mapped grassland areas.</p>	<p>High</p> <p>Kangaroo grass was abundant across the mapped grassland areas. With protection and management, it should be possible to retain and enhance these grassland areas.</p>
<ul style="list-style-type: none"> Mat-rush <i>Lomandra</i> spp. to weave baskets 	<p>Present</p> <p>Mat-rushes species were observed in many of the forest and woodland areas. Most of these were Wattle Mat-rush <i>L. filiformis</i> however, which is likely to be less ideal for weaving than Spiny-headed Mat-rush <i>L. longifolia</i>, which was only observed in low cover along creeklines.</p>	<p>High</p> <p>Mat-rushes were reasonably abundant in mapped areas of moderate-high quality woodland and forest. With protection and management, it should be possible to retain and enhance these. Further plantings of Spiny-headed Mat-rush could easily be achieved along Creswick Creek where indigenous vegetation cover is currently low.</p>
<ul style="list-style-type: none"> Flax-lily <i>Dianella</i> spp. 	<p>Present</p> <p>Black-anther Flax-lily <i>Dianella admixta</i> was observed in woodland and forest areas – Grassy Dry Forest, Heathy Dry Forest, Hills Herb-rich Woodland.</p>	<p>High</p> <p>Black-anther Flax-lily <i>Dianella</i> was reasonably abundant across areas of moderate-high quality woodland and forest. With protection and management, it should be possible to retain and enhance these.</p>

Name	Likelihood of presence	Potential for retention, enhancement and/or re-introduction
<ul style="list-style-type: none"> Murnong (Yam Daisies) 	<p>Likely</p> <p>These species are likely present within mapped areas of moderate to high quality grassland and woodland.</p>	<p>High</p> <p>With protection and management of moderate to high quality grassland areas. Management of the grasslands to reduce biomass and increase inter-tussock space would also be beneficial in many cases.</p>
<ul style="list-style-type: none"> Chocolate, Vanilla and Bulbine Lilies 	<p>They would not have been in flower at the time of survey.</p> <p>These may also be present in derived grasslands along pine-plantation fire-breaks.</p>	
<ul style="list-style-type: none"> Wattles/Wattle seeds 	<p>Present</p> <p>Wattles were observed within all of the mapped areas of vegetation, particularly within areas of Heathy Dry Forest and along Creswick Creek. There were also areas dominated by Wattles near Calembeen Park.</p>	<p>High</p> <p>Many areas lacking indigenous vegetation would be suited to planting a range of Wattle species.</p>
<ul style="list-style-type: none"> Buloke <i>Allocasuarina luehmannii</i> for tools and ceremony 	<p>Unlikely</p> <p>This species was not observed during the field survey and there are no VBA records within 5 km. Historically these have been heavily cleared and Creswick is at the edge of its range.</p>	<p>Moderate</p> <p>Not typical of this area but could be included in revegetation and/or amenity plantings.</p>
<ul style="list-style-type: none"> River Red-gum timber for tools and ceremony 	<p>Present</p> <p>River Red-gums were scattered across the Creswick area, particularly within areas mapped as Plains Grassy Woodland, Riparian Woodland and Plains Grassland.</p>	<p>High</p> <p>With plantings and protection of existing trees to allow for regeneration.</p>

Name	Likelihood of presence	Potential for retention, enhancement and/or re-introduction
<ul style="list-style-type: none"> Waterbodies, including farm dams with extensive stands of Rushes, Poong'ort <i>Carex tereticaulis</i> and other Sedges, Bulrushes and Reeds. 	<p>Present</p> <p>There are many dams and wetlands scattered across the Creswick area. These varied in their vegetation but often included Spike-rushes, Rushes, Sedges, Common Reed, and Bulrush.</p>	<p>Moderate</p> <p>With weed management and/or revegetation.</p>
<p>Spiritual importance (Murrup):</p>		
<ul style="list-style-type: none"> Brolga 	<p>Possible</p> <p>Recent records from St Georges Lake and further north of the Investigation areas. While Brolga is not considered migratory, this species is known to be nomadic in part as it moves to different areas based on seasonal rainfall.</p> <p>Therefore, given the number of recent records in the area, it is highly likely that animals occasionally visit the area while foraging. Brolgas could use waterbodies, pastures and croplands in the Investigation areas.</p>	<p>Moderate</p> <p>While reintroductions are not realistic for this species, existing habitat (especially the habitat near large waterbodies) could be enhanced with weed management and/or revegetation.</p>

Name	Likelihood of presence	Potential for retention, enhancement and/or re-introduction
<ul style="list-style-type: none"> Gal Gal (Dingo <i>Canis dingo</i>) 	<p>Unlikely No VBA records in the surrounding area.</p>	<p>Low</p> <p>Re-introduction program is not recommended given the land uses and associated high level of human activities within the investigation areas. Indeed, re-introduction of dingos within the Investigation areas may lead to interbreeding between domestic dogs and dingos and an increase in human-wildlife conflicts in the area. Therefore, this could compromise the success of the re-introduction program.</p>
<ul style="list-style-type: none"> Barramul (Emu <i>Dromaius novaehollandiae</i>) 	<p>Unlikely No VBA records in the surrounding area.</p>	<p>Low</p> <p>Many hazards for this species are present within the Investigation areas. They include railways, main roads, frequent wildlife-human interaction and other risks caused by the proximity of residential areas. Therefore, re-introduction of this species into the investigation areas is not recommended as the identified risks could lead a re-introduction program to have a high chance of failure.</p>

Name	Likelihood of presence	Potential for retention, enhancement and/or re-introduction
<ul style="list-style-type: none"> Yung (Eastern Quoll <i>Dasyurus viverrinus</i>). 	<p>Highly Unlikely</p> <p>No VBA records in the surrounding area. These were considered extinct/rare in mainland Australia from about 1960s, although they have been re-introduced to areas.</p>	<p>Low</p> <p>As for the Emu, many hazards for this species are present within the Investigation areas. They include railways, main roads, predation by domestic animals and other risks caused by the proximity of residential areas. However, if vegetation in the Creswick Regional Park is large enough to support a viable population, this could possibly be a long-term goal.</p>
Other Fauna		
<ul style="list-style-type: none"> Brushtail Possum <i>Trichosurus vulpecula</i> and the hollows they rely on Kangaroo Wallaby <i>Wallabia</i> spp. Goanna/Lace Monitor <i>Varanus</i> spp. 	<p>Present or Likely present</p> <p>Within mapped areas of bushland and forest.</p> <p>Kangaroos were observed within the investigation area, as well as a dead Wallaby along Clunes–Creswick Road.</p>	<p>High</p> <p>With retention of a variety of natural areas such as woodland, forest and plains, and maintained/improved connectivity.</p>
Healthy waterways, aquatic plants and fauna:		
<ul style="list-style-type: none"> Nardoo <i>Marsilea</i> spp. 	<p>Likely</p> <p>Many areas of appropriate habitat observed.</p>	<p>Moderate</p> <p>Many areas of appropriate habitat where species of this genus could be planted.</p>

Name	Likelihood of presence	Potential for retention, enhancement and/or re-introduction
<ul style="list-style-type: none"> River Blackfish <i>Gadopsis marmoratus</i> habitat 	<p>Possible</p> <p>The Atlas of Living Australia indicates 1977 and 1986 and 2007 records along Creswick Creek and other connected creeks in the area.</p>	<p>Unclear</p> <p>Potential for habitat improvement but unclear how abundant this fish is in the area.</p> <p>Its preferred habitat is slow flowing streams with rock cover and abundant snags, fallen timber and debris, and gravel bottom. Hence restoring such conditions may help their establishment.</p>
<ul style="list-style-type: none"> Re-snagging 	<p>Possible</p> <p>Re-snagging could occur naturally with the re-establishment of native vegetation along Waterways. Logs could also be introduced where their removal is unavoidable for other projects/Council maintenance.</p> <p>While there have been plantings of Eucalypts and Wattles further back from Creswick Creek, the creekline itself is dominated by exotic environmental weed species, and the control of these is another priority to be balanced with re-snagging.</p>	

4. LEGISLATION AND POLICY IMPLICATIONS FOR FUTURE DEVELOPMENT

Further requirements associated with development of the Investigation Area and any additional surveys that may be required are provided in Table 15 below in relation to National and State legislation.

Table 15. Summary of Legislation and Policy and its relevance to the Investigation Area

Legislation	Description	Relevance and Constraints
Environment Protection and Biodiversity Conservation Act	<p>The <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) applies to sites where proposed developments or projects may have a significant impact on Matters of National Environmental Significance (MNES). There are nine MNES:</p> <ul style="list-style-type: none"> • World heritage sites; • National heritage places; • Wetlands of international importance (often called ‘Ramsar’ wetlands after the international treaty under which such wetlands are listed); • Nationally threatened species and ecological communities; • Migratory species; • Commonwealth marine areas; • Nuclear actions; • The Great Barrier Reef Marine Park; and • A water resource, in relation to coal seam gas development and large coal mining development. <p>Under the EPBC Act, a proponent must refer proposed actions that may have a significant impact on matters of national environmental significance to the Australian Government Environment Minister (or delegate).</p> <p>The EPBC Act provides for the listing of nationally threatened native species and ecological communities, native migratory species and marine species. The EPBC Act protects Australia’s native species and ecological communities by providing for:</p> <ul style="list-style-type: none"> • Identification and listing of species and ecological communities as threatened; • Development of conservation advice and recovery plans for listed species and ecological communities; • Development of a register of critical habitat; • Recognition of key threatening processes; and • Where appropriate, reducing the impacts of these processes through threat abatement plans. 	<p>EPBC Act listed flora, fauna and ecological communities with the potential to occur or use the Investigation Area were described in Sections 3.2.1, 3.3.2 and 3.4.3.</p> <p>It is likely that patches of the following ecological communities are present, especially in relevant areas mapped as moderate to high quality:</p> <ul style="list-style-type: none"> – Natural Temperate Grassland of the Victorian Volcanic Plain (Investigation Areas 2a, 3a and 3b) – Grassy Eucalypt Woodland of the Victorian Volcanic Plain (Investigation Areas 2a, 3a and 3b) – Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands (Investigation Areas 3a and 3b) <p>Wetlands were also identified in areas 2a and 3b that may represent the EPBC Act ecological community:</p> <ul style="list-style-type: none"> – Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains <p>However, further surveying is needed to confirm if the vegetation within the Investigation areas meets the Key Diagnostic Characteristics and Condition Thresholds for these communities.</p> <p>Six flora species and nine fauna species listed under the EPBC Act were considered to have at least a moderate likelihood of occurrence within the Investigation Area (Table 9 and Table 13).</p> <p>If present, these ecological communities will likely constrain opportunities for development within these locations. This is taken into consideration in this report’s recommendations for potential development within each Investigation Area.</p>
Flora and Fauna Guarantee Act 1988	<p>The <i>Flora and Fauna Guarantee Act 1988</i> (FFG Act) was legislated to ensure the continued survival of all Victorian species of flora and fauna and all Victorian communities of plants and animals. The FFG Act provides a number of ways to achieve its objectives including:</p> <ul style="list-style-type: none"> • The listing of threatened taxa, communities of flora or fauna and potentially threatening processes, and creation of Action Statements and Management Plans for these. • Listing of protected flora species. It is an offence to take, trade in, keep, move or process protected flora without a permit, or unless authorised by Order of the Governor in Council published in the <i>Government Gazette</i> (GIC Order). The FFG Act defines “take” to mean to kill, injure, disturb or collect. This does not apply to private land where permission is given by the owner and the flora is not taken for the purposes of selling. The Protected Flora List includes all members of the Asteraceae (daisies), all members of <i>Epacridaceae</i> (heaths), all members of Orchidaceae (orchids) and all Acacias (excluding Silver, Early Black, Lightwood, Blackwood and Hedge Wattles). • Declaration of a Critical Habitat if the habitat is critical for the survival of a species or a community of flora or fauna, if listed as Critical Habitat, the Minister for Environment may then make an Interim Conservation Order (ICO) to conserve the Critical Habitat (NB: no Critical Habitat has been declared in the State). • Protection of flora and fauna through listing offences such as penalties relating to not following an ICO and taking, trading in, keeping, moving or processing protected flora without a licence. (NB: this does not apply to taking protected flora from private land (other than land which is part of the critical habitat for the flora) except for taking tree-ferns, grasstrees or sphagnum moss for the purpose of sale. <p>The Department of Environment, Land, Water and Planning (DELWP) is the referral authority for matters under the FFG Act.</p> <p>Proponents are required to apply for a Protected Flora Permit to ‘take’ flora in areas of public land (e.g., road reserves) that are listed as <u>protected</u> or <u>threatened</u>. This also includes individual species that may belong to an FFG Act listed community. A permit is not typically required under the FFG Act to take listed species on private land if it is not taken for the purposes of selling.</p>	<p><i>The FFG Act requires public authorities to have regard to the objectives of the Act in their operations, which includes the conservation of all of Victoria’s taxa of flora and fauna.</i></p> <p>Development of public areas within the Investigation Area with potential to impact the listed communities, flora and fauna may require a permit from DELWP. This could include road widening, realignment or accessways, for example.</p> <p>Much of the Investigation Area is privately owned and therefore the FFG Act does not directly apply to many of these areas. However, there is still a need to consider the FFG Act and listed species and communities under the Planning and Environment Act 1987.</p> <p>Based on the desktop analysis and ground-truthing it is likely that patches of the FFG listed Western Basalt Plains (River Red Gum) Grassy Woodland Ecological Community and/or the Western (Basalt) Plains Grasslands Community is present within the Investigation Areas 2a, 3a and 3b. It is also possible that the Butterfly Community No. 1 may be present within woodland areas. However, further surveying of vegetation attributes is needed to confirm both. Sixteen flora species and nineteen fauna species listed under the FFG Act were considered to have at least a moderate likelihood of occurrence within the Investigation Area. If present, these ecological communities and listed species will likely constrain opportunities for development, particularly within public land. This is taken into consideration in this report’s recommendations for potential development within each Investigation Area.</p>

Legislation	Description	Relevance and Constraints
Environment Effects Act 1978	<p>Under Victoria’s Environmental Effects Act 1978, projects that could have a ‘significant effect’ on Victoria’s environment can potentially require an Environmental Effect Statement. This Act applies to works ‘reasonably considered to have or be capable of having a significant effect on the environment’. The Minister for Planning and Environment is the responsible person for assessing whether this Act applies.</p> <p>The criteria for the types of potential effects on the environment that might be of significance with regard to ecology include:</p> <ul style="list-style-type: none"> • Clearing of 10 ha or more of native vegetation (that is of an endangered EVC or of very high conservation significance); • Impacts to matters listed under the <i>Flora and Fauna Guarantee Act 1988</i>, including: <ul style="list-style-type: none"> ○ Potential loss of a significant area of a listed ecological community; or ○ Potential loss of a genetically important population of an endangered or threatened species (listed or nominated for listing), including as a result of loss or fragmentation of habitats; or ○ Potential loss of critical habitat; or ○ Potential significant effects on habitat values of a wetland supporting migratory bird species. • Potential extensive or major effects on land stability, acid sulphate soils or highly erodible soils over the short or long term; and • Potential extensive or major effects on beneficial uses of waterbodies over the long-term due to changes in water quality, stream flows or regional groundwater levels. <p>The above are based on referral criteria in the <i>Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978</i> (DSE 2006).</p>	<p>Before commencing any works to which this Act applies, the proponent firstly must undertake a self-assessment to determine if the proposal meets the criteria to trigger an Environmental Effects Statement (EES). If the trigger is met, then the proponent must initiate an EES referral to the Victorian Minister for Planning. The Minister will then make a decision on the need for an EES.</p>

Legislation	Description	Relevance and Constraints																			
	<p>The <i>Planning and Environment Act 1987</i> establishes the framework for planning the use, development, and protection of land in Victoria in the present and long-term interests of all Victorians. This includes providing the structure for and administering the implementation of Planning Schemes in each municipality through the Victorian Planning Provisions (VPPs). Planning Schemes are legal instruments outlining provisions for land use, development and protection. They are constructed and sourced from the VPPs.</p>																				
	<p>Clause 52.17</p> <p>The key relevant clauses relevant to native vegetation is Clauses 52.17. Under Clause 52.17 a permit is required to remove, destroy or lop native vegetation on sites greater than 0.4 hectares (exemptions apply). The Guidelines for the removal, destruction and lopping of native vegetation is the main reference document and embedded in Clause 52.17 (DELWP 2017c).</p>	<p>Removal of any indigenous vegetation will most likely require a permit under Clause 52.17. Applications may fall into a basic, intermediate, or detailed pathway depending on the site’s location category and the extent of vegetation removed.</p> <p>There are three location categories that indicate the potential risk to biodiversity from the removal of a small amount of native vegetation, the higher the category the greater the risk. Map 11 maps the location categories across the Investigation Area. A significant portion of the Investigation Area is mapped as Category 2 indicating that the removal of a small amount of vegetation could significantly impact endangered EVCs and/or wetlands. Category 3 indicates the potential for significant impact to habitat for rare or threatened species.</p> <p style="text-align: center;">Table 16. Determining the Assessment pathway</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2" style="background-color: #c6e0b4;">Extent of native vegetation</th> <th colspan="3" style="background-color: #c6e0b4;">Location category</th> </tr> <tr> <th style="background-color: #c6e0b4;">Location 1</th> <th style="background-color: #c6e0b4;">Location 2</th> <th style="background-color: #c6e0b4;">Location 3</th> </tr> </thead> <tbody> <tr> <td style="background-color: #c6e0b4;">Less than 0.5 hectares and not including any large trees</td> <td style="background-color: #c6e0b4;">Basic</td> <td style="background-color: #c6e0b4;">Intermediate</td> <td style="background-color: #c6e0b4;">Detailed</td> </tr> <tr> <td style="background-color: #c6e0b4;">Less than 0.5 hectares and including one or more large trees</td> <td style="background-color: #c6e0b4;">Intermediate</td> <td style="background-color: #c6e0b4;">Intermediate</td> <td style="background-color: #c6e0b4;">Detailed</td> </tr> <tr> <td style="background-color: #c6e0b4;">0.5 hectares or more</td> <td style="background-color: #c6e0b4;">Detailed</td> <td style="background-color: #c6e0b4;">Detailed</td> <td style="background-color: #c6e0b4;">Detailed</td> </tr> </tbody> </table> <p style="text-align: center; font-size: small;">Source: Table 3, <i>Guidelines for the removal, destruction or lopping of native vegetation</i> (DELWP 2017)</p> <p>A key aspect of Clause 52.17 is to avoid and minimise negative impacts to threatened species and communities. As mentioned earlier, there is potential for a number of listed species under the FFG Act to be present across the investigation areas. If removal of listed flora, fauna and ecological communities is unavoidable, offsets will likely be required. These offsets can be in the form of general habitat offsets and species-specific habitat offsets. NatureKit provides Habitat Importance Maps (HIMs) for significant species. Where vegetation removal falls into areas of habitat importance, species specific habitat offsets are needed if the native vegetation to be removed goes beyond a specific threshold. Depending on the vegetation communities and threatened species impacted by the vegetation removal, these offsets can be expensive and difficult to source.</p> <p>It is noted that a permit is not required for trees that are planted for amenity purposes according to the Planted Vegetation exemption at Clause 52.17-7 Table of exemptions.</p> <p>It will be important to consider the future requirements under Clause 52.17 associated with potential development in the Investigation Areas. For example, areas with high cover of native vegetation will require substantial offsets for development and the need to avoid and minimise impacts to biodiversity may prove difficult when compounded with the need to address bushfire safety. Ecological communities associated with the Victorian Volcanic Plains can be particularly difficult and expensive to source due to their high level of depletion. We have therefore included recommendations for avoiding future development in such areas in the recommendations.</p>	Extent of native vegetation	Location category			Location 1	Location 2	Location 3	Less than 0.5 hectares and not including any large trees	Basic	Intermediate	Detailed	Less than 0.5 hectares and including one or more large trees	Intermediate	Intermediate	Detailed	0.5 hectares or more	Detailed	Detailed	Detailed
Extent of native vegetation	Location category																				
	Location 1	Location 2	Location 3																		
Less than 0.5 hectares and not including any large trees	Basic	Intermediate	Detailed																		
Less than 0.5 hectares and including one or more large trees	Intermediate	Intermediate	Detailed																		
0.5 hectares or more	Detailed	Detailed	Detailed																		
	<p>Overlays</p> <p>The Planning Provisions can also contain zoning and overlays, some of which pertain to ecological values.</p>	<p>Please see Section 1.2.1 for areas covered by environmental overlays that need to be considered by future developments.</p>																			

Legislation	Description	Relevance and Constraints
Wildlife Act 1975 and Wildlife Regulations 2013	<p>The <i>Wildlife Act 1975</i> provides for the protection and conservation of native wildlife (fauna) within Victoria. It also provides the basis for the majority of wildlife permit/licensing requirements within the state. Under the Act a person must not hunt, take or destroy endangered, notable or protected wildlife; this includes all native vertebrate animals, all kinds of deer, non-indigenous quail, pheasants, and partridges, and all terrestrial invertebrate animals listed under the <i>Flora and Fauna Guarantee Act 1988</i>.</p> <p>The <i>Wildlife Regulations 2013</i> provide further detail relating to the Act, including that a person not to damage, disturb or destroy any wildlife habitat (s42), although this does not apply if the person is authorised to do so under any other Act such as the <i>Planning and Environment Act 1987</i>.</p>	<p>This Act does not directly inform recommendations in this report, although the overall recommendations aim to reduce impacts to wildlife habitat. However, if any wildlife is located within the habitat proposed for development in the future, salvage and translocation of such wildlife may be required as part of the planning permit. This should also ensure wildlife is not damaged during construction works.</p>
Catchment and Land Protection Act 1994	<p>The <i>Catchment and Land Protection Act 1994</i> (CaLP Act) intends to manage land degradation including detrimental environmental or economic impacts of declared noxious weeds and pest animals.</p> <p>Under section 20 of the CaLP Act, all land owners, including the Crown, public authorities and licensees of Crown lands, must, in relation to their land, take all reasonable steps to:</p> <ul style="list-style-type: none"> • Avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner; • Eradicate regionally prohibited weeds; • Prevent the growth and spread of regionally controlled weeds on their land; and • Prevent the spread of, and as far as possible, eradicate established pest animals. <p>There are also provisions within the Act to prevent the spread of declared noxious weeds, through regulating the purchase, sale, possession for the purposes of sale, display, propagation or transport of these species into or within Victoria. Furthermore, under the Act it is prohibited to bring into Victoria, keep, sell or release declared pest animals without an authority (permit).</p>	<p>Future developments should control the spread of CaLP weeds and pests to other areas and minimise impacts to ecological values in the area.</p> <p>Please see Section 3.3.3 for a list of CaLP weeds observed during the field survey.</p>

5. CONCLUSION AND RECOMMENDATIONS

This report is based on a detailed desktop Investigation followed by ground-truthing. As discussed throughout Section 3, the ground-truthing identified a number of sites of high ecological value which are likely to support a number of state and nationally significant species and ecological communities. The listed Golden Sun Moth and Growling Grass Frog, for example, are both known to occur within Investigation areas 2a and 2b.

5.1 Areas with High Ecological Values

Priority ecological values recommended for retention include:

- Extensive areas of moderate to high quality woodland (primarily EVC 20: Heathy Dry Forest) throughout Areas 2b, 3b, 3c and 3d.
- An area of Hills Herb-rich Woodland which extends into both Investigation Areas 3a and 3b, either side of Ascot-Creswick Rd. This also likely represents an EPBC listed ecological community.
- Several areas of EVC 55: Plains Grassy Woodland, in its woodland form, again likely to represent EPBC and FFG listed ecological communities.
- Moderate to high quality grassland in Areas 2a and 3a. These occur both within private property and roadside vegetation. Some lower quality areas may also be important to retain to ensure connectivity between these. These areas also likely represent FFG and EPBC listed ecological communities.
- Long Point Bushland Reserve (Area 3a).
- Creswick Creek Corridor (Area 3a).
- Creswick Broomfield Rail Line Nature Conservation Reserve (Areas 2a).
- Large trees both within woodland areas and scattered in cleared areas.
- Areas of rocky outcrop, particularly those within moderate to high quality grassland areas.
- Pine plantation firebreaks that are identified in future surveys to support high quality derived grasslands.

The majority of Investigation Areas 2a, 3a and 3b (west) fall within the Victorian Volcanic Plains (VVP) Bioregion, which has been heavily cleared. Consequently, remaining patches of grassland and woodland in the VVP, and the listed species they support (such as Golden Sun Moths and Striped Legless Lizards), are of particularly high ecological value. Where possible, remaining patches should be protected and considered when planning for landscape connectivity.

