

Final Report

Flora and Fauna Assessment, Deans Creek and Barongarook Creek, Colac, Victoria

Prepared for

Colac Otway Shire

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SUMMARY

Introduction

Ecology and Heritage Partners Pty Ltd was commissioned by Colac Otway Shire to conduct a Flora and Fauna Assessment of four Special Investigation Areas and the broader Deans Creek and Barongarook Creek riparian zones within the Colac township and surrounding areas. The purpose of the assessment was to get an understanding of the ecological values present within the investigation areas and riparian zones to inform future development and enable appropriate management to ensure ecological values are maintained and enhanced as part of any strategic planning in the region.

Methods

A field assessment was undertaken on 1 to 3 December 2015, including rapid targeted surveys for Growling Grass Frog, to obtain information on terrestrial flora and fauna values within the Special Investigations Areas and the lower reaches of the