The high value of remaining ecological communities in the VVP is also reflected in legislative requirements, particularly under Clause 52.17. Under this clause, unavoidable native vegetation removal needs to be offset through general habitat and/or species-specific habitat units. These offsets, especially for rarer communities and species, can be difficult to source and expensive. Referrals and offsets may also be required under the EPBC Act if Federally-listed ecological communities, flora and fauna species are impacted by future developments, which is likely within VVP areas. Hence consideration of this at early planning stages is strongly recommended to avoid impacts to and protect these ecological values in future rezoning or development.

It is also noted that many of the identified high-quality grassland, woodland, forest and wetland areas are within private ownership, with no environmental overlays or mechanisms to protect them from future land management changes or change in ownership. Implementation of mechanisms to further protect these areas are recommended, such as environmental overlays, collaboration with land-owners and encouragement of covenants. Roadside grasslands could be clearly identified and managed accordingly to enhance their biodiversity values and connectivity.

5.2 Development Potential of Investigation Areas – Ecological Constraints and Opportunities

Based on the desktop assessment and ground-truthing, in terms of the future development/restructuring of the Investigation Areas, findings indicate that:

- **Investigation Area 1** is highly developed although some pockets of cleared land or urban densification could support further residential development while retaining connectivity through the area's waterways. Strengthening the creek corridor could also provide greater connectivity between woodland areas and regional parks to the east and grassland, woodland and forest to the west of the township.
- **Investigation Areas 2a and 3a** are highly cleared but also retain significant areas of quality grassland. Hence rezoning and development should be directed towards areas with exotic pasture while protecting and improving the connectivity between quality grassland areas. The grassland areas, as discussed above are of high ecological value, likely represent EPBC Act and FFG listed ecological communities, and may also support significant species such as Golden Sun Moth and Striped Legless Lizard. As such any proposed future removal of grassland vegetation will likely prove difficult and costly under Clause 52.17 in the planning scheme. It is strongly recommended to protect any identified grassland areas (even of low quality) both within private and public (e.g., road sides) land, and improve connectivity between these where possible.

Both investigation areas also support small pockets of rocky outcrops, which are a rarity given the tendency to de-rock properties. These are of high ecological value, particularly those within areas of quality grassland, for supporting reptile species including listed species such as the Pink-tailed Worm-lizard *Aprasia parapulchella*. Again, protecting and avoiding development of these areas is highly recommended.

An area of Hills Herb-rich Woodland spanning either side of Ascot – Creswick Rd may also represent an EPBC listed ecological community. While further surveying is needed to verify this, protecting this area is recommended.

Creswick Creek is a key habitat corridor within **Investigation 3a** and waterbodies within the creek's vicinity such as the treatment ponds, are known to have supported listed bird species and Growling Grass Frog. Any future development will need to manage and minimise negative impacts to Creswick Creek, Growling Grass Frog habitat and listed bird species. There are also opportunities to strengthen the Creswick Creek corridor and its connections to other habitat areas. If future development is planned within areas adjacent Creswick Creek, it is strongly recommended that buffer zones between sensitive areas are included and that any lighting is carefully planned to minimise light pollution (See Section 5.9). Water Sensitive Urban Design Measures are also strongly recommended to prevent further degradation of the flow regime and stream ecology of Creswick creek and other waterways (Please see Section 5.8).

- **Investigation Area 2b** supports a combination of cleared paddocks and woodland. This area is mapped as part of the VVPs bioregion. However, the treed vegetation present is representative of EVC 20: Heathy Dry Forest, which has a Bioregional Conservation Status of Least Concern. This means

that offsets required under Clause 52.17 for any future vegetation removal, may be more readily available and less costly per unit. Although the extent of remnant habitat means that any future development and clearing is likely to be associated with high ecological impacts and substantial offsets. Importantly, listed species such as Golden Sun are known to be present in the area (Map 9 and 10, Appendix 1) and may require species specific offsets which could increase cost and difficulty. Careful rezoning in this area may be required to allow development within cleared patches that avoid impacts to listed species while meeting obligations under Clause 52.17 as well as bushfire safety.

The woodland areas in Investigation Area 2b currently have good connectivity to Creswick North Natural Features Reserve through to Creswick Regional Park. This connectivity is largely enabled by woodland in **Investigation Area 3d**. There is also some connectivity to the Creswick Broomfield Rail Line Nature Conservation Reserve. Hence, planning to ensure continued connectivity throughout these areas is recommended.

- **Investigation Area 3b** supports a combination of cleared land and woodland, and forest. The western area falls within the VVP and is representative of EVC 55: Plains Grassy Woodland and EVC 23: Hills Herb-rich Woodland, both of which may also represent EPBC listed ecological communities. Hence as described above, this onsite vegetation has high ecological value with the offsets for any future vegetation removal likely difficult to source and costly. The areas within Area 3b mapped as EVC 20: Heathy Dry Forest are less depleted with offsets likely more available and less costly per unit. However, the sheer extent of this vegetation, if cleared or modified will likely have significant ecological impacts and substantial offsets. The southern border of Area 3b is adjacent forestry plantations, and again, will likely have implications for bushfire planning and management which likely limit future development.
- **Investigation Areas 3c and 3d** support a large area of woodland and forest, with some cleared areas around rural properties. Both are mapped as part of the Central Victorians Uplands (CVU) Bioregion. The EVCs associated with the CVU Bioregion are not as depleted as those of the VVPs Bioregion. Therefore, while offsets may be more available and less costly per unit than those in the VVP, the substantial amount of remnant habitat means that any future development is likely to be associated with high ecological impacts and substantial offsets. Any rezoning will also need to consider the area's greater susceptibility to erosion (erosion management overlay also present for Area 3d) and ideally maintain connectivity into neighbouring areas of habitat. Surrounding both of these areas are forestry activities and pine plantations, as well as further areas of remnant woodland, which will have implications for bushfire management and will likely significantly limit future development.

5.3 Habitat Connectivity

This section considers approaches to strengthen existing habitat corridors and build upon existing native vegetation to create linkages, especially between key conservation reserves and habitat nodes. Based on the desktop analysis and ground-truthing the following habitat corridors and core habitat areas were identified along with possible opportunities to improve connectivity.

Key habitat corridors within the Investigation Areas include:

- Creswick Creek (Investigation Area 1 and 3a)
- Creswick – Broomfield Rail Line Nature Conservation Reserve (Investigation Area 2a)

There are opportunities to strengthen linkages between Creswick Creek and adjacent reserves such as Long-Point Bushland Reserve and the area of EVC 23: Hills Herb-rich Woodland. Strengthening the Creek corridor could also provide greater connectivity between woodland areas and regional parks to the east and Grassland/Woodland to the west of the township. Habitat enhancement of the creek could also focus on

listed species such as the Growling Grass Frog, particularly within ~2km either side of the Creswick Creek Corridor.

There are opportunities to better connect the Creswick–Broomfield Rail Line Nature Conservation reserve to nearby woodland areas, for example through protecting and managing road verge vegetation along Barby's Road which was found to contain high quality grassland. There is reasonable connectivity between the Rail Line Reserve and woodland at its north. However, opportunities to protect and strengthen this connectivity would be beneficial. If the area surrounding the Rail Line Nature Conservation reserve is redeveloped in the future, it would be a good opportunity to widen the corridor and incorporate nearby pockets of high-quality vegetation. Wider corridors reduce the impacts from adjoining land uses and edge effects such as weeds and predators, and in doing so provide more effective dispersal of species.

It is also noted that a number of wetlands were identified along small tributaries in Area 2a that flow north-west into Glendonald Creek. According to DELWP modelling (Map 4) these could be remaining patches of EVC 647 but further surveying is needed to determine if this is the case. If the area is to be developed, it could provide an opportunity to protect and improve the condition and connectivity between these wetlands, the tributary and The Rail Line Nature Conservation Reserve.

Core habitat areas included:

Woodland and Forest

- Long Point Bushland Reserve
- Areas of Hills Herb-rich Foothill Forest and Plains Grassy Woodland either side of Ascot–Creswick Rd. *(with opportunities to improve connectivity between Creswick Creek and the latter two areas)*
- Creswick North Natural Features Reserve
- Creswick Regional Park and State Forest
- Extensive well-connected areas of quality woodland/forest within Investigation Areas 2b, 3b–d.

Lakes/Waterbodies that are known to support listed fauna species (See Section 3.4.3)

- Cosgrove Reservoir
- St Georges Lake
- Western evaporation sewerage ponds

There is currently good connectivity between woodland in Investigation Areas 2b and 3d with Creswick Regional Park and State Forest as well as St Georges Lake and Cosgrove Reservoir. It is recommended that habitat connectivity is maintained between these, especially if Investigation Area 3d is to be developed in some form although this does not appear feasible at this stage.

Grassland

Moderate to high quality grassland is supported within private and crown/public land within Investigation Areas 2a and 3a with opportunities to protect and strengthen connectivity between these. Areas of grassland within crown/public land includes:

- Key Dam Historic Reserve
- Australasian No 1 Deep Lead Mine Historic Reserve
- Australasian No 2 Deep Lead Mine Historic Reserve
- Roadsides

It is important to consider protecting and enhancing lower quality grassland areas that act as a connection between high quality grassland areas, particularly within Investigation Zone 3a. There was also considerable

quality grassland within Roadside verges. Hence protecting and management of the roadside vegetation could provide one route towards a well-connected network of grassland patches. It is noted that male Golden Sun Moths are unlikely to fly more than ~100m (DAWE 2021). Striped legless lizard movements are less well-known but there are reports of moving 10–50 m over several weeks (DCCEEW 2016). Hence stepping stone habitat should be fairly closely spaced to provide sufficient connectivity for these listed grassland species.

5.3.1 Derived Grasslands along Pine Plantation fire-breaks

Pine plantation firebreaks were not surveyed as part of this project, but may support high quality derived grasslands. These could contribute important habitat connectivity around exotic pine plantations that have limited habitat value to many indigenous fauna and flora species.

5.3.2 Weed Management considerations for connectivity

A number of woody weeds, many CaLP listed such as Gorse, Tree Lucerne, Hawthorn, Blackberry and Broom, were observed across the investigation areas but particularly in wetter areas along creeks, gullies and drainage lines. These areas often provide habitat corridors and landscape connectivity. While these weed species are highly undesirable, they also provide a degree of refuge, cover and habitat for native wildlife, particularly small mammals and birds. Hence carefully staged plans for weed removal across large areas followed by revegetation to re-instate a shrubby understorey are encouraged to maintain a degree of connectivity. Figure 17 shows an example where weeds have been removed along a gully near Ascot-Creswick Rd, which would benefit from revegetation of a shrubby understorey to maintain connectivity.



Figure 17. An area with cleared weeds along a gully near Ascot-Creswick Rd. It would benefit from revegetation of the understorey to maintain habitat connectivity across the landscape.

5.3.3 Connectivity Summary

The Creswick Township is fortunate to have large areas of remaining natural habitat and woodland. With careful rezoning and planning, there do appear to be opportunities for positive biodiversity outcomes within areas with potential for development, such as:

- The creation of habitat corridors for GGF within Investigation Area 3a, particularly within ~2km either side of the Creswick Creek Corridor.
- Enhancement of the Creswick Creek Corridor to improve connectivity through the Township between natural areas to the east and west.
- There are opportunities for better connectivity between Creswick Creek and areas of nearby high-quality vegetation, such as Long-Point Bushland reserve and areas of Hills Herb-rich Foothill Forest in Area 3a.
- Protection of remaining habitat patches of grassland and grassy woodland communities within Investigation Areas 3a, 3b (west), and 2a, including roadside verges, and improved connectivity where possible. This could also include enhancement for focal fauna species such as Golden Sun Moth and Striped Legless lizards.
- Increased connectivity between the Creswick Broomfield Rail line Nature Conservation Reserve and woodland areas within Investigation Area 2b. This could occur, for example by protecting and managing road verge vegetation along Barby's Road as well as protecting woodland to the north of the linear reserve.
- If the area surrounding the Rail Line Nature Conservation reserve is redeveloped in the future, it would be a good opportunity to widen the corridor and incorporate nearby pockets of high-quality vegetation.
- Another opportunity within Investigation Area 2a could be to improve the condition and strengthen connectivity between wetlands along tributaries to Glendonald Creek and the Railway Nature Conservation Reserve (See Map 6).
- Careful rezoning to maintain habitat corridors and connectivity through the Investigation Areas, water bodies and Creswick Regional Park.
- Protection of areas with rocky basalt outcrops, particularly those in grassland areas.
- Protection of large trees throughout the Investigation Areas, especially those with hollows.
- Protection of plantation fire-breaks that are identified through future surveys as supporting quality grasslands and/or diverse wildflower species.

5.4 Erosion and Salinity

The Geomorphology database from DELWP also indicated that regions within the CVU bioregion have greater potential of erosion due to surface runoff, gully and wind. This encompasses Investigation Areas 2b, 3a (South of Creswick Creek), 3b, 3c and 3d. However, no evidence of this was observed during the ground-truthing exercise. A high density of pits and holes were observed within Investigation Area 3c (Figure 15), likely from forming gold mining. These may be susceptible to erosion and more importantly be a hazard to anyone walking in the area.

5.5 Further surveys

Table 17 outlines further surveys of areas that could potentially support ecological communities and species listed under either the EPBC or FFG Act.

5.6 Weed Management

Woody environmental weeds, many CaLP listed, such as Gorse, Hawthorn, Tree Lucerne, Blackberry and Broom, were observed across the investigation areas. Control of these weeds should prioritise areas with high ecological value with regular weed monitoring and control recommended.

These weeds were particularly prevalent in wetter areas along creeks, gullies and drainage lines which often provide habitat corridors and landscape connectivity. As mentioned previously, while these weed species are highly undesirable, they also provide a degree of refuge, cover and habitat for native wildlife, particularly small mammals and birds. Hence carefully staged plans for weed removal across large areas followed by revegetation to re-instate a shrubby understorey is recommended to maintain habitat connectivity.

Table 17. Further Recommended Surveys

Survey	Areas to survey	Further Information
Surveys for the following EPBC Act ecological communities are recommended. A referral under the EPBC Act may be required if they are present and impacted by future works.		
Natural Temperate Grassland of the Victorian Volcanic Plain Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Areas mapped as Grassland and EVC 55: Plains Grassy Woodland, especially those with moderate to high quality.	Section 3.2.1
Grey Box (<i>Eucalyptus microcarpa</i>) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Areas mapped as EVC 71: Hills Herb-rich woodland	Section 3.2.1
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Wetlands mapped within in Areas 2a and 3a (that are not reliant on overbank flooding from Creswick Creek or other waterways).	Section 3.2.1
Surveys for the following FFG Act ecological communities are recommended where public land, such as roadsides, are proposed for development:		
Western Basalt Plains (River Red Gum) Grassy Woodland Western (Basalt) Plains Grasslands Community	Areas mapped as Grassland and EVC55: Plains Grassy Woodland, especially those with moderate to high quality.	Section 3.2.2
Butterfly Community No. 1	Woodland/Forest areas	Section 3.2.2
Surveys for the following FFG and EPBC Act listed species are recommended where land is proposed for development.		
Golden Sun Moths <i>Synemon plana</i> Striped Legless Lizards <i>Delmar impar</i>	Areas mapped as Grassland and EVC 55: Plains Grassy Woodland	Section 3.3.2
Growling Grass Frog <i>Litoria raniformis</i>	Creeks, Wetlands and Dams, particularly those with emergent vegetation as described in Section 3.4.4.	Section 3.4.4.
Pink-tailed Worm-lizard <i>Aprasia parapulchella</i>	Mapped rocky areas	Section 3.4.3
River Swamp Wallaby-grass <i>Amphibromus fluitans</i> Plump Swamp Wallaby-grass <i>Amphibromus pithogastrus</i> (Very rare)	Wetlands, particularly in areas 2a and 3a.	Section 3.4.3
Other species listed in Table 9 and Table 13, as relevant.	All Areas	
Further “on-foot” detailed ecological surveys are recommended if rezoning or future development is planned, especially where surveying was undertaken over-the-fence.		
Surveys of pine plantation fire breaks are recommended to identify those that support valuable derived grasslands and/or provide important connectivity.		

5.7 Culturally Significant Flora and Fauna

Many culturally significant species may now be rare, regionally extinct or at numbers that cannot sustain their cultural use (NCCMA 2022). Collaboration with the Dja Dja Wurrung would be highly beneficial to better recognise and identify culturally significant species and culturally practices such as Wi (fire) to better manage and promote these.

5.8 Water Sensitive Urban Design (WSUD)

WSUD is a holistic approach that considers the entire water cycle, stormwater, waste water, ground water and potable water, in order to maintain or restore a more natural water cycle.

Across all but Investigation Area 1, the majority of land cover is permeable, with relatively little area covered by buildings, concrete paths and roads, for example. Future redevelopment could significantly increase impermeable surfaces with increased surface run-off. Historically, storm-water collection systems have been designed to collect and deliver surface run-off to the nearest waterway, as quickly as possible. This results in pulses of high-velocity water flows, in turn leading to erosion and other knock-on effects for the stream ecology and biota (Walsh 2004). The surface run-off also typically contains higher pollutant loads, delivering these pollutants to the nearest waterway, especially in the first flush of run-off following a period of low rainfall.

The percentage of impervious surface directly connected to waterways can be reduced through the use of either centralised systems such as swales which intercept, filter and slow the run-off before it enters waterways, or through the encouragement of dispersed systems such as rainwater tanks, green roofs and rain gardens at individual properties.

It is strongly recommended that an integrated approach is taken to stormwater, waste water and potable water in any future redevelopments, especially those in close proximity to creeks and waterways.

5.9 Lighting

Light is a critical input for animals to orient themselves within their niche environment, forage for food, to control the timing of biological processes, and for reproduction and communication.

Any lighting that is incorporated into future developments, especially those nearby habitat corridors and areas of high ecological values, should be planned in a manner that ensures ecological light pollution is avoided and minimised as much as possible.

General recommendations to minimise light pollution impacts to fauna include:

- Follow the guidelines outlined in *The National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2020)*.
- Ensure lighting is located away from retained habitat wherever practicable.
- Use adaptive light controls to manage light timing, intensity and colour.
- Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid spill, especially to sensitive areas.
- Use the lowest intensity lighting to achieve the desired effect.

- Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.
- Ensure any temporary lighting is removed promptly from site once not required.
- Consider the use of low walls and/or plantings to prevent headlight and streetlight spill across habitat/sites of ecological value, if required.

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Appendix 1. Maps

Map 1 Investigation Areas

Map2 Bioregions

Map 3 Modelled Pre-1750 EVCs

Map 4 Modelled 2005 EVCs

Map 5 Waterways

Map 6 Vegetation Type and Extent

Map 7 Vegetation Quality

Map 8 Significant Flora

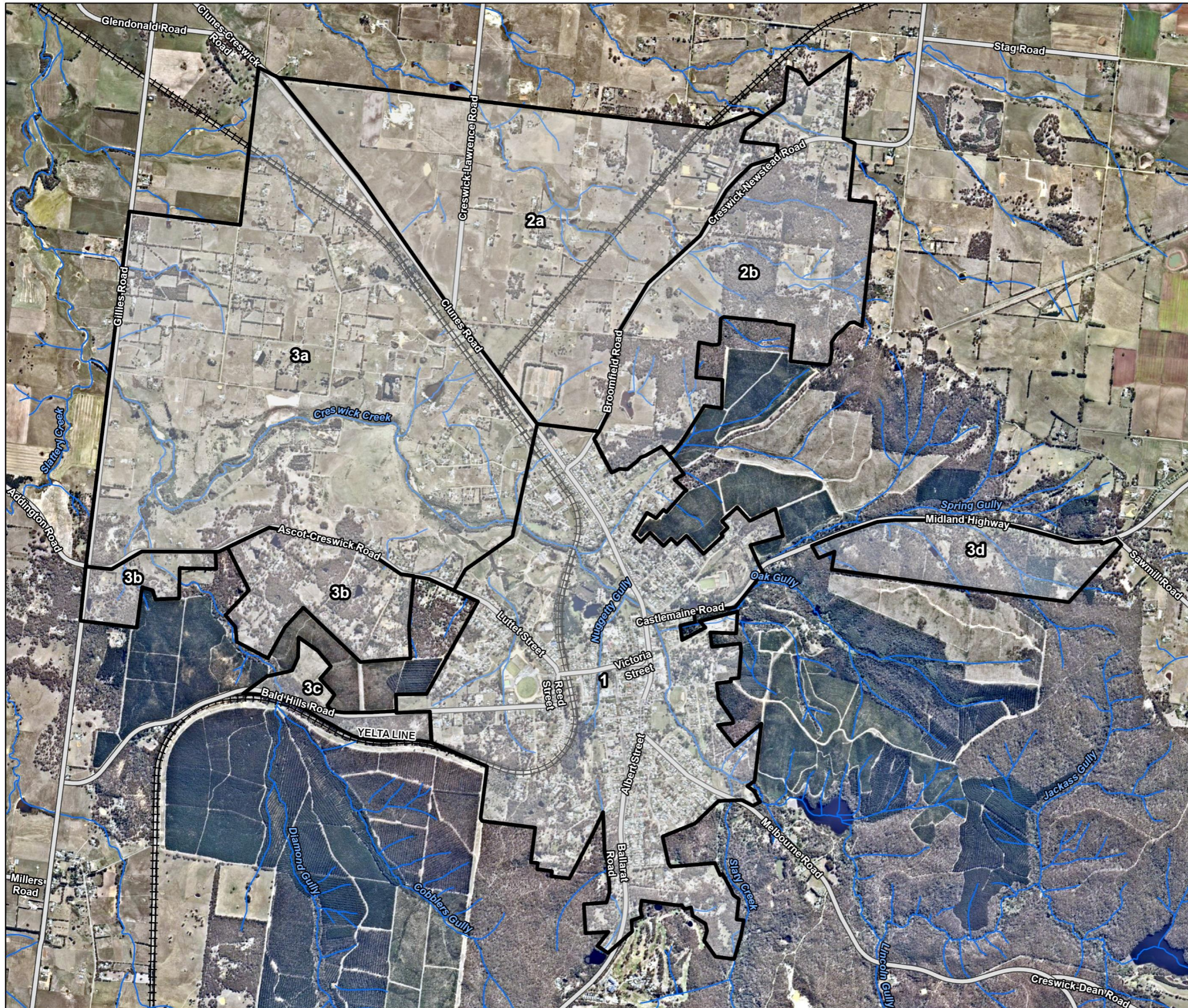
Map 9 Significant Fauna

Map 10 Growling Grass Frog and Golden Sun Moth Records

Map 11 Location Map

Start on next page

Map 1. Investigation Areas
Creswick Township Structure Plan





Legend

- Investigation Areas
- Natural watercourse
- Railways

Details

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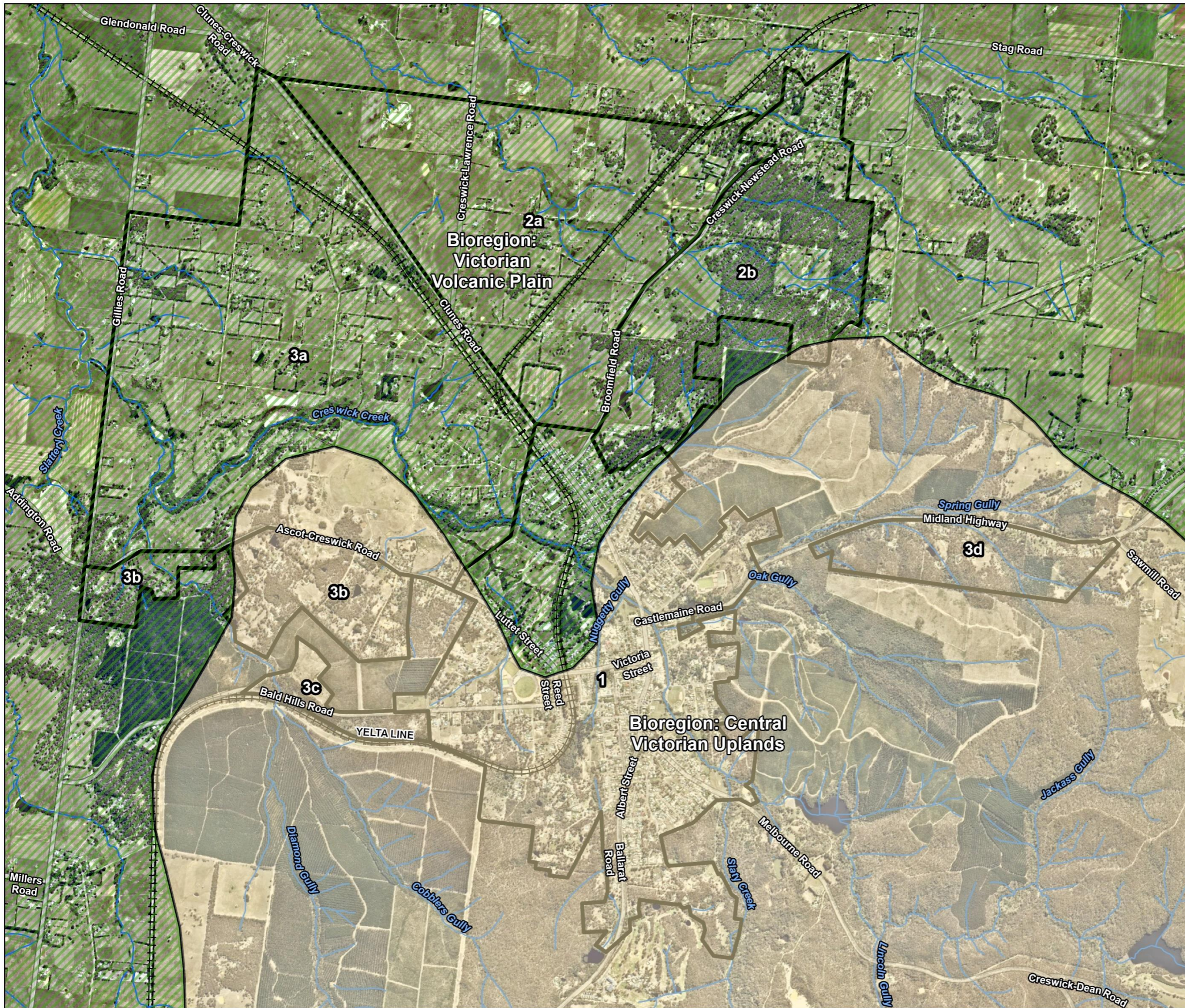

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Map 2. Bioregions
Creswick Township Structure Plan

Legend

- Investigation Areas
- Natural watercourse
- Railways

Bioregion

- Victorian Volcanic Plain
- Central Victorian Uplands

Details

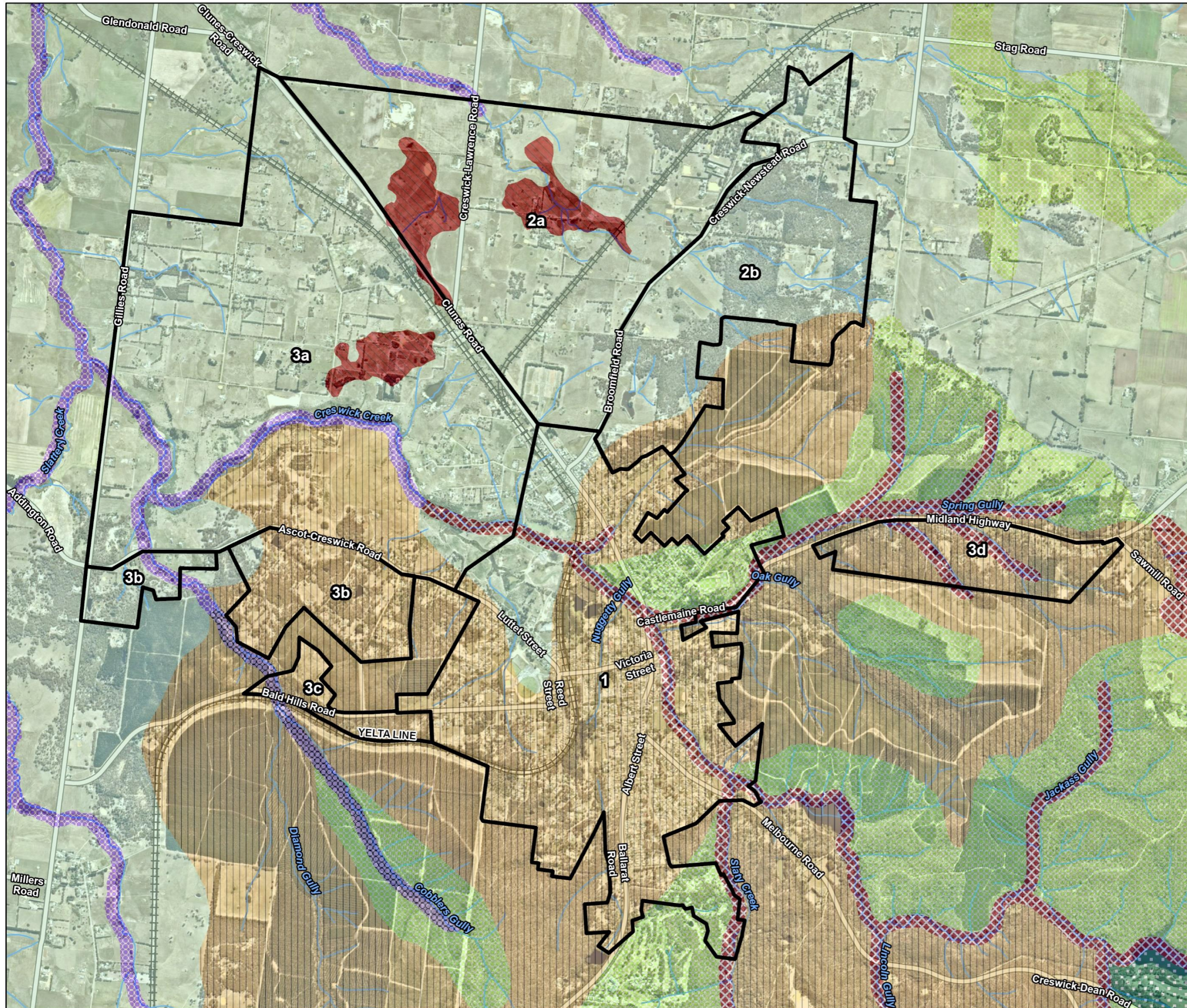
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Map 3. Modelled pre-1750 EVCs (Data from DELWP)
Creswick Township Structure Plan



Legend

- Investigation Areas
- Natural watercourse
- Railways

Pre 1750 Ecological Vegetation Classes

- 164 Creepline Herb-rich Woodland
- 20 Heathy Dry Forest
- 22 Grassy Dry Forest
- 23 Herb-rich Foothill Forest
- 47 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 641 Riparian Woodland
- 647 Plains Sedgy Wetland

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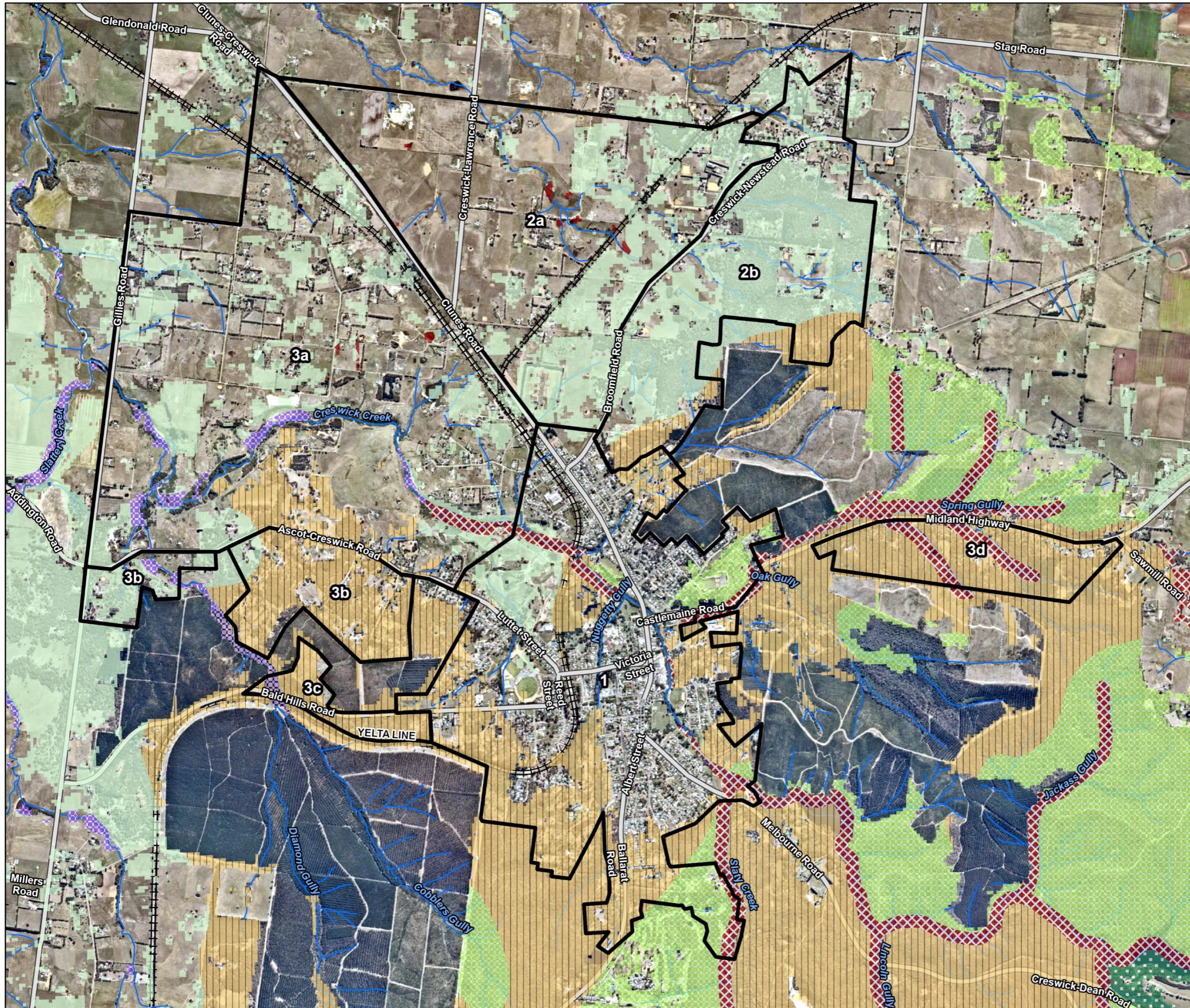
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Map 4. Modelled 2005 EVCs (Data from DELWP)

Creswick Township Structure Plan



Legend

- Investigation Areas
- Natural watercourse
- Railways

2005 Ecological Vegetation Classes

- 164 Creekline Herb-rich Woodland
- 20 Heathy Dry Forest
- 22 Grassy Dry Forest
- 23 Herb-rich Foothill Forest
- 47 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 641 Riparian Woodland
- 647 Plains Sedgy Wetland

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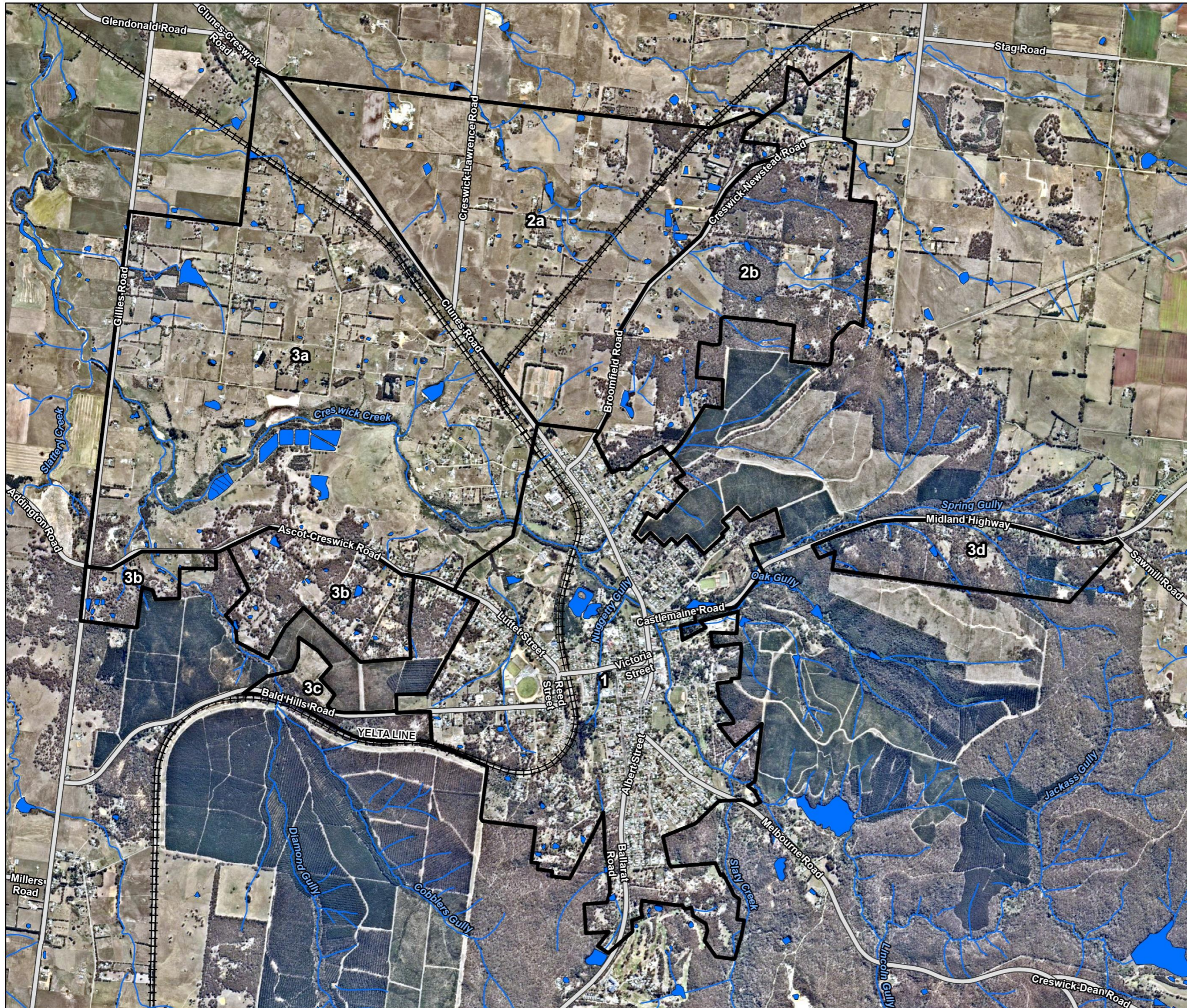
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Map 5. Waterways

Creswick Township Structure Plan



Legend

- Investigation Areas
- Natural watercourse
- Railways
- Waterways

Details

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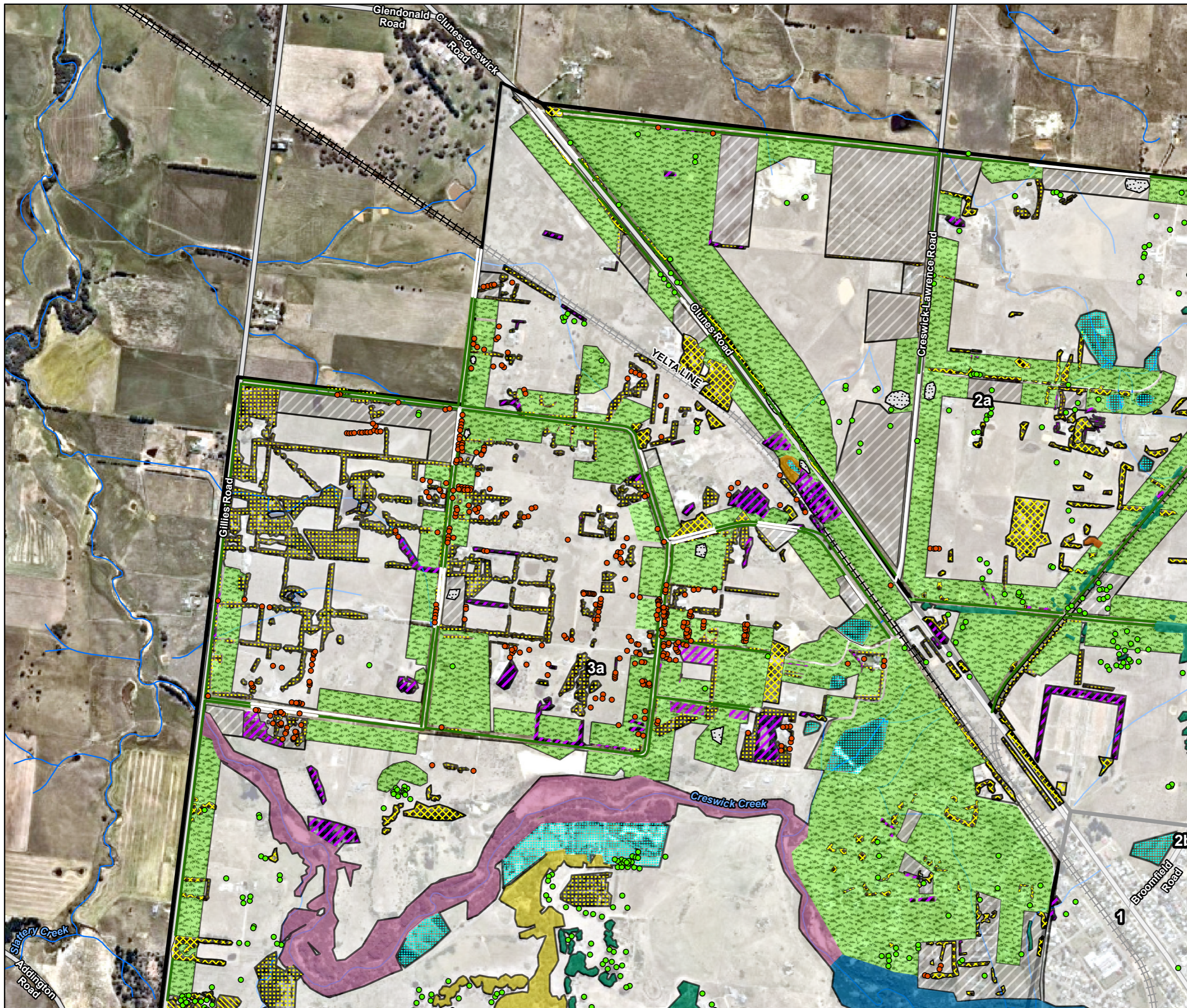
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Map 6. Vegetation Types and Extent
Creswick Township Structure Plan



Legend

- Investigation Areas
- Constructed watercourse
- Natural watercourse
- Railways
- Rock Areas
- Roadside Grassland**
- Present
- None
- Scattered Trees**
- Planted
- Remnant
- Existing Vegetation Types EVCs**
- 20 Heathy Dry Forest
- 22 Grassy Dry Forest
- 23 Herb-rich Foothill Forest
- 46 Valley Grassy Forest
- 55 Plains Grassy Woodland
- 71 Hills Herb-rich Woodland
- 164 Creekline Herb-rich Woodland
- 641 Riparian Woodland
- 132 Plains Grassland / 55 Treeless Plains Grassy Woodland
- Other Vegetation Categories**
- Long Point Bushland Reserve
- Mixed Patch
- Planted Native Vegetation
- Wetland
- Exotic Vegetation
- No Grassland Present
- Unassessed Areas

Note: The vegetation type and extent was determined by a combination of site surveys and desktop analysis.



Details

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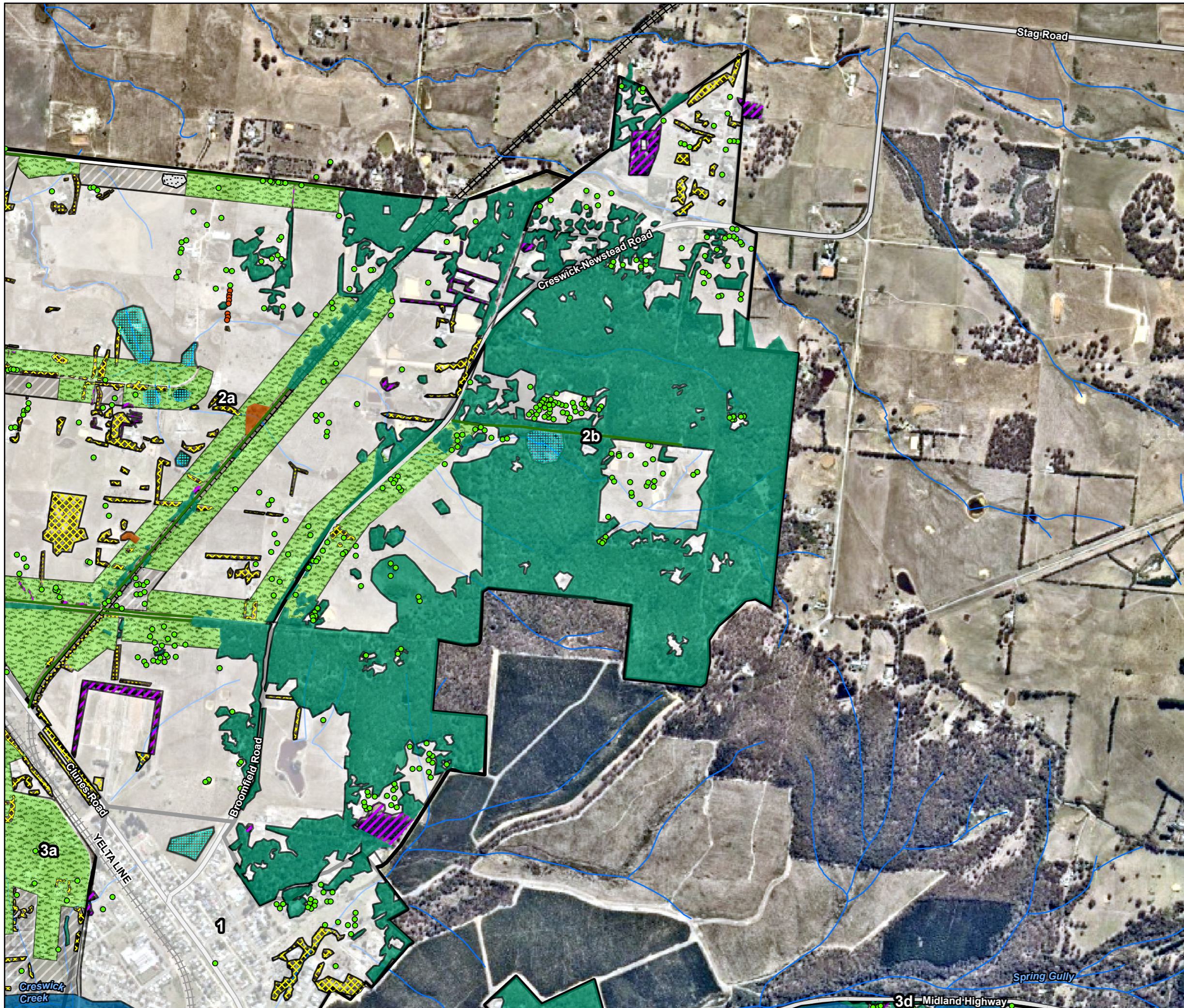
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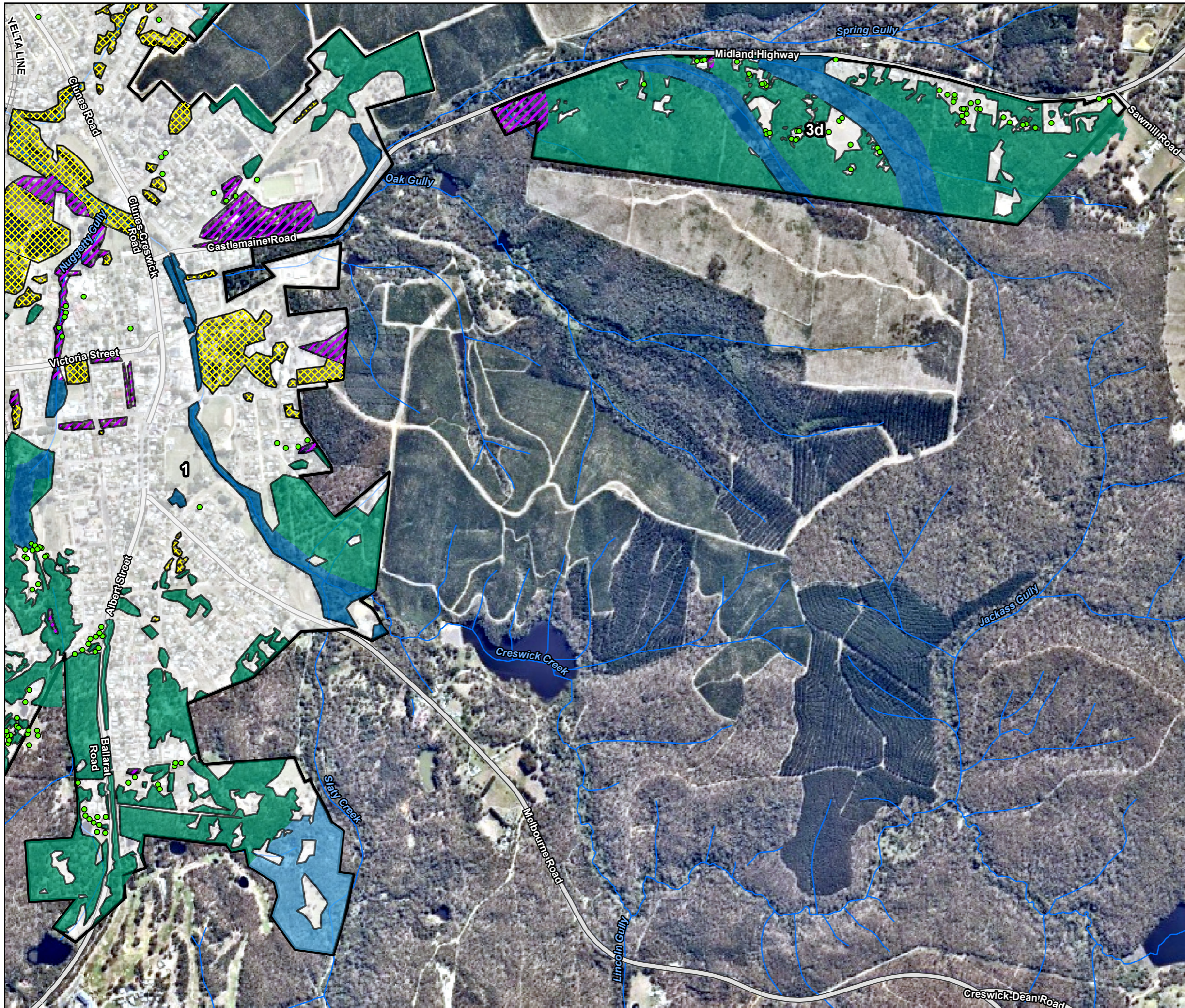
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Legend

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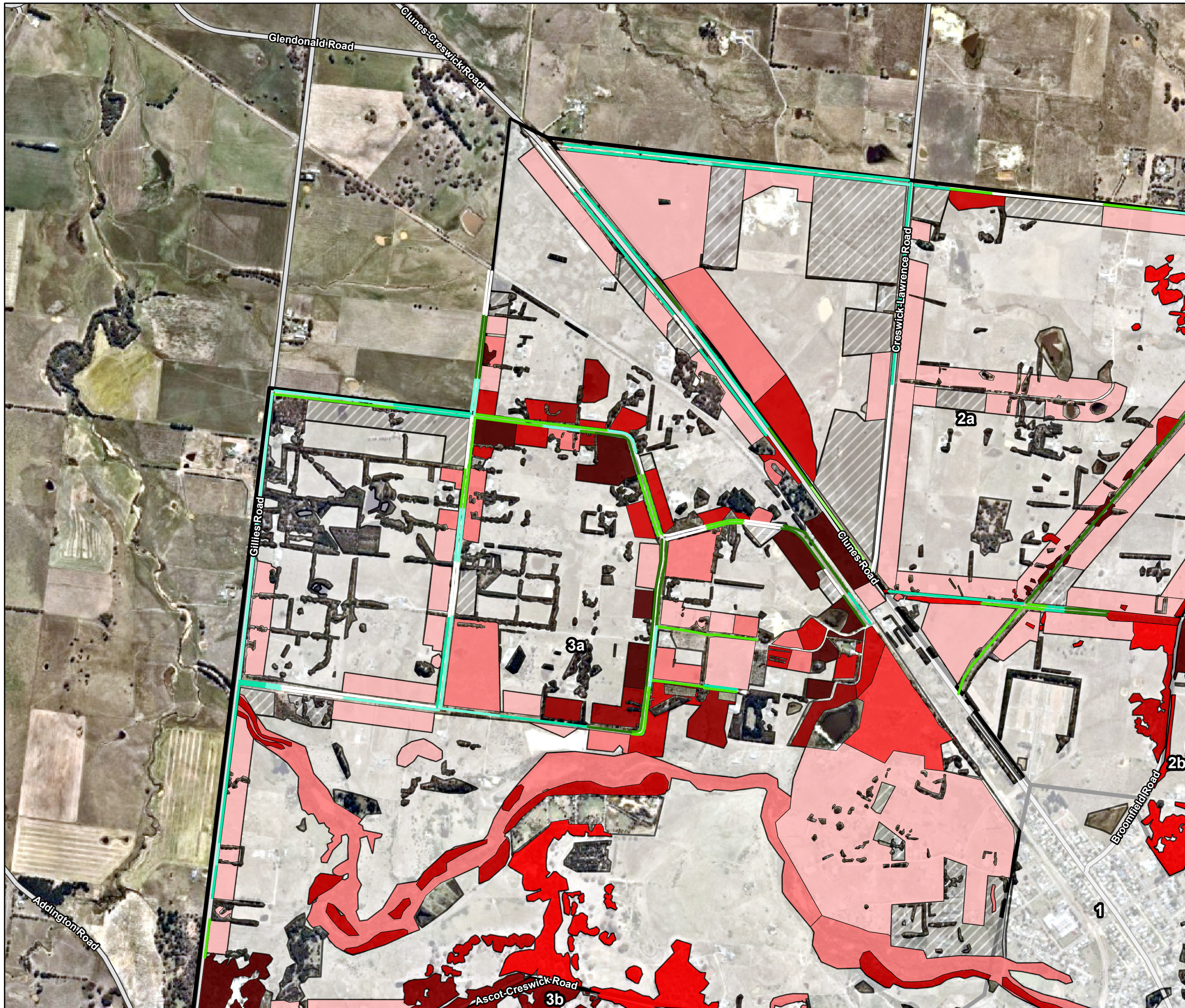
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Map 7. Vegetation Quality
Creswick Township Structure Plan



Legend

- Investigation Areas
- Roadside Grassland (PGW/PG)**
- LQ?
- LQ
- L- MQ
- MQ
- M- HQ
- HQ , HQ+
- No Roadside Grassland Present
- Quality**
- LQ?
- LQ
- L- MQ
- MQ
- M- HQ
- HQ , HQ+
- No Grassland Present
- Unassessed Areas

Note: Unmapped areas correspond to Vegetation Types that were not assigned a quality e.g. Planted Vegetation, Wetlands and Exotic Vegetation.



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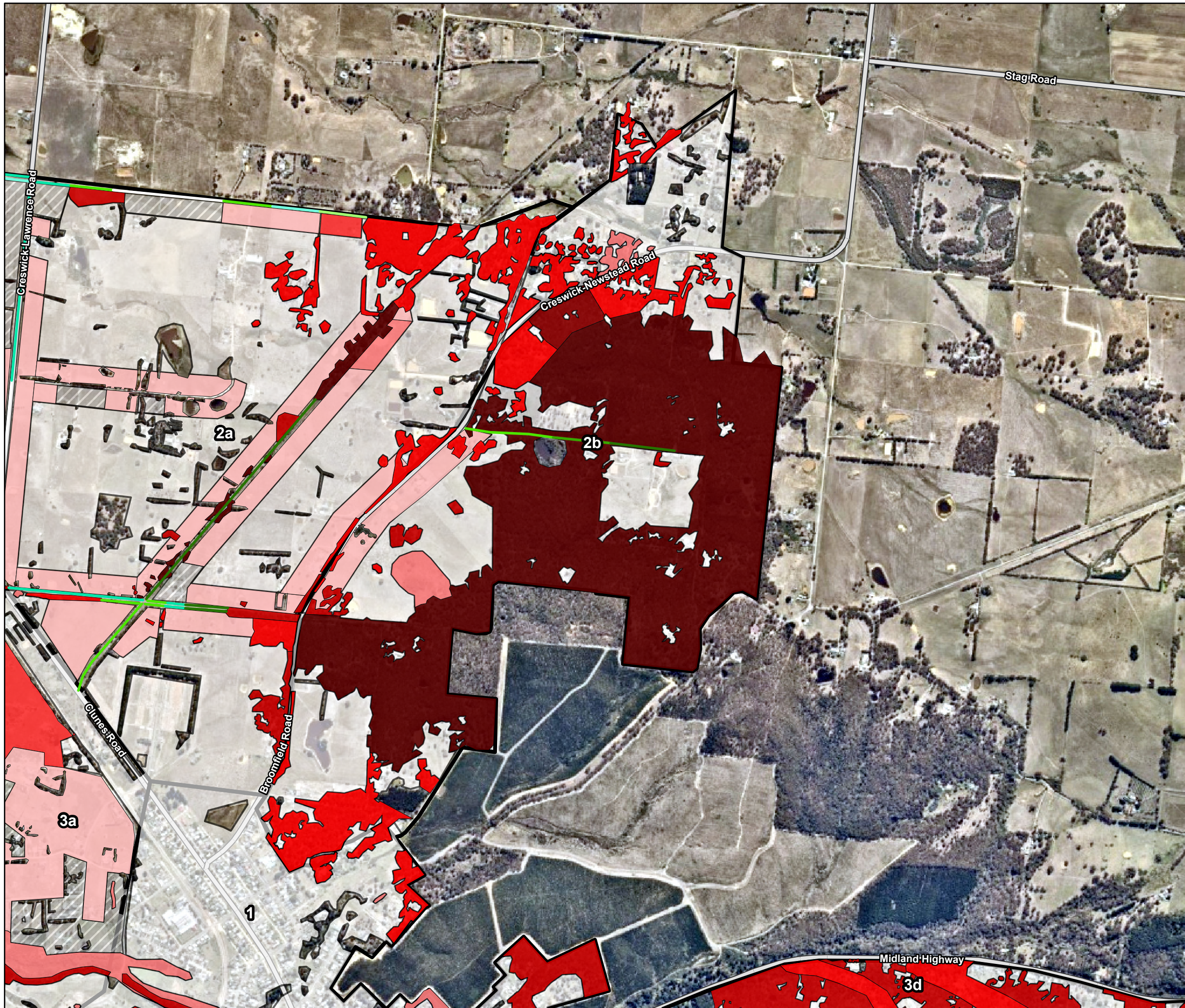
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Map 7. Vegetation Quality
Creswick Township Structure Plan



Legend

- Investigation Areas
- Roadside Grassland (PGW/PG)**
- LQ?
- LQ
- L- MQ
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- M- HQ
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- L- MQ
- MQ
- M- HQ
- HQ , HQ+
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Details

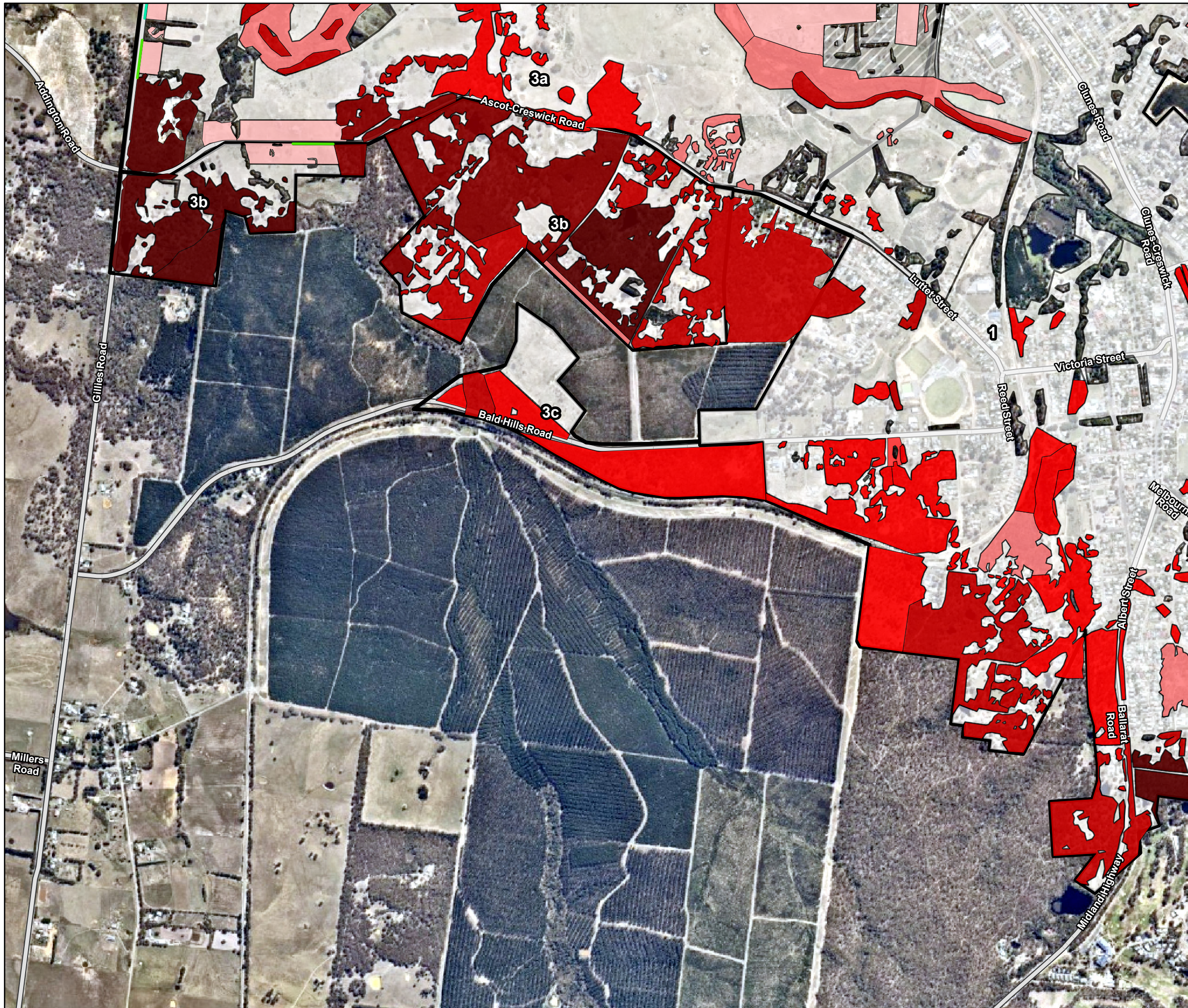
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Map 7. Vegetation Quality
Creswick Township Structure Plan



Legend

- Investigation Areas
- Roadside Grassland (PGW/PG)**
- LQ?
- LQ
- L- MQ
- MQ
- M- HQ
- HQ , HQ+
- No Roadside Grassland Present
- Quality**
- LQ?
- LQ
- L- MQ
- MQ
- M- HQ
- HQ , HQ+
- No Grassland Present
- Unassessed Areas

Note: Unmapped areas correspond to Vegetation Types that were not assigned a quality e.g. Planted Vegetation, Wetlands and Exotic Vegetation.



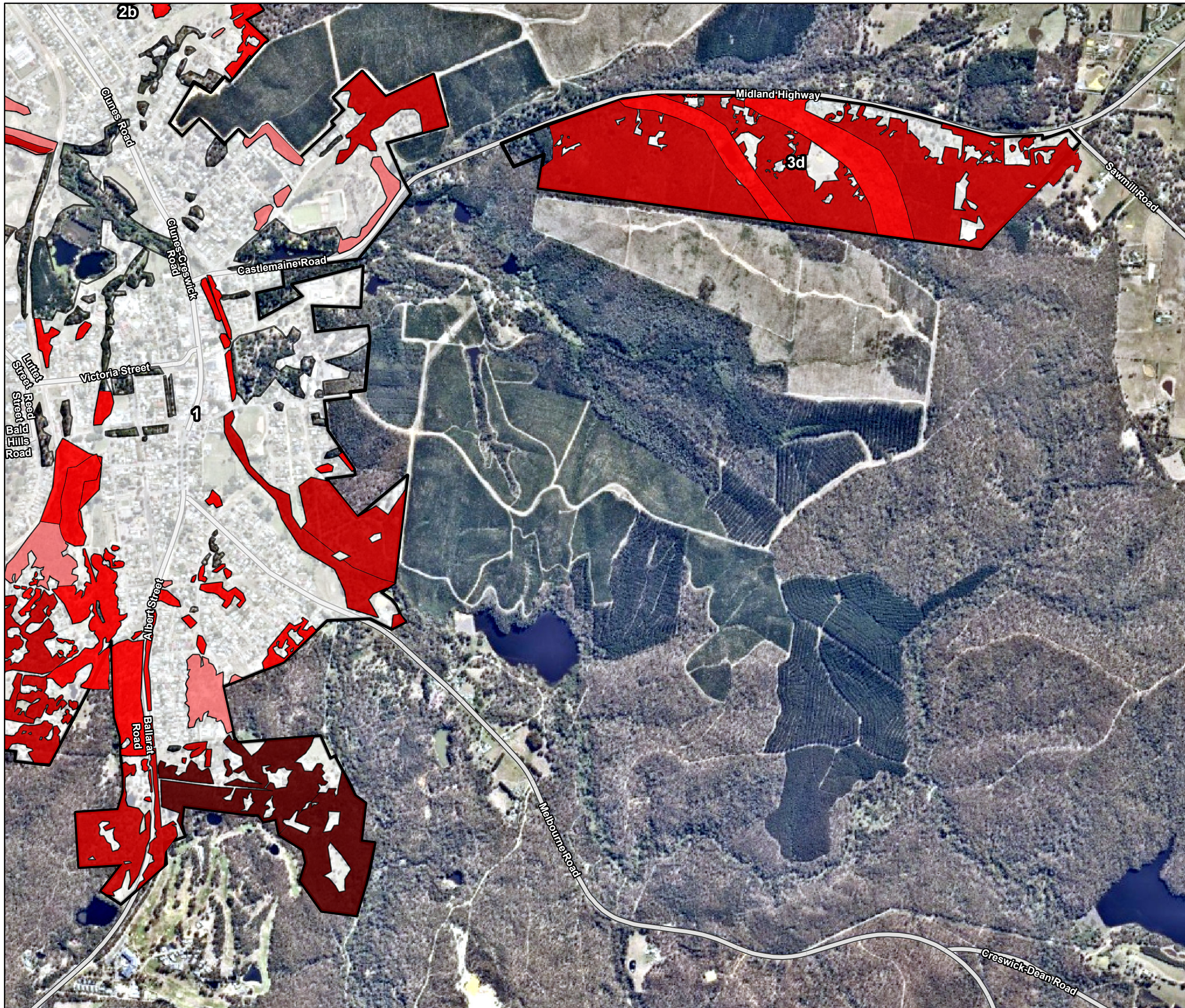
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Map 7. Vegetation Quality
Creswick Township Structure Plan



Legend

- Investigation Areas
- Roadside Grassland (PGW/PG)**
- LQ?
- LQ
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- MQ
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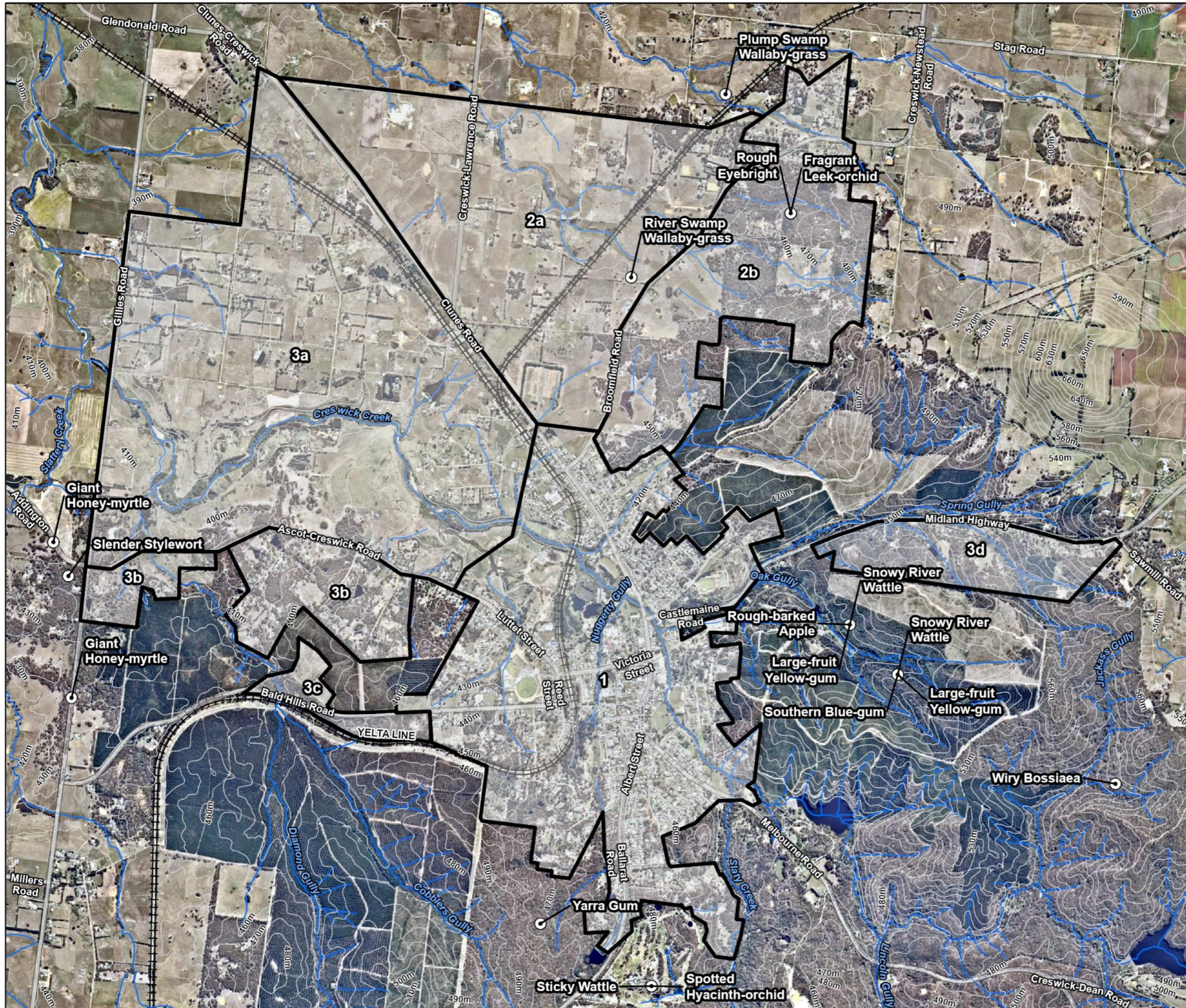
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Map 8. Listed Flora
Creswick Township Structure Plan



Legend

- Investigation Areas
- Contours (10m)
- Natural watercourse
- Railways
- VBA Flora

Details

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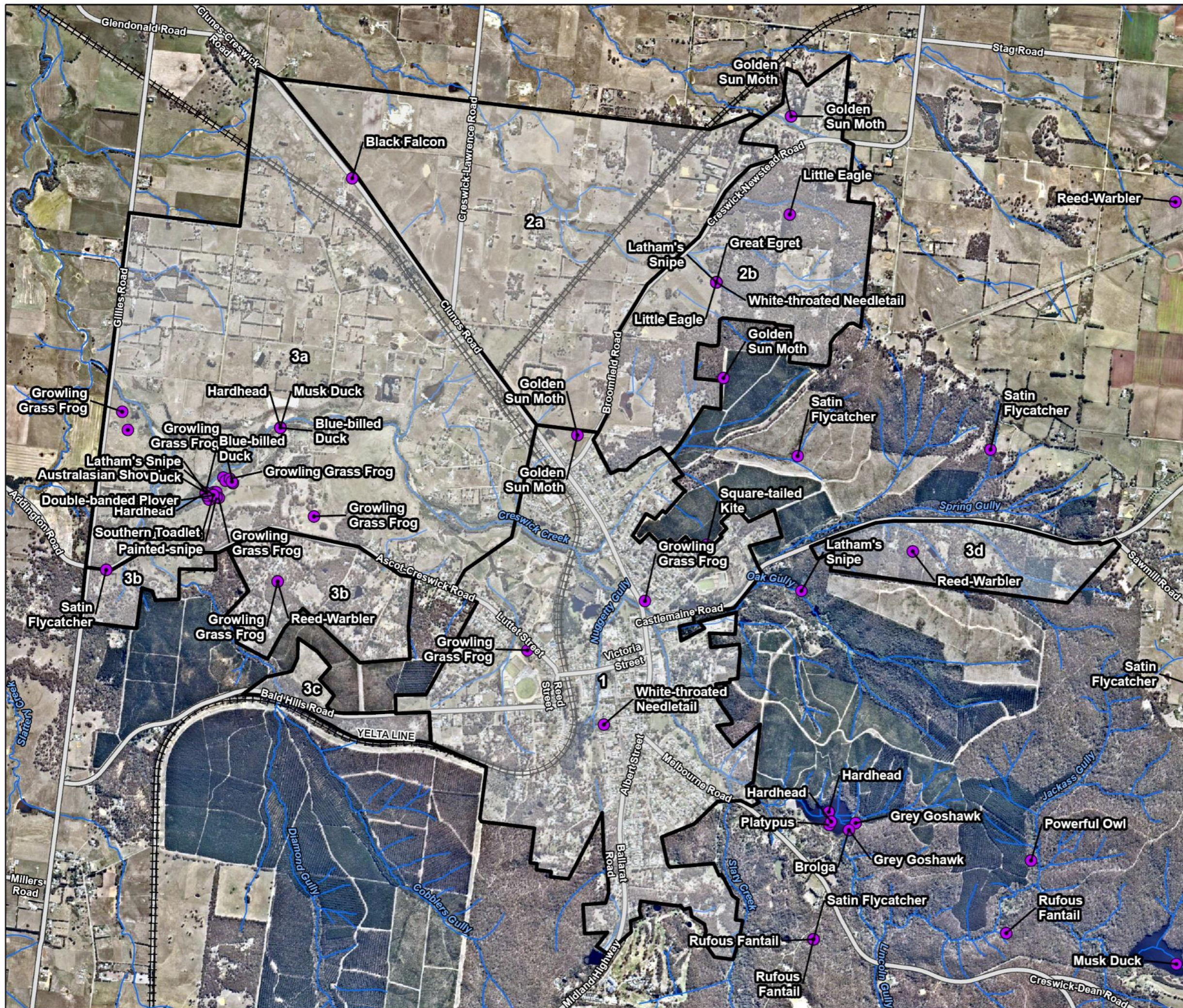
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Map 9. Listed Fauna
Creswick Township Structure Plan



Legend

- Investigation Areas
- Natural watercourse
- Railways
- VBA Fauna

Details

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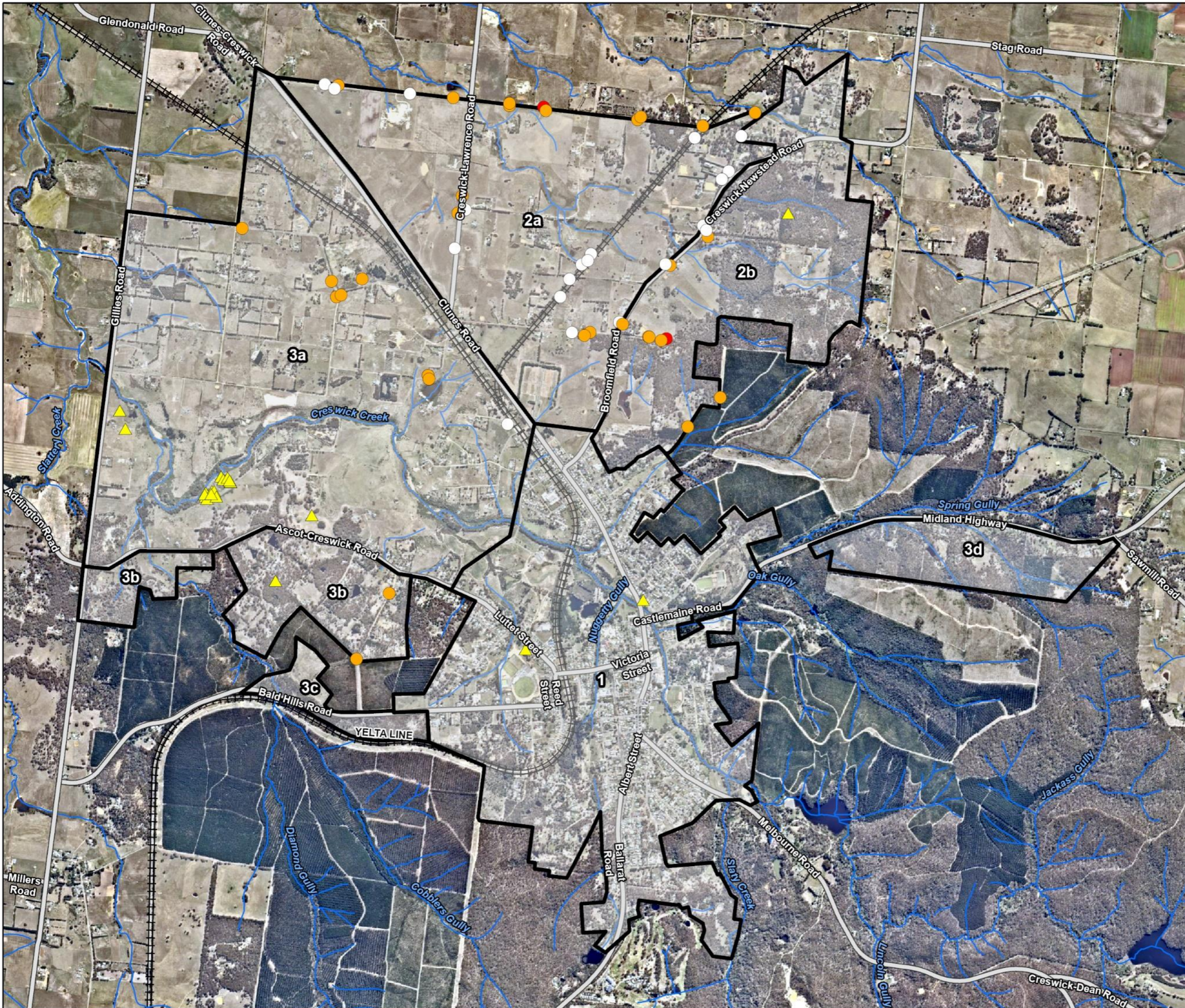
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Map 10. GGF and GSM Records

Creswick Township Structure Plan



Legend

- Investigation Areas
- Natural watercourse
- Railways

GGF Records

- ▲ 1-8

GSM Records

- 0
- 1-20
- 20-40

Details

Mapping by: Ali Nia
 Date: 7/26/2022
 Version: 1
 Aerial photography from Nearmap (Mar. 2022).
 Data Source: Base layers courtesy of VicMap,
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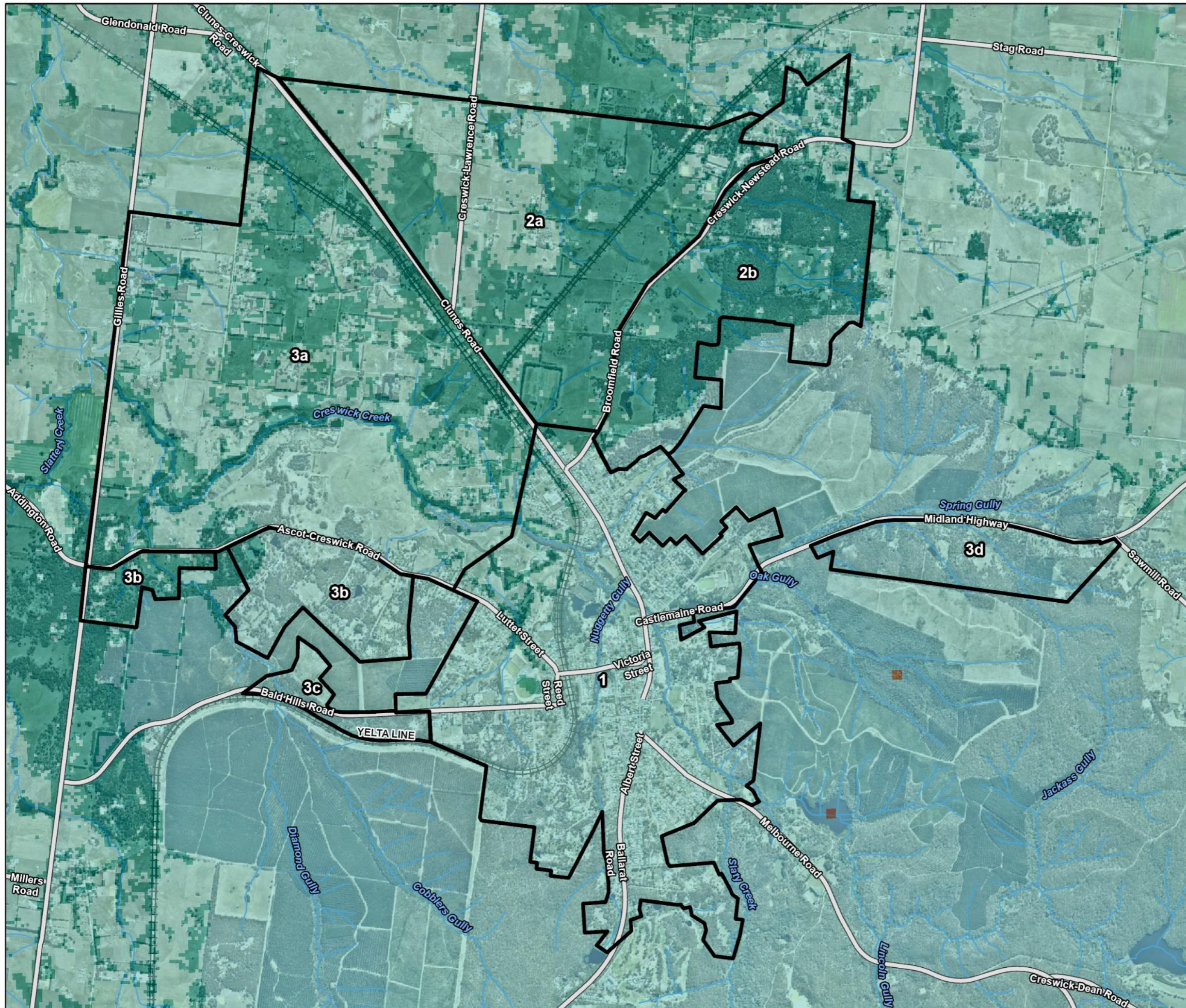
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Map 11. Location Categories

Creswick Township Structure Plan



Legend

- Investigation Areas
- Natural watercourse
- Railways

Location category

- Location 1
- Location 2
- Location 3

Details

Mapping by: Ali Nia
 Date: 7/26/2022
 Version: 1
 Aerial photography from Nearmap(Mar. 2022).
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Appendix 2. On-site Flora List

* CHRW – EVC 164: Creekline Herb-rich Woodland, GDF – EVC 22: Grassy Dry Forest, HDF – EVC 20: Heathy Dry Forest, HHRW – EVC 71: Hills Herb-rich Woodland
 HrFF – EVC 23: Herb-rich Foothill Forest, PGW – EVC 55: Plains Grassy Woodland, PG – EVC 132: Plains Grassland, RW – EVC 641: Riparian Woodland, VGF – EVC 47: Valley Grassy Forest

Family	Origin	Scientific Name	Common Name	EPBC	FFG	*EVC							
						CHRW	GDF	HDF	HHRW	HrFF	PGW/PG	RW	VGF
FERNS AND ALLIES													
Dennstaedtiaceae		<i>Pteridium esculentum subsp. esculentum</i>	Austral Bracken									X	
CONIFERS													
Pinaceae	*	<i>Pinus radiata</i>	Radiata Pine				X					X	
MONOCOTYLEDONS													
Cyperaceae		<i>Carex spp.</i>	Sedge									X	X
Cyperaceae		<i>Lepidosperma spp.</i>	Sword Sedge										X X
Cyperaceae		<i>Schoenus apogon</i>	Common Bog-sedge			X							
Hemerocallidaceae		<i>Dianella admixta</i>	Black-anther Flax-lily				X	X	X				
Iridaceae	*	<i>Romulea rosea</i>	Onion Grass									X	
Juncaceae		<i>Juncus spp.</i>	Rush			X						X	
Poaceae	*	<i>Agrostis capillaris</i>	Brown-top Bent									X	
Poaceae		<i>Anthosachne scabra s.s.</i>	Common Wheat-grass			X							
Poaceae	*	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass									X	
Poaceae		<i>Austrostipa spp.</i>	Spear Grass									X	X
Poaceae	*	<i>Briza maxima</i>	Large Quaking-grass			X		X				X	
Poaceae		<i>Chloris truncata</i>	Windmill Grass									X	
Poaceae	#	<i>Cynodon dactylon</i>	Couch									X	
Poaceae	*	<i>Dactylis glomerata</i>	Cocksfoot									X	X
Poaceae	*	<i>Festuca arundinacea</i>	Tall Fescue									X	
Poaceae	*	<i>Holcus lanatus</i>	Yorkshire Fog									X	

Creswick Township Structure Plan – Biodiversity Assessment

Family	Origin	Scientific Name	Common Name	EPBC	FFG	*EVC							
						CHRW	GDF	HDF	HHrW	HrFF	PGW/PG	RW	VGf
Poaceae		<i>Lachnagrostis spp.</i>	Blown Grass								X		
Poaceae		<i>Microlaena stipoides var. stipoides</i>	Weeping Grass						X				X
Poaceae	*	<i>Paspalum dilatatum</i>	Paspalum								X		
Poaceae	*	<i>Phalaris aquatica</i>	Toowoomba Canary-grass								X	X	
Poaceae		<i>Phragmites australis</i>	Common Reed						X				
Poaceae		<i>Poa labillardierei</i>	Common Tussock-grass								X		
Poaceae		<i>Poa sieberiana</i>	Grey Tussock-grass				X	X					
Poaceae		<i>Poa spp.</i>	Tussock Grass						X		X		
Poaceae		<i>Rytidosperma pallidum</i>	Silvertop Wallaby-grass					X					
Poaceae		<i>Rytidosperma spp.</i>	Wallaby Grass			X		X			X		X
Poaceae		<i>Themeda triandra</i>	Kangaroo Grass			X			X		X		
Poaceae		<i>Walwhalleya proluta</i>	Rigid Panic								X		
Typhaceae		<i>Typha spp.</i>	Bulrush			X			X				
Xanthorrhoeaceae		<i>Lomandra filiformis subsp. coriacea</i>	Wattle Mat-rush				X				X		
Xanthorrhoeaceae		<i>Lomandra filiformis subsp. filiformis</i>	Wattle Mat-rush			X	X	X	X		X		
Xanthorrhoeaceae		<i>Lomandra longifolia</i>	Spiny-headed Mat-rush			X							
Xanthorrhoeaceae		<i>Xanthorrhoea minor subsp. lutea</i>	Small Grass-tree				X						X
DICOTYLEDONS													
Apocynaceae	*	<i>Vinca major</i>	Blue Periwinkle					X		X			
Araliaceae	*	<i>Hedera spp.</i>	Ivy						X				
Asteraceae		<i>Cassinia sifton</i>	Drooping Cassinia					X			X		X
Asteraceae	*	<i>Chrysanthemoides monilifera</i>	Boneseed					X		X			
Asteraceae		<i>Euchiton spp.</i>	Cudweed					X					
Asteraceae	*	<i>Hypochaeris radicata</i>	Flatweed								X		
Asteraceae		<i>Laphangium luteoalbum</i>	Jersey Cudweed								X		

Creswick Township Structure Plan – Biodiversity Assessment

Family	Origin	Scientific Name	Common Name	EPBC	FFG	*EVC							
						CHrW	GDF	HDF	HHrW	HrFF	PGW/PG	RW	VGf
Asteraceae		<i>Senecio spp.</i>	Groundsel						X				
Asteraceae		<i>Vittadinia spp.</i>	New Holland Daisy									X	
Campanulaceae		<i>Wahlenbergia spp.</i>	Bluebell						X			X	
Droseraceae		<i>Drosera aberrans</i>	Scented Sundew					X	X				
Elaeocarpaceae		<i>Tetratheca spp.</i>	Pink Bells					X	X				
Ericaceae		<i>Acrotriche serrulata</i>	Honey-pots						X				
Ericaceae		<i>Styphelia humifusa</i>	Cranberry Heath									X	
Fabaceae	*	<i>Chamaecytisus palmensis</i>	Tree Lucerne						X				
Fabaceae	*	<i>Cytisus scoparius</i>	English Broom						X				
Fabaceae		<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea					X					
Fabaceae	*	<i>Genista spp.</i>	Broom				X		X		X	X	
Fabaceae		<i>Hardenbergia violacea</i>	Purple Coral-pea					X	X				
Fabaceae		<i>Hovea heterophylla</i>	Common Hovea						X				
Fabaceae		<i>Kennedia prostrata</i>	Running Postman									X	
Fabaceae	*	<i>Ulex europaeus</i>	Gorse					X	X		X	X	X
Geraniaceae		<i>Geranium spp.</i>	Crane's Bill									X	
Goodeniaceae		<i>Goodenia lanata</i>	Trailing Goodenia					X	X				
Haloragaceae		<i>Gonocarpus tetragynus</i>	Common Raspwort					X	X			X	
Loranthaceae		<i>Amyema preissii</i>	Wire-leaf Mistletoe									X	
Loranthaceae		<i>Amyema spp.</i>	Mistletoe						X				
Mimosaceae		<i>Acacia acinacea s.s.</i>	Gold-dust Wattle						X				
Mimosaceae		<i>Acacia aculeatissima</i>	Thin-leaf Wattle						X				
Mimosaceae	*	<i>Acacia baileyana</i>	Cootamundra Wattle									X	
Mimosaceae		<i>Acacia dealbata</i>	Silver Wattle					X		X			
Mimosaceae		<i>Acacia mearnsii</i>	Black Wattle				X						
Mimosaceae		<i>Acacia melanoxylon</i>	Blackwood				X		X		X	X	

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Family	Origin	Scientific Name	Common Name	EPBC	FFG	*EVC							
						CHRW	GDF	HDF	HHrW	HrFF	PGW/PG	RW	VGF
Mimosaceae		<i>Acacia paradoxa</i>	Hedge Wattle									X	
Mimosaceae		<i>Acacia provincialis</i>	Wirilda							X			
Mimosaceae		<i>Acacia pycnantha</i>	Golden Wattle								X		X
Myrtaceae		<i>Eucalyptus camaldulensis</i>	River Red-gum								X	X	
Myrtaceae		<i>Eucalyptus dives</i>	Broad-leaf Peppermint							X	X		
Myrtaceae		<i>Eucalyptus gonicalyx s.s.</i>	Bundy							X	X		
Myrtaceae		<i>Eucalyptus macrorhyncha</i>	Red Stringybark								X		
Myrtaceae		<i>Eucalyptus melliodora</i>	Yellow Box						X				X
Myrtaceae		<i>Eucalyptus microcarpa</i>	Grey Box						X				
Myrtaceae		<i>Eucalyptus obliqua</i>	Messmate Stringybark							X			X
Myrtaceae		<i>Eucalyptus ovata</i>	Swamp Gum							X			
Myrtaceae		<i>Eucalyptus polyanthemos</i>	Red Box								X		
Myrtaceae		<i>Eucalyptus radiata subsp. radiata</i>	Narrow-leaf Peppermint										X
Myrtaceae		<i>Eucalyptus rubida</i>	Candlebark										X
Myrtaceae		<i>Eucalyptus spp.</i>	Eucalypt								X		
Myrtaceae		<i>Eucalyptus viminalis</i>	Manna Gum							X			
Pittosporaceae	*	<i>Billardiera fusiformis</i>	Bluebell Creeper							X			
Plantaginaceae	*	<i>Plantago lanceolata</i>	Ribwort								X		
Plantaginaceae		<i>Veronica plebeia</i>	Trailing Speedwell										X
Rosaceae		<i>Acaena spp.</i>	Sheep's Burr								X	X	
Rosaceae	*	<i>Crataegus monogyna</i>	Hawthorn							X	X		
Rosaceae	*	<i>Rosa rubiginosa</i>	Sweet Briar								X		
Rosaceae	*	<i>Rubus fruticosus spp. agg.</i>	Blackberry							X			
Rubiaceae		<i>Asperula conferta</i>	Common Woodruff								X		
Santalaceae		<i>Exocarpos cupressiformis</i>	Cherry Ballart							X	X		
Stylidiaceae		<i>Stylidium graminifolium s.s.</i>	Grass Triggerplant								X		

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Family	Origin	Scientific Name	Common Name	EPBC	FFG	*EVC							
						CHrW	GDF	HDF	HHrW	HrFF	PGW/PG	RW	VGF
Thymelaeaceae		<i>Pimelea humilis</i>	Common Rice-flower					X			X		
Thymelaeaceae		<i>Pimelea linifolia</i>	Slender Rice-flower								X		
Thymelaeaceae		<i>Pimelea spp.</i>	Rice Flower										X
Violaceae		<i>Viola hederacea sensu Willis (1972)</i>	Ivy-leaf Violet					X					

Appendix 3. Potentially occurring threatened flora species

Conservation status under EPBC Act X999:				Conservation status under FFG Act X988:				Origin		
EX: Extinct, CR: Critically endangered, EN: Endangered, VU: Vulnerable and CD: Conservation dependant				Vu: Vulnerable, En: Endangered, Cr: Critically Endangered, – x: Extinct in Victoria and ex: Extinct				*: exotic species; #: Victorian native species extended beyond natural range; Empty: Indigenous species		
Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA		En	#	<i>Acacia boormanii</i>	Snowy River Wattle	Restricted mostly to open forest on rocky slopes and along banks of Snowy River and its tributaries (Walsh and Entwisle 1996)	2	3/06/2016	Low	There are two records from the La Gerche Track. It is less likely to be found within the Investigation Areas, especially lower lying areas within the flat VVP region.
VBA		Vu	#	<i>Acacia howittii</i>	Sticky Wattle	Indigenous to the Tarra Valley and surrounds, central Gippsland, Victoria. It is also widely cultivated. Prefers moist forests and sheltered areas (Tame 1992, pp. 79–80).	3	28/02/2011	Low	The Investigation – area is outside this species typical range. None were observed from the limited road-side survey. However, there could still be cultivated plants in the Investigation Areas.
VBA		Vu		<i>Acacia nanodealbata</i>	Dwarf Silver Wattle	A small mountain or subalpine tree 2–6m high. Known from forest in the Healesville–Warburton area, the top of Mt Macedon, near Creswick and in the Otway range (Flora of Victoria).	1	13/10/1994	Low–Moderate	This species is more likely to be found in the Mountain/Hill areas around Creswick. It is unlikely to be present within the lower-lying Investigation Areas.

Creswick Township Structure Plan – Biodiversity Assessment

Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA, PMST	VU			<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	Moist soils, usually confined to permanent swamps, and tolerates inundation. Mainly distributed along Murray River, it is rarer in southern Victoria (Walsh and Entwisle 1994, Australian Plants Society Maroondah 2001, p. 449). Largely restricted in greater Melbourne to seasonal wetlands and mudflats of River Red Gum swamps of the Lower Yarra and Plenty/Merri volcanic plains north of Melbourne (Cam Beardsell pers. comm.)	1	9/12/1997	Moderate	While there is only one old record, it could potentially occur near waterbodies in the area, especially within the VVP region. A number of wetland areas were identified in Investigation Areas 2a and 3a. Further surveys are needed to determine if this species is present.
VBA		Cr		<i>Amphibromus pithogastrus</i>	Plump Swamp Wallaby-grass	Known from only a few records mostly in swampy depressions in dark clay soils (Walsh and Entwisle 1999, p. 446).	1	17/12/1991	Low-moderate	There could potentially be suitable conditions for this species in the Investigation Area. However, there is only one very old record and this species is known to be rare.
VBA		En		<i>Angophora floribunda</i>	Rough-barked Apple	In Victoria confined to far East Gippsland (east of c. Wingan Inlet) where found mainly in lowland, near-coastal forests on sandy soils (Flora of Victoria).	1	13/06/2016	Low	Creswick is well outside the typical range for this species although there could be cultivated plants.
VBA		En		<i>Bossiaea cordigera</i>	Wiry Bossiaea	Straggly wiry shrub to 1.3m high. Occurs sporadically in south-western and central Victoria, apparently nowhere common. Favours moist situations in heathland, heathy woodland and open-forest. Flowers Oct-Jan (Walsh and Entwisle 1996, p. 810).	3	29/01/2015	Moderate	Three records from Creswick Regional Park. It could potentially occur in areas with moist woodland.

Creswick Township Structure Plan – Biodiversity Assessment

Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST	VU	En		<i>Caladenia ornata</i>	Ornate Pink-fingers	Flowers in October. Confined to western Victoria, from Portland to Stawell, growing in heathy and grassy woodland. An uncommon orchid, most readily distinguished from the similar taxa by the bright red labellum that has darker red bars. Endemic to Victoria (Jeanes and Backhouse 2006).	-	NA	Low	Creswick is outside the typically range of this species. There are no records
VBA		Cr		<i>Comesperma polygaloides</i>	Small Milkwort	Occurs on heavier soils in Plains Grassland and Plains Grassy Woodland EVCs on volcanic soils (Walsh and Entwisle 1999).	1	1/09/1992	Moderate	No recent records. However, it could occur in remaining patches of moderate to high quality Plains Grassy Woodland or Grassland (Investigation Areas 2a and 3a).
VBA		Cr		<i>Coronidium gunnianum</i>	Pale Swamp Everlasting	Occurs through north-eastern to south-western Victoria. Generally found in grasslands and riverine woodlands (under <i>Eucalyptus camaldulensis</i>) on soils that are prone to inundation. Mostly at low elevations (less than 100m) (Walsh 2014)	1	1/02/2012	Moderate	One recent record in the surrounding area. It could occur in moderate to high quality patches of grassland or Plains Grassy Woodland, especially those prone to inundation (Investigation Areas 2a and 3a).
PMST	EN	Cr		<i>Dianella amoena</i>	Matted Flax-lily	This plant is known to occur in lowland grasslands, grassy woodlands and grassy wetlands. It ranges from well drained to seasonally wet soils (DSE 2006).	-	NA	Moderate	No records. Creswick is at the edge of this species typical range but this species could occur in remaining patches of moderate to high quality grassy woodland and grassland (Investigation Areas 2a and 3a).

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA		Cr		<i>Dianella sp. aff. longifolia (Benambra)</i>	Arching Flax-lily	Occasional, and rarely common in dryish forest and Themeda grassland, sometimes forming colonies through spreading rhizomes (Walsh and Entwisle 1999, pp. 649–50).	1	1/02/2012	Moderate	Only one record. However, it could occur on remaining patches of drier grassy woodland and forest (3b, 3c, 3d), as well as within Kangaroo Grass-dominated grasslands (2a and 3a).
VBA		En		<i>Dipodium pardalinum</i>	Spotted Hyacinth-orchid	Scattered in higher rainfall parts of western Victoria. Flowers Dec.–Mar. (Royal Botanic Gardens Victoria 2015)	3	22/10/2015	High	Records from the hilly woodland areas. It could be present in moderate-high quality woodland and grassland throughout the Investigation Areas.
VBA		Cr		<i>Discaria pubescens</i>	Australian Anchor Plant	Ridged, spiny, almost leafless shrub, Mostly on rocky slopes near streams particularly on basalt. Rare due to clearing for stock (Costermans 2000)	3	10/12/1998	Low	Three old records. It typically occurs on streams but these are highly disturbed in the Investigation Areas.
PMST	VU			<i>Dodonaea procumbens</i>	Trailing Hop-bush	Largely confined in Victoria to the south-west (Penola-Dergholm area, Grampians, Lake Fyans) with disjunct occurrences near Castlemaine, Avoca, Skipton and Camperdown. A X900 record from near Sale in the east has not been confirmed by recent collections. Grows in low-lying, often winter wet areas in woodland, low open-forest and grassland on sands and clays. Flowers Summer. (Walsh and Entwisle 1999).		NA	Low	No records in the area and it occurs in disjunct occurrences typically outside of Creswick.
PMST	VU	Vu		<i>Eucalyptus aggregata</i>	Black Gum	Tree to 18m. Very restricted in Victoria to the Woodend-Gisborne region. Flowers summer-autumn (Walsh and Entwisle 1996, p. 965). The habitat is invariably frost hollows and swamps (ANBG 2010).	–	NA	Low	Creswick is outside the typical range of this species (Typically found closer to Woodend).

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA		En		<i>Eucalyptus brookeriana</i>	Brooker's Gum	Found in two areas, on the northern foothills of the Otway Ranges and north of the Great Dividing Range in the Bells-Reef Trentham area (Walsh and Entwisle 1996, p. 961)1).	20	18/06/2015	High	Many records in the area, particularly in the foothills near 3b and 3c.
VBA		En	#	<i>Eucalyptus globulus subsp. globulus</i>	Southern Blue-gum	This subspecies of <i>E. globulus</i> is thought to only occur south of the Strzelecki Ranges, e.g., Port Franklin/Wilsons Promontory, and possibly intergraded spp. in Otway's and elsewhere in S. Gippsland (Walsh and Entwisle 1996, pp. 973–74).	1	30/01/2016	Low	The Investigation Areas are outside the typical range of this species, although there may be cultivated plants.
VBA		Cr	#	<i>Eucalyptus leucoxylon subsp. megalocarpa</i>	Large-fruit Yellow-gum	The Victorian occurrence, near Nelson, is the easternmost part of the mainly South Australian coastal distribution, south of Mt Gambier. Flowers spring to summer. The largest-fruited form of the species. It has been widely planted for its pink to red flowers (Walsh and Entwisle 1996, p. 993).	2	13/06/2016	Low	The Investigation Areas are outside the typical range of this species, although there may be cultivated plants.
VBA		Cr		<i>Eucalyptus yarraensis</i>	Yarra Gum	Tree to 15m, endemic in Victoria, distribution fragmented: open forest areas, from Traralgon to north west Victoria, near Ararat. Flowers September to December (Walsh and Entwisle 1996, p. 964). A close relative to Swamp Gum and usually found on river flats and floodplains (Bull 2014).	7	29/01/2015	High	Many records in the area, particularly in the wooded Creswick Regional Park. It could potentially be present in Woodland areas within Investigation Areas 2b, 3b–d.

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA		En		<i>Euphrasia scabra</i>	Rough Eyebright	Threatened with extinction and confined to a few sites in the eastern ranges. Found in damp grassy situations among shrubs in sclerophyll forest, clearings or subalpine woodland (Walsh and Entwisle 1999).	1	23/10/2006	Low	This is a rare species and the Investigation Areas are outside its current range, although it was once common.
PMST	VU	Vu		<i>Glycine latrobeana</i>	Clover Glycine	Widespread, infrequent populations in southern Victoria (Walsh and Entwisle 1996). It occurs mainly in grassland and grassy woodland habitats, less often in dry forests, and only rarely in heathland. Populations occur from sea level to c. 1,200 m altitude (900 m in Tasmania). In Victoria, plants grow in a range of soil types including alluvial soils, and those derived from sandstones, mudstones, granite and basalt. Soils are usually clay, but may also have high loam content (Carter and Sutter 2010).	-	NA	Low-Moderate	There are no records. Although it could occur in patches of remaining grasslands and grassy woodlands.
PMST	EN	En		<i>Lachnagrostis adamsonii</i>	Adamson's Blown-grass	Occurs along slow moving creeks, depressions and drainage lines that are seasonally inundated or waterlogged and usually moderately to highly saline. Occurs on black, cracking clays or duplex soils with poorly permeable subsoils. Plants appear to favour sheltered sites.	-	NA	Low-moderate	There are no records. This is at the edge of its range and it is generally found in more saline areas. It could potentially occur if saline depressions or waterbodies are present in the VVP area north of Creswick.

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST	VU	En		<i>Lepidium aschersonii</i>	Spiny Peppercross	Mostly on heavy clay soil near salt lakes on volcanic plain, but with outlying records from near Lake Omeo (in 1940 & 1981) and the Grampians (in 1893). Note that grazing may lead to spine-like remnants on other species. Such artefacts were used to distinguish <i>L. dubium</i> , now referable to <i>L. hyssopifolium</i> . Flowers spring–autumn (Walsh and Entwisle 1996).	–	NA	Low–moderate	There are no records. This is at the edge of its range and it is generally found in more saline areas. It could potentially occur if there are relatively undisturbed (e.g. grazed) saline depressions waterbodies in the VVP area north of Creswick.
PMST	EN	En		<i>Lepidium hyssopifolium</i>	Basalt Peppercross	Grows on basalt plains; rarely reported in western Victoria and only present at two known locations north and north–east of Melbourne (Walsh and Entwisle 1996); in total seven Victorian locations and now considered extinct in Greater Melbourne (Bull 2014).	–	NA	Low–Moderate	No records and it is very rare.
PMST	EN	En		<i>Leucochrysum albicans subsp. tricolor</i>	White Sunray	Very rare in Victoria, the only recent collections from volcanic grassland remnants in the Wickliffe, Willaura, Streatham, Inverleigh and Creswick districts. All other Victorian collections were made last century, from e.g., Mt Cole, the Grampians and the Port Fairy district.	–	NA	Low	No records and very rare.

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA		En		<i>Levenhookia sonderi</i>	Slender Stylewort	Distributed mainly in south-western Victoria but also occurs in central Victoria (Rushworth) and south-central Victoria (Beaconsfield); grows in seasonally damp ground and in drying swamps in lowland areas (Walsh and Entwisle 1999).	3	29/01/2015	Moderate	There are three records (Creswick Regional Park and near Investigation Area 3b). It could potentially occur in damp areas near drainage lines and Creswick Ck.
VBA		En	#	<i>Melaleuca armillaris subsp. armillaris</i>	Giant Honey-myrtle	Mostly confined to near-coastal sandy heath, scrub on slightly raised saltmarsh, riparian scrub, foothill outcrops, and rocky coastlines. Mainly distributed (native) east of Marlo, Vic., but regularly naturalizes in areas where planted (Walsh and Entwisle 1996, p. 1031).	5	28/02/2011	Low	The Investigation areas are outside this species' typical range. However, there could be cultivated plants in the Investigation Areas.
PMST	CR	Cr		<i>Pimelea spinescens subsp. spinescens</i>	Spiny Rice-flower	Grows in grassland or open shrubland on basalt derived soils west of Melbourne, but rare (Walsh and Entwisle 1994).	-	NA	Moderate	While there are no records, it could potentially occur in less disturbed, moderate-high quality grassland in Investigation areas 2a and 3a.
VBA	EN	Cr		<i>Prasophyllum suaveolens</i>	Fragrant Leek-orchid	A Victorian endemic, distributed on basalt plains of south-western Victoria. Grows in remnant native grassland in heavy clay soil (Jeanes and Backhouse 2006).	1	23/10/2006	Moderate	One record. It could potentially occur in less disturbed, moderate-high quality grassland in Investigation areas 2a and 3a.

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST	VU			<i>Prasophyllum validum</i>	Sturdy Leek Orchid	The Sturdy Leek-orchid <i>Prasophyllum validum</i> is a tall, slender, deciduous terrestrial orchid endemic to south-eastern Australia, where it occurs in Victoria and South Australia. Little is known of the ecology or biology of the species, although it seems to prefer relatively dry woodland habitats [SPRAT profile].	-	NA	Low-moderate	No records
PMST	VU	En		<i>Pterostylis chlorogramma</i>	Green-striped Greenhood	Apparently localized in Victoria, but exact range uncertain due to confusion with closely allied species. Grows in moist areas of heathy and shrubby forest, on well-drained soils. Flowers Jul.-Sep. (Walsh and Entwisle 1994)	-	NA	Moderate	No records. However, it could potentially occur in moist areas of woodland (Investigation Areas 2b, 3b, 3c and 3d).
PMST	EN	En		<i>Rutidosia leptorhynchoides</i>	Button Wrinklewort	In Victoria confined to Basaltic grasslands between Rokewood and Melbourne where endangered due to loss of habitat (formally as far west as Casterton, and on Gippsland Plain near Newry). Flowers mostly late spring and summer (Walsh and Entwisle 1999, p. 797).	-	NA	Moderate	While there are no records within the Investigation Areas, it could potentially occur in moderate to high quality grassland and woodland. There are records in the broader area.

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST	EN	Cr		<i>Senecio behrianus</i>	Stiff Groundsel	Exceedingly rare in Victoria, and thought to be extinct until X99X when rediscovered between Rochester and Stanhope. Apparently confined to heavy, winter-wet, clayey soils. Formerly known from Casterton, Swan Hill, Barham areas, with specimens from the 'Wimmera', and You Yangs near Lara of uncertain affinity, but closest to <i>S. behrianus</i> . Flowers Mar.-Jun.(Walsh and Entwisle 1999)	-	NA	Low-moderate	No records and very rare.
VBA		En		<i>Senecio campylocarpus</i>	Floodplain Fireweed	Grows in forests and woodlands with loam to clay soils, often where seasonal inundation occurs; distribution in Victoria ranges from central regions along the Murray River, down to Port Welshpool. (National Herbarium of NSW 20X0 – online resource)	1	15/10/2015	Moderate	Only one record from within Creswick Regional Park. It could potentially occur in woodland areas with seasonal inundation (Investigation Areas 2b, 3b-d).
PMST	VU	Cr		<i>Senecio macrocarpus</i>	Large-headed Fireweed	Distribution within Victoria largely limited to Themeda grasslands on loamy clay soils derived from basalt, ranging from near Melbourne to Skipton in the west. Also found in auriferous soils near Stawell (Walsh and Entwisle 1999, p. 964).	-	NA	Low-moderate	Outside its typical range but could potentially occur in grasslands within Investigation Areas 2a and 3a, which were often Themeda dominated.

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA		Vu		<i>Senecio microbasis</i>	Slender Fireweed	In Victoria grows in drier forest and woodland, mostly in east Gippsland between the Tambo and Snowy River with a few sporadic occurrences in central Victoria .	1	29/01/2015	Moderate	Only one record from within Creswick Regional Park. The Investigation areas are outside its typical range but it could potentially occur in woodland/forest areas (2b, 3b, 3c, 3d)
PMST	VU			<i>Senecio psilocarpus</i>	Swamp Fireweed	Rare, restricted in Victoria to a few herb-rich winter-wet swamps south and west from Ballarat, growing on Volcanic clays or peaty soils. Flowers Nov-Mar (Walsh and Entwisle 1999).	-	NA	Low	No records and very rare.
PMST	VU	En		<i>Thelymitra matthewsii</i>	Spiral Sun-orchid	Widely distributed but rare, in coastal sandy flats or slightly elevated sites (to 400 m) in well-drained soils (sandy loams to gravelly limestone soils) in open forest. Plants colonise disturbed sites and slowly disappear as these sites stabilise. Flowers Aug.-Sep.-Oct.). Flowers open widely on warm days, but are self-pollinating and short-lived. (Royal Botanic Gardens Victoria 2015)	-	NA	Low	No records in the area or surrounds.The Investigation Area is outside its typically range.

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Source	EPBC	FFG	Origin	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST	VU	Cr		<i>Xerochrysum palustre</i>	Swamp Everlasting	Found in the Midlands, Wannon, Volcanic Plains and Gippsland Plains regions and in SA and Tas. Occurs in lowland swamps usually on black cracking clay soils, scattered from near the south Australia border northwest of Portland to Bairnsdale district, but rare due to habitat depletion. Flowers November to March (Walsh and Entwisle 1999, p. 750).	-	NA	Moderate	No records in the area. However, it could occur in swampier habitat within the Investigation Areas, if relatively undisturbed areas remain.

Appendix 4. Potentially occurring threatened fauna species

International Treaty				EPBC Act X999 conservation status			FFG Act X988 status			
B: Bonn Convention; C: CAMBA; J: JAMBA; R: ROKAMBA.				EX: Extinct, CR: Critically endangered, EN: Endangered, VU: Vulnerable and CD: Conservation dependant.			Vu: Vulnerable, En: Endangered, Cr: Critically Endangered, -x: Extinct in Victoria and ex: Extinct dependant.			
Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA			En	<i>Accipiter novaehollandiae</i>	Grey Goshawk	The Grey Goshawk has a stronghold in Victoria; particularly the white form in the Otway Ranges, where wet forests and gullies containing Mountain Grey Gum adjoin partly cleared farmlands. They occur in lower densities in similar habitats in the Strzelecki Ranges, Gippsland Plains and Otway Plains. Elsewhere in the State they are occasionally seen in woodlands, dry forests, suburban parks and wooded farmlands (Marchant and Higgins 1993).	2	2018	Moderate	Recent records. The species could hunt for prey in the more wooded areas (Investigation areas 2b, 3b–d). Prey species such as Rabbits were observed within the Study Areas.
VBA	B			<i>Acrocephalus australis</i>	Reed warbler	The Australian Reed–Warbler prefers dense vegetation alongside water, especially thick reed beds, as well as tall crops, bamboo thickets and lantana (Birdlife Australia Website)	7	2011	High	Recent records. This species could use areas of dense vegetation along creeks, lakes and dams.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST		C R	Cr	<i>Anthochaera phrygia</i>	Regent Honeyeater	Its range has contracted dramatically from its historical distribution as the species has suffered badly from broad-scale clearing and complete absence of old growth box-ironbark habitat so that now only around 100 individuals remain wild in Victoria. It is a rare vagrant to the country around Bendigo (where it was once common) and to Gippsland (where it was a regular visitor), and in most years only a handful of birds are seen in eastern Victoria — four-fifths of sightings are from just three locations: Chiltern, the Killawarra, and the Reef Hills. It is highly nomadic in its movements as determined by the need for a nectar rich diet from the flowering of eucalypts particularly Mugga Ironbark <i>Eucalyptus sideroxylon</i> , White Box <i>Eucalyptus albens</i> , Yellow Box <i>Eucalyptus melliodora</i> and Yellow Gum <i>Eucalyptus leucoxylon</i> (SWIFFT 2017).	-	NA	Low-moderate	While there are no recent records, this species is highly nomadic and could transiently forage on flowering gums in the more wooded areas. It is noted that the Investigation Area is outside its usual range and prefers box-ironbark communities, which weren't observed during the field survey although Box species were common.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA			En	<i>Antigone rubicunda</i>	Brolga	The Brolga is a large light grey crane. It is generally found in tropical, subtropical and temperate freshwater terrestrial wetlands. It is an omnivorous bird eating tubers, grains, insects and molluscs. Numbers in Victoria have reduced due to draining of freshwater wetlands for agriculture (Marchant and Higgins 1993). Occur in the Northern Plains and along adjacent parts of the Murray River as well as on the plains and adjacent foothills of W. Vic. Uses shallow wetlands, farm dams, flooded areas, margins of large lakes, pastures, grasslands, crops and stubbles. Obtains food from the surface of the ground or by digging in moist areas. Nests are usually made on the ground on islands or as isolated mounds within wetlands. Drainage and grazing of wetlands and other human activities have contributed to reductions in numbers.	5	2019	High	Recent records from St Georges Lake. It could also use waterbodies, pastures and croplands in the Investigation areas.
PMST		V U	En	<i>Aprasia parapulchella</i>	Pink-tailed Worm-Lizard	Dry open forest and woodland, with sparse grassy understorey and abundant surface rock. Particular preference for hilly, north-west facing, well-drained slopes with outcropping sedimentary rock. Often shelters beneath rocks and in ant tunnels, on which it preys. Secretive and seldom seen (Tzaros 2005).	-	NA	Moderate	No records However, it may be present in rocky outcrops within grassland and woodland areas, such as those identified in Investigation Areas 2a and 3a. Species or species habitat has been mapped as 'may occur' within the Study Area.
VBA	C J			<i>Ardea alba</i>	Great Egret	Habitat includes terrestrial wetlands, estuarine, littoral and moist grass habitats. Forages in open, shallow water and generally avoids dry or deeply flooded areas. Breed in wetlands with fringing or flooded trees, or other tall vegetation in which nests are built. Are known to use mangroves along the coast. Roosts in trees or near wetlands (Marchant and Higgins 1990).	1	2001	Low-Moderate	No recent records. However it could use wetlands in the area such as the sewerage ponds or vegetated dams.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA			Vu	<i>Aythya australis</i>	Hardhead	Hardheads inhabit deep to shallow wetlands with open water and fringing emergent vegetation (Pizzey and Knight 2007). The species feeds by diving in deep water and occasionally by dabbling just under the water surface (Rogers 1990). Nests are built in thick vegetation (e.g., reeds, lignum, cumbungi), usually over water (Rogers 1990, Halse, Pearson et al. 2005). These birds are most common in the wetland systems of inland Australia (Halse, Pearson et al. 2005). Birds do visit Victoria from these areas in spring and summer, returning as the northern wetlands are replenished by rain (Halse, Pearson et al. 2005). However, some birds are present in Victoria all year round depending on the suitability of the wetland (Pizzey and Knight 2007).	8	2018	Moderate-High	Recent records including at St Georges Lake. They may use wetlands, and sewerage ponds identified in the investigation areas.
VBA			Vu	<i>Biziura lobata</i>	Musk Duck	Usually seen in small numbers on the deep waters of well-vegetated fresh to saline lakes, swamps and occasionally shallow inlets and bays. Nests are formed in low vegetation in areas sheltered by surrounding vegetation (Marchant and Higgins 1990, Pizzey and Knight 2007).	8	2020	Moderate - High	Recent records. It could use deeper vegetated dams and water bodies in the area such as the wetland within Investigation Area 2b off McMillan Rd.
PMST		EN	Cr	<i>Botaurus poiciloptilus</i>	Australasian Bittern	This species is part nocturnal and forages over water in dense cover, sometimes from platforms in wetland vegetation. Habitat is usually tall reedbeds, sedges, rushes, cumbungi or lignum. Also occurs on rice fields, drains in tussocky paddocks and occasionally on saltmarshes and brackish wetlands. Nests are shallow saucers on trampled water plants (Pizzey and Knight 2007).	-	NA	Low-Moderate	No recent records. Unlikely to be its preferred habitat.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST	B R J C	C R	Cr	<i>Calidris ferruginea</i>	Curlew Sandpiper	Summer migrants to Victoria from Arctic breeding grounds (Aug–April). This species is found in a range of wetland habitats: tidal mudflats, saltmarsh, saltfields, fresh to saline wetlands, both coastal (most) and inland. Also visits sewage ponds (Pizzey and Knight 2007).	–	NA	Low	No recent records More typically a shorebird and unlikely to find suitable habitat within the Investigation Area.
PMST		EN		<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	During summer, the Gang-gang Cockatoo is found in tall mountain forests and woodlands, with dense shrubby understoreys. In winter, Gang-gangs will move to lower altitudes into drier, more open forests and woodlands. At this time, they may be seen by roadsides and in parks and gardens of urban areas. They require tall trees for nest hollows. (Birdlife Australia webpage – https://birdlife.org.au/bird-profile/gang-gang-cockatoo)	–	NA	Moderate	While there are no recent records, there is suitable foraging habitat present (Investigation areas 2b, 3b–d). Species may occasionally use such areas during winter months.
VBA	B			<i>Charadrius bicinctus</i>	Double Banded Plover	Occurs in south and east Australia from about mid-Feb to late August. Mainly coastal and near coastal in Australia, using firm tidal flats and nearby short open saltmarsh and freshwater wetlands; It also ventures inland to open grasslands and short-cropped pasture, usually near water. (The Australian Bird Guide, Peter Menkhorst)	1	2011	Low-Moderate	There is one record. Species usually occupies more coastal habitat. May forage briefly while on route to high quality waterbodies.
PMST		EN	En	<i>Dasyurus maculatus maculatus</i>	Spot-tailed Quoll	The species is recorded in a range of treed habitats including tropical, subtropical and temperate rainforests, vine thickets, wet and dry sclerophyll forest, woodland and coastal scrub. In Tasmania it also occurs in heathland (Van Dyck and Strahan 2008).	–	NA	Low-Moderate	There are no records. This species could use the forest/woodland areas. However, perhaps the Creswick reserves lack the needed connectivity to other areas (e.g., Great dividing range to the east) to support them.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA, PMST		V U	En	<i>Delma impar</i>	Striped Legless Lizard	Found in native grasslands and open grassy woodlands; also known to occur in areas with cover of exotic species. Shelters beneath loose rocks and in grass tussocks (Wilson and Swan 2008).	2	1988	Moderate	Only two older records. However, the moderate to high quality grasslands observed in Investigation areas 2a and 3a represent possible habitat, especially those areas with rocky outcrops.
VBA			En	<i>Egretta garzetta</i>	Little Egret	Inhabits terrestrial wetlands and shallow margins of tidal estuaries and inland lakes and rivers. Feed in shallow water and nest colonially, often with other waterbirds. Stick-nests are usually built in trees over water, although occasionally in reedbeds (Marchant and Higgins 1990).	1	5/06/2018	Moderate	One recent record. Likely to use edges of dams, sewerage ponds, lakes and other shallower water bodies in the area.
PMST		V U	Vu	<i>Falco hypoleucos</i>	Grey Falcon	Inhabit grasslands, lightly wooded plains and scrublands of interior Australia. Birds occur sporadically on the periphery of their range, such as NW. Vic. More common in Vic during or after droughts. They surprise their prey on the ground while flying low and fast over open country and also catch prey in flight. They nest in trees, in the disused stick-nests of other birds.	-	NA	Moderate	No records. However this species could transiently hunt for prey in the area over plains and grasslands in the area.
VBA			Cr	<i>Falco subniger</i>	Black Falcon	The Black Falcon has a stronghold in inland Australia. Most Victorian records come from the lowlands and only occasionally from the foothills. It occurs mainly over croplands, grasslands and wooded farmlands. To catch flushed prey, they sweep low over croplands and grasslands and are often attracted by smoke from grassfires and late-summer burning off. This species nests in trees in old stick-nests of other birds (Marchant and Higgins 1993, Pizzey and Knight 2007).	1	2019	Moderate	One recent record. However this species could transiently hunt for prey in the area over plains and grasslands in the area.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST		C R	Vu	<i>Galaxias rostratus</i>	Flat-headed Galaxias	Restricted to the Murray Darling system including major tributaries such as the Murrumbidgee, Loddon, Goulburn, Ovens, Mitta Mitta and Lachlan rivers. Inhabits still or gently flowing water on the margins of lakes, billabongs and streams. It usually occurs in shoals in midwater over rocky or sandy bottoms near aquatic vegetation (Allen, Midgley et al. 2002, Gomon and Bray 2011).	-	NA	Low	No records While it could potentially occur in slow moving water-bodies in the Investigation Area, it is unlikely this far from its typical range, closer to the Murray.
PMST		V U	En	<i>Galaxiella pusilla</i>	Dwarf Galaxias	Typically occur in slow flowing and still, shallow, permanent and temporary freshwater waterways including swamps, the backwaters of streams and creeks, drains and ditches, usually with dense aquatic, emergent or flooded vegetation. Ephemeral sites require seasonal flooding and linkages to other more permanent populations for population replenishment; therefore, wetland connectivity may be critical to survival. They occur across most of southern Victoria, however are sparse in the landscape and more abundant in the south-east of the state, most specifically in Mornington Peninsula & Western Port areas (Allen, Midgley et al. 2002, Museum Victoria 2006).	-	NA	Low	No records. Creswick is outside the known habitat range of this species. Creswick Creek was highly modified/disturbed where surveyed and lacked dense aquatic or emergent vegetation.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA	B R J C			<i>Gallinago hardwickii</i>	Latham's Snipe	Latham's Snipe is a migratory species. The species migrates to Victoria from breeding grounds in Japan. In Victoria this species is widely distributed in a range of habits including heavily vegetated freshwater swamps, and pools or ditches in heaths or subalpine herblands (Pizzey and Knight 2007). Also occurs in small ephemeral wetlands such as wet depressions after floods recede. Generally, roosts in thick vegetation during the day, sometimes under shrubs away from wetlands, and will feed in swamps at night. They are occasionally seen feeding during the day. This species feeds by probing in soft mud and rarely moves far from concealing vegetation (Higgins and Davies 1996).	5	2009	Moderate	Some recent scattered records. It could use sewerage ponds, lakes and dams that are reasonably well vegetated.
PMST		V U	Vu	<i>Grantiella picta</i>	Painted Honeyeater	The Painted Honeyeater is a summer migrant to Victoria. They are generally found to inhabit box-ironbark, Broad-leaved Peppermint and Red Stringybark forests and box-buloke woodlands in the northern foothills of the great Divide. May also occur in Red Ironbark, Red Box forests in southern Victoria. They are occasionally found along Murray River valley to Hattah-Kulkyne NP where they inhabit Black Box woodlands. This species is usually found in open stands of old eucalypts that are infested with mistletoes (Higgins, Peter et al. 2001).	-	NA	Low-Moderate	This species is highly nomadic and could transiently forage on flowering gums, particularly areas of Broad-leaved Peppermint and Red Stringybark. However, there are no recent records and this species prefers larger areas of less disturbed forest, especially those with heavy mistletoe infestations.
VBA			Vu	<i>Hieraetus morphnoides</i>	Little Eagle	Found across mainland Australia and Tasmania. Occurs in mountain forests to nearly treeless plains, occasionally over lakes, beaches and cities	13	2011	High	Many relatively recent records. It could hunt for prey across the Investigation Areas, while using the treed areas

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA, PMST	C RJ	V U	Vu	<i>Hirundapus caudacutus</i>	White-throated Needletail	In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable. In Australia, White-throated Needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats (Higgins 1999).	2	2008	Moderate	Two records. Largely aerial and could forage aerially over all the Investigation Areas.
PMST	C R	Cr		<i>Lathamus discolor</i>	Swift Parrot	The Swift Parrot is a winter migrant to Victoria (Swift Parrot Recovery Team 2001). They arrive from their breeding areas in Tasmania, however small numbers of non-breeding birds may remain here during summer (Higgins 1999, Swift Parrot Recovery Team 2001). They are nomadic, and follow the flowering of trees and psyllid infestations. In Victoria their distribution is centred on box-ironbark forests, but they are often seen in town parks and occur sporadically elsewhere in dry forests, dry woodlands and wooded farmlands. They are seldom seen in treeless areas, rainforests or wet forests (Higgins 1999, Pizzey and Knight 2007). Feed mainly in winter-flowering plants, especially Red Ironbarks and ornamental trees and shrubs (Higgins 1999, Swift Parrot Recovery Team 2001).	-	NA	Moderate	There are no records but the Swift Parrot is nomadic and could potentially forage on woodland areas with flowering gums. Although these are unlikely to be dominated by box-ironbark species that are preferred by Swift Parrots.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA, PMST		V U	Vu	<i>Litoria raniformis</i>	Growling Grass Frog	The species often inhabits water bodies with a diverse assemblage of aquatic vegetation, including emergent species such as sedges (<i>Gahnia spp.</i>), submergent species such as curly pondweed (<i>Potamogeton spp.</i>), floating species such as water ribbon (<i>Triglochin spp.</i>) and filamentous algae (Heard, Robertson et al. 2004, Hamer and Organ 2006). The aquatic vegetation provides sites for male frogs to call from, sites for eggs to be deposited and relatively safe development, and food and shelter for tadpoles. Dense submergent vegetation is especially important to protect eggs and tadpoles from predation (Heard, Robertson et al. 2004). However, it is also known to occur in ditches, dams and swamps or sheltering under discarded debris near those sites (Tyler and Knight 2009, pp. 38–39).	22	2011	High	Recent records from the sewerage ponds and nearby water bodies in Investigation Area 3a. Please see Section 0
VBA			Vu	<i>Lophoictinia isura</i>	Square-tailed Kite	Found in heathlands, woodlands, forests, tropical and sub-tropical rainforest, timbered watercourses, hills and gorges. Nest are large and loose made of sticks 15–25m up in leafy tree. Range in coastal and sub-coastal south east Australia including Murray River region in SA. (Pizzey and Knight 2007)	3	2005	Moderate	Some older records Could hunt for prey over much of the woodland areas (Investigation areas 2b, 3b–d). Prey species etc Rabbits observed within the investigation area.
PMST		EN	En	<i>Maccullochella macquariensis</i>	Trout Cod	Found in rapidly flowing streams, around the cover of logs and debris, over rocky and gravel bottoms. Larger fish occur in deeper sections. The last remaining self-sustaining wild populations occur in the Murray River, both in northern Victoria (Allen, Midgley et al. 2002).	–	NA	Low	There are no records in the area. While this species could potentially occur in water bodies in the area, it is outside its typically range closer to the Murray.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST		V U	En	<i>Maccullochella peelii</i>	Murray Cod	The Murray Cod lives in a wide variety of habitats from silty slow-moving rivers to clear rivers with pools and riffles. This fish prefers instream habitat of rocks and logs with over-hanging vegetation (Allen, Midgley et al. 2002).	-	NA	Low	There are no records in the area. While this species could potentially occur in water bodies in the area, it is outside its typically range closer to the Murray.
VBA	B			<i>Myiagra cyanoleuca</i>	Satin Flycatcher	The Satin Flycatcher migrates to southern parts of Victoria during the spring/summer months. It is generally found in many habitat types including wet sclerophyll and woodland particularly along watercourses (Higgins, Peter et al. 2006).	8	2004	Low-Moderate	Some older records Could occasionally forage over much of the woodland areas (Investigation areas 2b, 3b-d), though surrounding records are restricted to larger dense treed areas
PMST		V U	Vu	<i>Nannoperca australis Murray-Darling Basin lineage</i>	Southern Pygmy Perch	Their natural distribution includes the southern Murray-Darling Basin. In Victoria, the species can be found in low numbers within the Mitta Mitta, Kiewa, Ovens, Goulburn-Broken, Campaspe, Avoca and Wimmera river catchments. Southern Pygmy Perch prefer habitats in low-gradient waterways and floodplains with slow flowing or still water and aquatic macrophyte cover or wood at shallow depths, which may have little or no flow in summer (Cadwallader 1979; Humphries 1995; Woodward & Malone 2002; Unmack et al., 2011; 2013; Hammer et al., 2013; Price et al., 2016). The species has a limited tolerance of salinity and prefers waters with salinity less than 3.3 ppt (Chessman & Williams 1974), however it can tolerate a broad range of temperatures and extremely low dissolved oxygen levels (McNeil & Closs 2007). Listing advice		NA	Low	No recent records

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST		V U	Vu	<i>Nannoperca obscura</i>	Yarra Pigmy Perch	Inhabits small lakes and streams, preferring habitats with flowing water and abundant aquatic vegetation for shelter. It is found in coastal drainages from southern SA to Frankston, Victoria (Allen, Midgley et al. 2002).	-	NA	Low	No recent records
VBA			Vu	<i>Ninox strenua</i>	Powerful Owl	Widespread in foothill and coastal forests where they especially favour gullies with Peppermint-Manna Gum forests. Occasionally seen in wetter mountain forests, drier box-ironbark forests and woodlands, and softwood plantations. Hunts at night by flying through the forest canopy catching prey from tree branches. They nest in large holes in trees (DSE 2004).	6	2018	High	Recent records across the Creswick regional park. It could forage across the woodland areas (Investigation areas 2b, 3b-d).
PMST	B R J C	C R	Cr	<i>Numenius madagascariensis</i>	Eastern Curlew	Common summer migrant to Australia (Aug-May) (Pizzey and Knight 2007). Found in sheltered coasts, especially estuaries, embayments, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats. Mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation, also on saltflats and in saltmarsh (Higgins and Davies 1996).	-	NA	Low	No records More likely in coastal areas and unlikely to find suitable habitat in the Investigation Area.
VBA			Vu	<i>Ornithorhynchus anatinus</i>	Platypus	Platypus inhabit a wide variety of streams and lake ranging from small, fast-moving mountain streams, to broad, slow moving and sometimes polluted streams near the coast. They also inhabit artificial lakes but are absent from deep lakes and storage dams (>5m deep) and from brackish and estuarine waters. They require fairly shallow freshwater for easy access to the bottom dwelling invertebrates on which they prey. They also prefer deep vegetated banks with friable soil in which to construct their burrows for shelter and nesting.	5	1986	Low	Some older records but a house now occurs on the site of four of these. The other is in St Georges Lake.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA			Vu	<i>Oxyura australis</i>	Blue-billed Duck	This species inhabits deep, permanent, well-vegetated swamps, but at times (especially in winter) may occur in large numbers on large open wetlands. The Blue-billed Duck catches food while diving or occasionally by feeding from the water surface. Their nests are built on trampled swamp vegetation around the base of established stands of reeds/rushes, often over water or on small islands (Marchant and Higgins 1990, Pizzey and Knight 2007).	3	2009	Moderate	Some recent records. Three records including 2008/2009 records from the Sewerage ponds along Creswick Ck. It's noted this is towards the end of the Millennium drought and the sewerage pond may have offered a reliable source of water at this time. This species tends to prefer water bodies with low human presence. It could possibly use the sewerage ponds along Creswick Ck transiently, when filled and the larger wetland within Investigation Area 2b off McMillan Rd.
PMST		C R	Cr	<i>Pedionomus torquatus</i>	Plains-wanderer	Main distribution is within the Riverina of NSW, patchy elsewhere, and only occurring in small numbers in northern Victoria. Inhabits open grasslands with preference towards Danthonia and Stipa species. However, vegetation structure is more important than floristic composition. Does not occur in dense grasslands and woodlands (Marchant and Higgins 1993, Pizzey and Knight 2007).	-	NA	Low-Moderate	No records This species could potentially use the grassland areas within Investigation Areas 2a and 3a. However, these are disturbed with roads and residences and not likely to be ideal habitat.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST		V U	Vu	<i>Petauroides volans</i>	Greater Glider	Occurs in wet sclerophyll forest on the ranges and coastal plains from near Mossman, NE. QLD to Daylesford, VIC. Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred food tree species. Requires large tree hollows for shelter, and found in most abundance where there is a high density of tree hollows. In southern Queensland require at least 2–4 den trees for every 2ha of habitat. They are significantly vulnerable to logging and have relatively small home ranges and poor dispersal ability. In Victoria, their numbers have declined sharply in recent years (TSSC 2016).	–	NA	Low	This is at the edge of the species usual range and there are no records in the area.
PMST		V U		<i>Petaurus australis australia (South-eastern)</i>	Yellow-bellied Glider	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. It occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	–	NA	Low	This is at the edge of the species usual range and there are no records in the area.
VBA			En	<i>Pseudophryne semimarmorata</i>	Southern Toadlet	The Southern Toadlet can be found in dry forest, woodland, shrubland, grassland and heaths. It shelters under leaf litter and other debris in moist soaks and depressions. Their eggs are spawned in shallow burrows under organic litter in low areas close to water (Hero, Littlejohn et al. 1991).	1	2011	Moderate	Only one recent record. It may be present in moist areas throughout the area.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
PMST		V U	Vu	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Eastern coastal Australia from Gladstone in Qld to South Gippsland and Melbourne in Vic, with rare influxes further west and south. Rarely more than 200km inland. In warmer months gathers in very large camps, usually in dense forest in gullies. Population is more dispersed in winter. Size of camps fluctuate in response to local food supplies. In south numbers fluctuate in regular pattern, being highest in late summer-autumn and lowest in winter (Menkhorst and Knight 2001).	-	NA	Low-Moderate	No records and they are quite conspicuous. They may forage over the area but unlikely to roost within the Investigation Area.
VBA	B			<i>Rhipidura rufifrons</i>	Rufous Fantail	In Victoria, the Rufous Fantail mainly inhabits the undergrowth of temperate rainforests, and wetter eucalypt forests and gullies, but also occurs in paperbark thickets, sub-inland/coastal scrub, along watercourses and within parks/gardens. On migration it is seen at a wide range of locations from farmland to built up streets (Pizzey and Knight 2007).	3	2004	Low-Moderate	Some older records from Creswick Regional Park/State Forest. This species is less likely to use vegetation within the investigation areas. Although they may transiently occur along vegetated areas of Creswick creek when migrating.
VBA, PMST	C	EN	Cr	<i>Rostratula australis</i>	Australian Painted Snipe	Generally uncommon in Australia and scattered records in Victoria. Uses terrestrial shallow freshwater (occasionally brackish) wetlands, ephemeral and permanent lakes, swamps, claypans, inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire, often with scattered clumps lignum, canegrass or tea-tree (Marchant and Higgins 1993).	1	2009	Low-Moderate	Only one older record from Treatment ponds along Creswick Ck. This is around the end of the Millenium Drought and the ponds may have provided a reliable water source at this time. It may transiently use dams, sewerage ponds, lakes and other water bodies in the area.

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
VBA			Vu	<i>Spatula rhynchotis</i>	Australasian Shoveler	The Australasian Shoveler occurs mainly on large, well-vegetated wetlands and lakes, occasionally including areas with saline waters. Populations are found in higher numbers on permanent, well-vegetated freshwater swamps with areas of open water. This species nests in grass nests on the ground, usually in dense cover and near water (Marchant and Higgins 1990, Pizzey and Knight 2007).	3	2009	Moderate	Three records including a 2009 record from the Sewerage ponds along Creswick Ck. It's noted that 2009 was towards the end of the Millennium drought and the sewerage pond may have offered a reliable source of water at this time. This species tends to prefer larger water bodies and lakes. It could possibly use the sewerage ponds along Creswick Ck transiently, when filled and the larger wetland within Investigation Area 2b off McMillan Rd.
VBA, PMST	V U		Vu	<i>Synemon plana</i>	Golden Sun Moth	It is generally found in temperate grasslands and open grassy woodlands where the ground layer is dominated by native Wallaby Grass. Optimal habitat is dominated by wallaby grasses <i>Austrodanthonia spp</i> with an open tussock structure. It has also been recorded in grasslands dominated by Kangaroo Grass <i>Themeda triandra</i> and exotic dominated grasslands (i.e. Chilean Needlegrass)(O'Dwyer and Attiwill 2000).	6	9/12/2020	Present	There are many recent records and Council survey data, especially within Grassland areas in Investigation Areas 3a, 2a and 2b. See Section 3.4.4

Source	Treaty	EPBC	FFG	Scientific name	Common name	Habitat/species notes	No. records	Last record	Likelihood of occurrence	Likelihood Reasoning
**			En	<i>Trapezites luteus luteus</i>	Yellow Ochre	<p>Grassland species. One or two pale eggs are laid on the upper side of leaves near the base of the host plant. Host plants include species of <i>Lomandra</i> species (Mat Rushes) such as <i>L. confertifolia</i>, <i>L. densiflora</i> (Soft Tussock, Mat-rush), <i>L. filiformis</i> (Wattle Mat Rush), <i>L. longifolia</i> (Spiny-head Mat-rush), and <i>L. multiflora</i>.</p> <p>On the mainland adults fly in spring, and sometimes in late summer and autumn. In Tasmania they appear from October to March. It is seen in open woodland and grassland supporting its food plants.</p> <p>References: http://lepidoptera.butterflyhouse.com.au/hesp/luteus.html</p>	<i>Trapezites luteus</i> was observed by Hepburn Shire's Biodiversity Officer, Brian Bainbridge, within the Alfred St Pine Plantation Fire break in November 2020.		Moderate	<p>This species could occur in areas of Heathy Dry Forest, Hillside Herb-rich Woodland and Grassy Dry Forest, and grasslands derived from these. Their host plants such as Wattle Mar-tush <i>Lomandra filiformis</i> subsp. <i>coriacea</i> and subsp. <i>filiformis</i> and Spiny-headed Mat-rush <i>Lomandra longifolia</i> were observed in these ecological vegetation communities.</p>

** Brian Bainbridge pers. comm. 25.08.2022

Appendix 5. Growling Grass Frog survey report by Ray Draper, 2012

Starts on the next page

**Growling Grassfrog Distribution in the
Creswick and Clunes area plus breeding season
and froglet dispersal.**

**Prepared for:
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**Consultant
Ray Draper**

August

2012

Growling Grassfrog Distribution in the Creswick and Clunes area plus breeding season and froglet dispersal.



Photo by Ray Draper

Legal Status

The current conservation status of the Growling Grass Frog, *Litoria raniformis*, under Australian and State/Territory Government legislation, is as follows:

National: Listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*

Tasmania : Listed as Vulnerable under the *Threatened Species Protection Act 1992*

Victoria : Listed as Threatened under the *Flora and Fauna Guarantee Act 1988*

New South Wales : Listed as Endangered under the *Threatened Species Conservation Act 1999*

Taxonomy

Scientific name: *Litoria raniformis* (Keferstein 1867)

Common name: Growling Grass Frog

Other common names: Southern Bell Frog, Green and Golden Frog, Warty Frog, Warty Bell Frog, Green or Warty Swamp Frog



Photo by Ray Draper

Description

The Growling Grass Frog can reach up to 104 mm in length, with females usually larger (60-104 mm) than males (55-65mm). The Growling Grass Frog colour pattern is generally olive to bright emerald green, with irregular gold, brown, black or bronze spotting. Their backs are warty and usually have a pale green mid-dorsal stripe. The eardrum is pronounced. A cream or yellow stripe underlined by a dark brown stripe runs from the nostril, through the eye, above the inner ear and down the sides of the body to the groin as a dorso-lateral fold. On their bellies, Growling Grass Frogs are white and coarsely granular. During the breeding season males may become yellow or dark grey/black under the throat. The groin and posterior of the thighs are turquoise blue..

Habitat

Growling Grass Frogs are found mostly amongst emergent vegetation including *Typha sp.*, *Phragmites sp.* and *Eleocharis sp.* in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes and ponds they can also inhabit agricultural lands so long as permanent and non-permanent water sites are available with dense emergent or fringing vegetation.

Submerged vegetation is important habitat for breeding success as it provides egg-laying sites, calling stages for males, and food and shelter for tadpoles. Grassland provides habitat for foraging, dispersal and shelter, and may also provide overwintering sites for Growling Grass Frogs

The Growling Grass Frog can be found floating in warmer waters in temperatures between 18–25°C. Growling Grass Frogs are active during both day and night throughout the warmer months and can be seen basking out of water amongst vegetation or on rocks and logs. The Growling Grass Frog is frequently found basking on grassy banks near water. Its behaviour during winter is not well known, although it is speculated that it hibernates in warm, moist areas such as under logs, rocks and debris but it has been found in Yabby holes.

Breeding Habitat

The Growling Grass Frog is dependent upon permanent and ephemeral freshwater for breeding. The ideal breeding habitat is the shallow part of wetlands, farm dams lagoons and slow moving streams (up to approximately 1.5 m) where there is vegetation communities dominated by emergent plants such as water ribbons (*Triglochin*) and spikerush (*Eleocharis*) and submerged plants such as water milfoil (*Myriophyllum*), marsh-flower (*Villarsia*), and pondweed (*Potamogeton*). However, other plant communities can form equally suitable habitat

In both the Creswick and Clunes area preferred breeding habitat is still water with emergent and submerged vegetation.

Life Cycle

The minimum age at which females are known to first reproduce is 2-3 years.

Growling Grass Frogs generally breed between September and January, depending on temperature, rain triggers calling in breeding males. Breeding usually occurs in still or slow moving water. and vegetation composition is a significant determinant of breeding habitat quality with extensive growth of either emergent or submergent vegetation.

Females have been recorded laying up to almost 4000 eggs. Eggs are contained within a floating jelly mass that eventually breaks up and sinks after 12 hours. Egg-laying occurs and tadpoles hatch 2-4 days later. Metamorphosis of tadpoles generally takes around 3 months but may take up to 12 months in some circumstances such as long periods of cold weather.

Outside the breeding season adult animals will disperse away from the water, Froglets will stay in the vicinity until the cooler weather arrives then they will disperse.

Growling Grass Frogs have been known to travel up to 2km from water.

Disease

Chytrid fungus, a water-borne pathogen responsible for the Chytridiomycosis (an infectious disease which affects amphibians worldwide), is widespread in frog populations in eastern Australia and has recently been detected in the Growling Grass Frog and the closely related Green and Golden Bell Frog (Berger et al. 1999). Chytridiomycosis disease is believed to be a significant cause of death in some frog species in recent years and is also found in a small proportion of apparently healthy frogs and tadpoles (Berger et al. 1999).

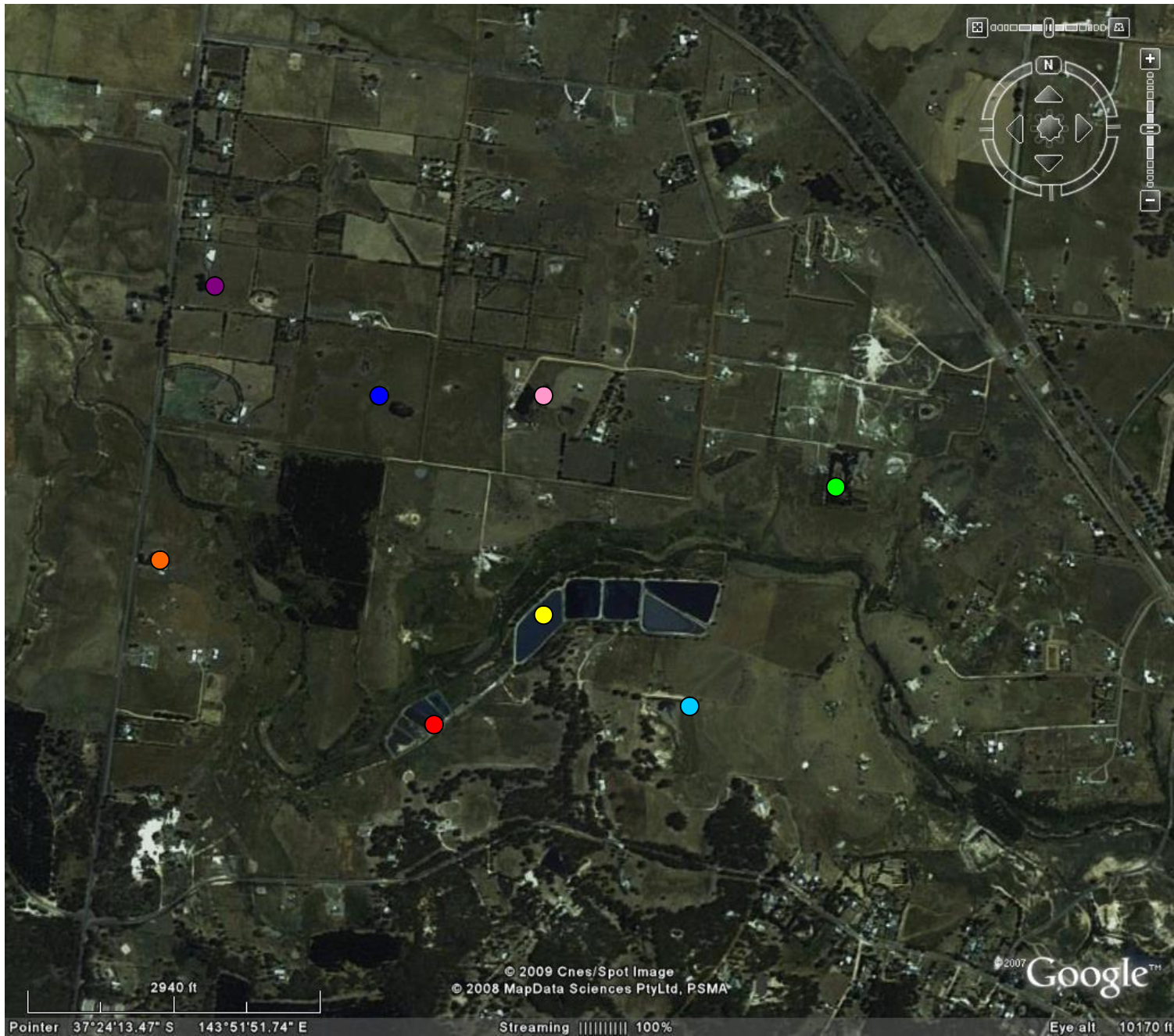
Chytridiomycosis has been recorded in four regions of Australia, namely the east coast, south-west Western Australia, Adelaide, and more recently Tasmania. This highly virulent fungal pathogen of amphibians is capable at the minimum of causing sporadic deaths in some populations, and 100 per cent mortality in other populations (DEH 2006a). Staff and or contractors need to carry out field hygiene when working on site to ensure that Chytrid Fungus spores do not infect the site or bring in spores from other areas.

The most affective method is foot baths with F10 for workers boots and to spray equipment and under vehicles coming onto and leaving the site.

I have been researching the Growling Grass Frogs in western Victoria for the last 35 years. While living in the Creswick area for 30 of those years, I have been monitoring the populations of Creswick and surrounding areas.

The data that follows refers to the average number of calling males at the various sites over this period. The number of males calling at each site remains static over the years, and these figures are an average of many years of sightings.

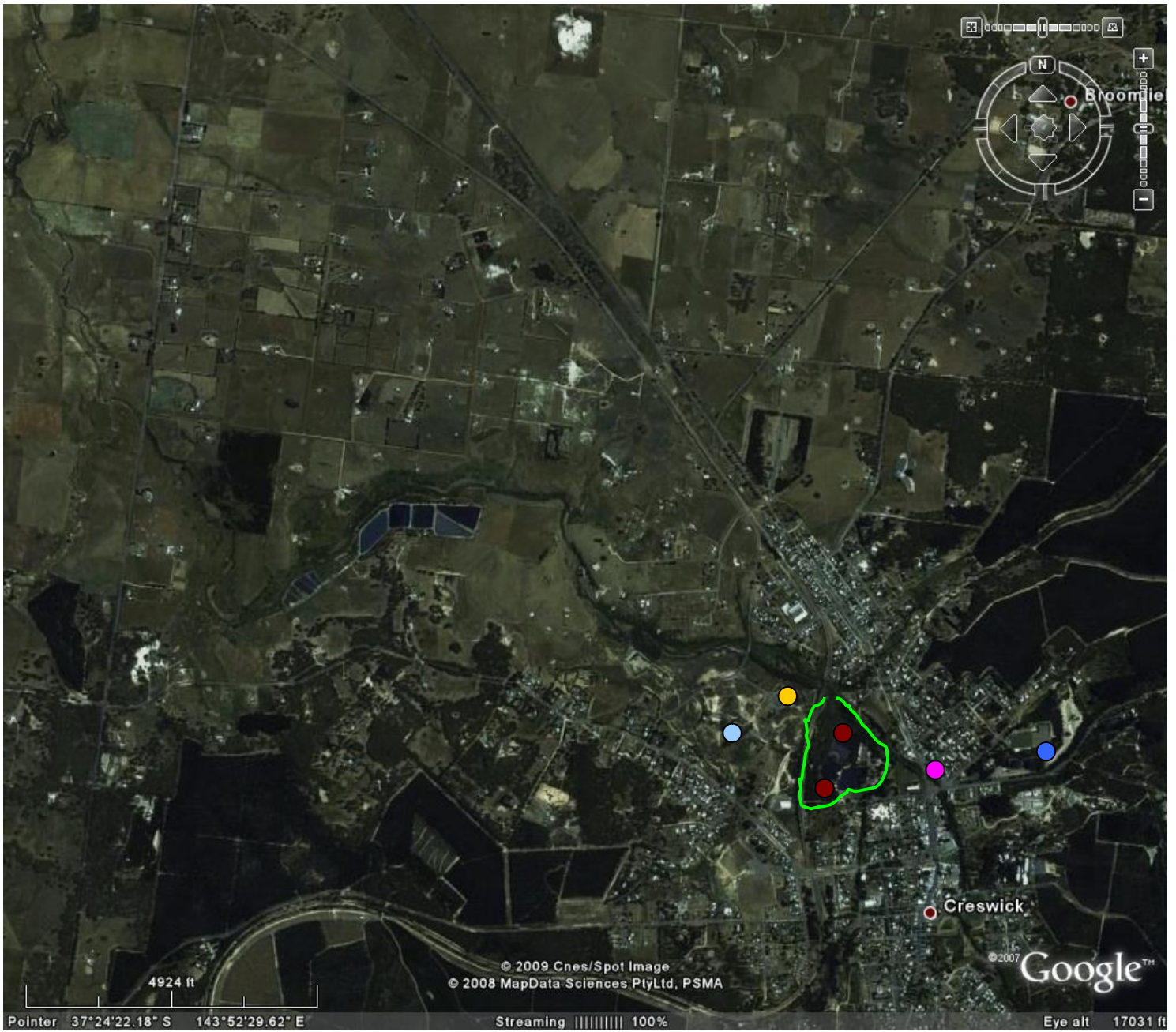
GGF sites at Creswick Data Ray Draper



- 5 Calling Males (CM)
- 3 CM
- 15 CM
- 5 CM
- 3 CM
- 5 CM
- 5 CM
- 3 CM
- 3 CM

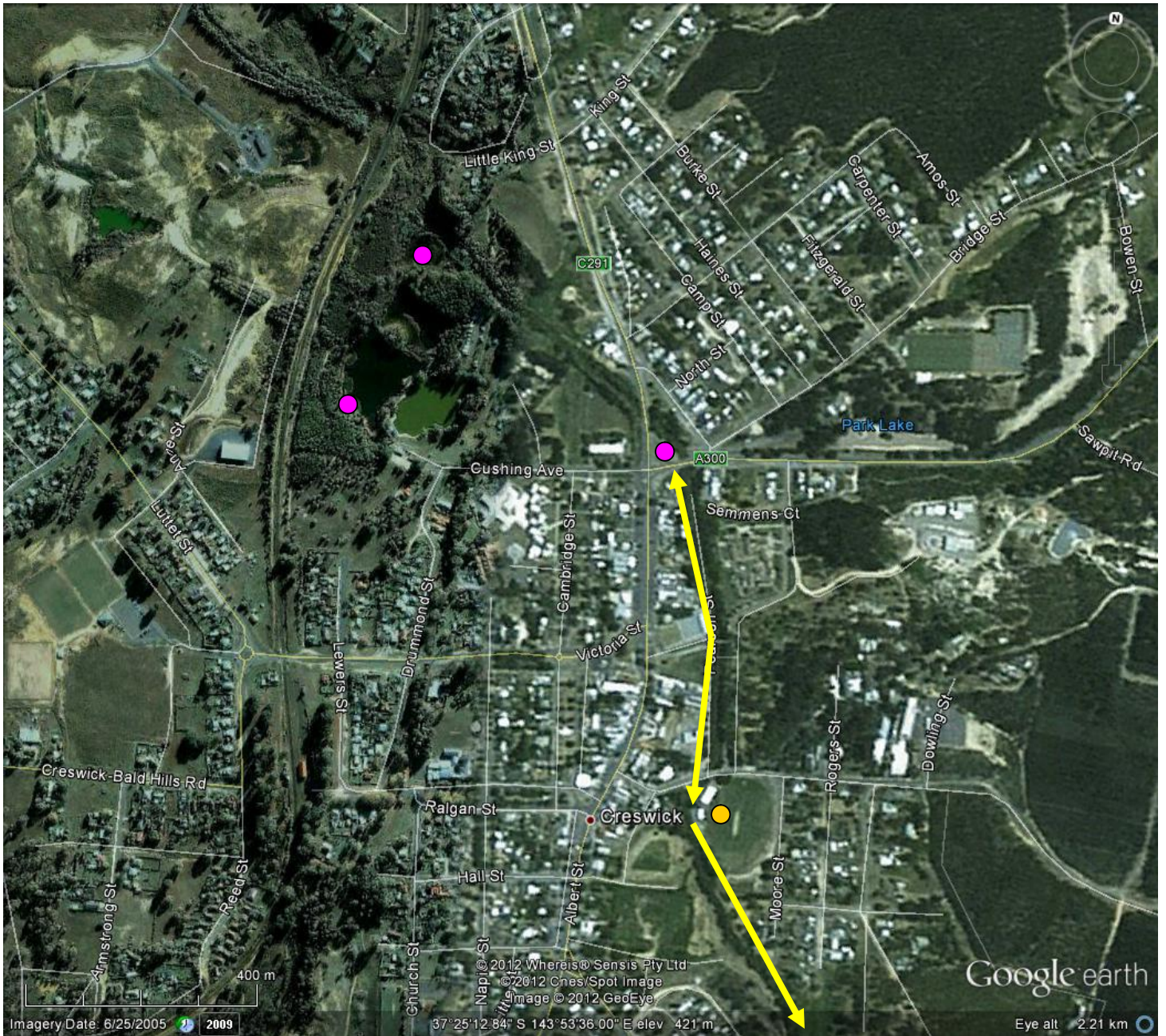


- 3 CM
- 2 CM
- 4 CM
- 2 CM



- 3 CM
- 10 CM
- 4 CM
- 4 CM
- 8 CM

Calembreen Park

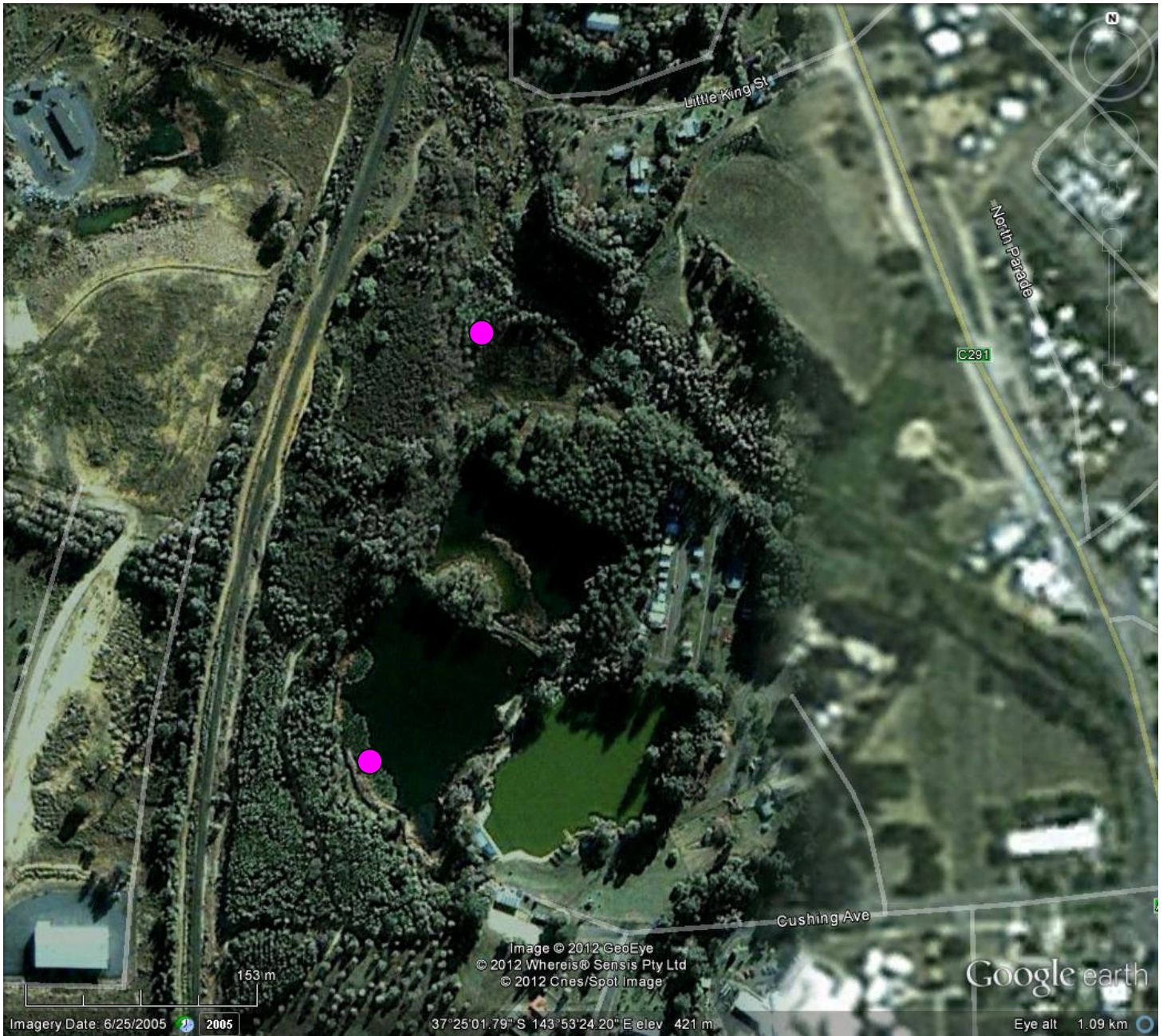


● Growling Grassfrog site

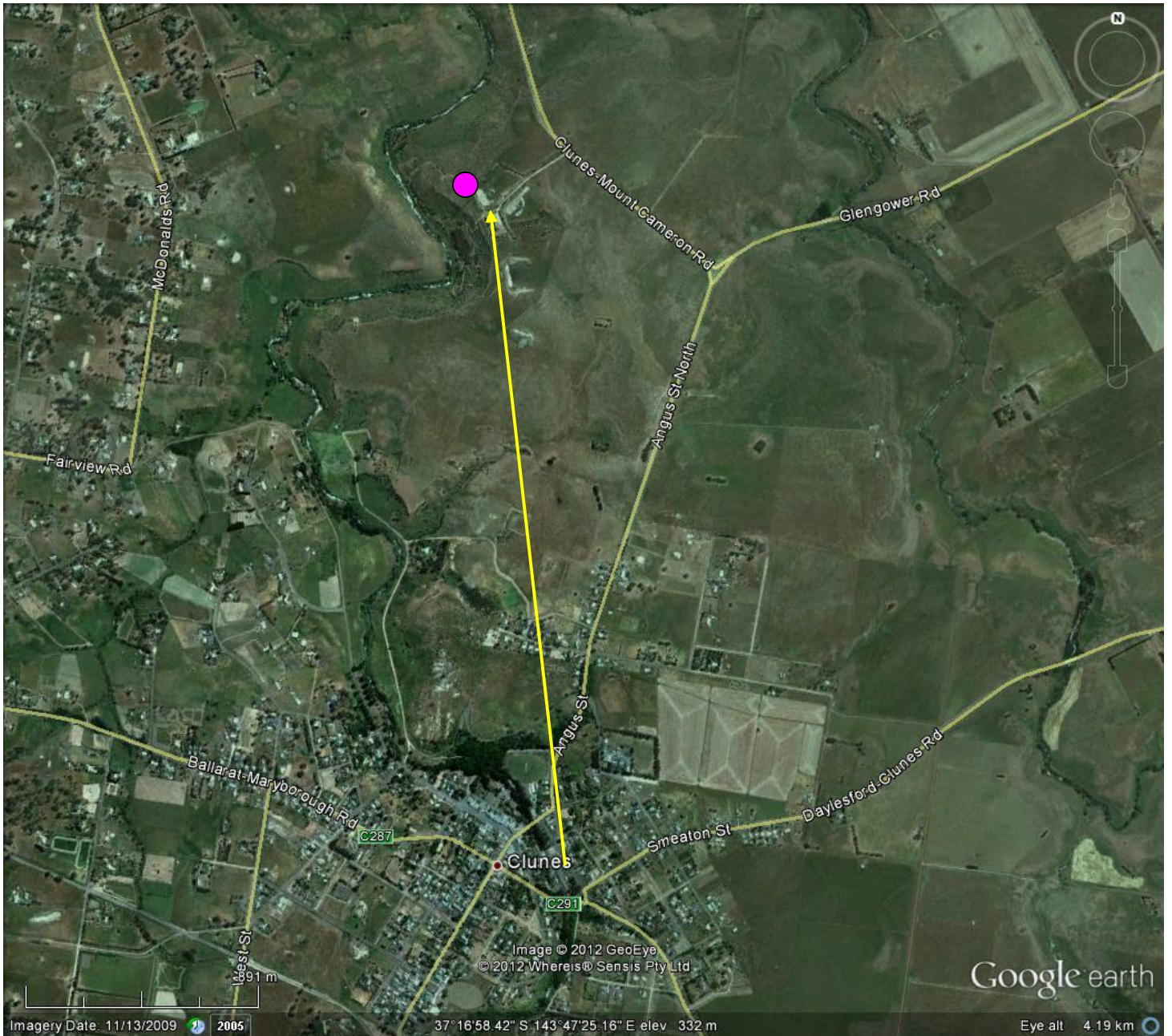
● Hammon Park

No Growling Grassfrogs or their habitat have been found between Hammon Park and the park on the corner of Castlemaine Road and from Hammon Park to St Georges Lake in the south in the 35 years that I have been monitoring for this species.

All the Growling Grass Frog sites have over the years been added by me to the Atlas of Victorian Wildlife, (DSE Biodiversity Database).



Calmben Park, Growling Grassfrog positive sites.



The closest Growling Grassfrog site to the Clunes bowling club is 2.5Km as the crow flies.

● Growling Grassfrog site

Disturbance to Growling Grass Frogs during their breeding season will disrupt their breeding. Tadpoles develop at a rate dependant in the ambient and water temperature.

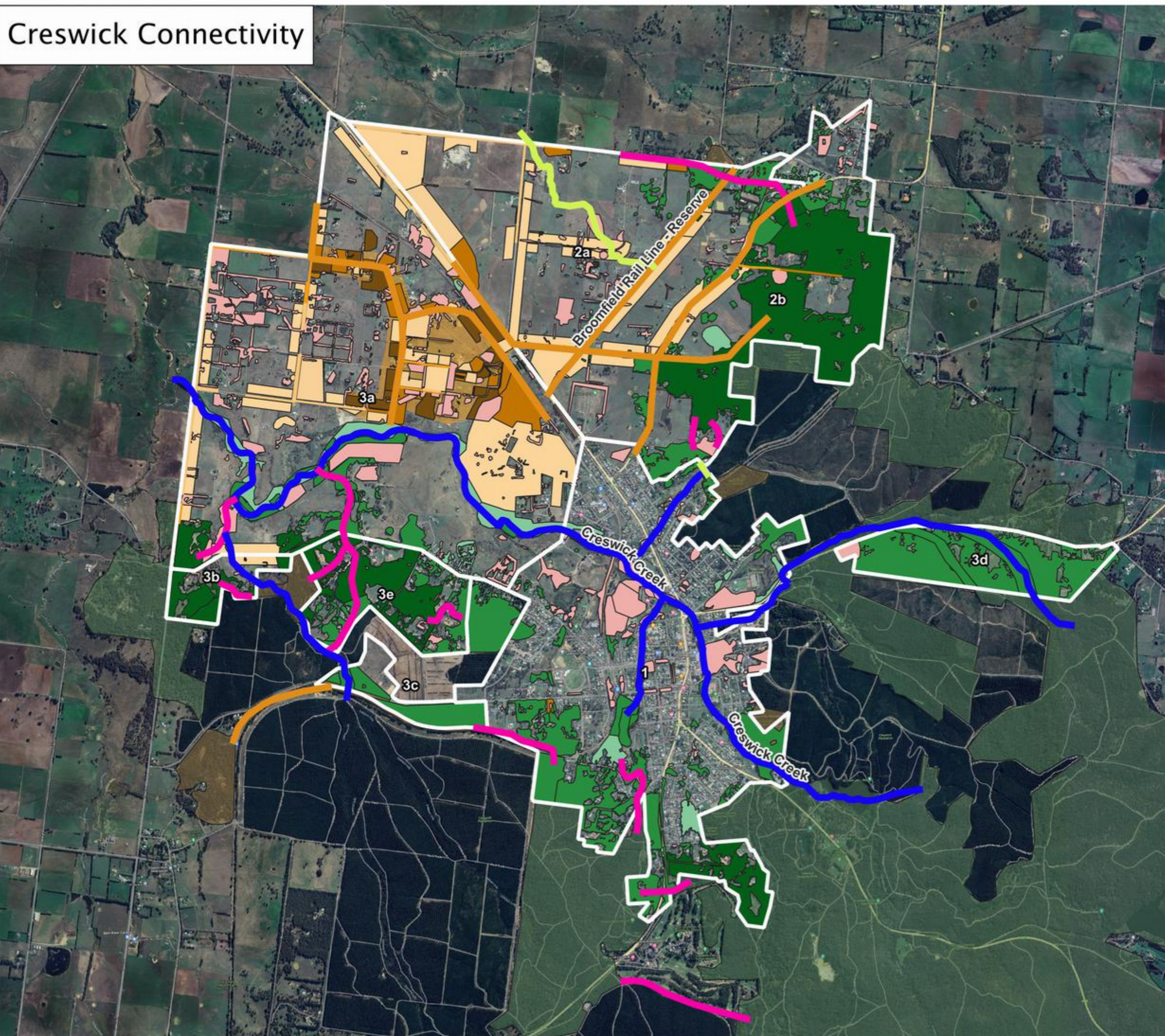
Normally Froglets of the Growling Grass Frog emerge from the water around February to March and then disperse.

I can see no reason why works on waterways in the Hammon Park and Clunes Bowling Club areas could not go ahead at the beginning of March as there is a lack of Growling Grass Frogs and their habitat in those areas.

The Calemben Park area would need to be assessed for tadpoles before works on waterways could commence.

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Creswick Connectivity



- Corridors**
- █ Creek Corridor
 - █ Land Corridor
 - █ Road Corridor
 - █ Potential Corridor
- Core and Nodes**
- █ Treed Core Area
 - █ Treed Node Area
 - █ Grassland Core Area
- Grassland EVCs - Quality**
- █ HQ
 - █ MQ
 - █ LQ
- Treed EVCs - Quality**
- █ HQ
 - █ MQ
 - █ LQ
 - █ Mixed Patch
- Roadside_Grassland - Quality**
- █ HQ
 - █ MQ
 - █ LQ

Details

Date: 02 November 2023
 Created by: Kallista Sears
 Aerial Photography from Google Satellite
 Base map data Copyright State of Victoria



(Page size A3)

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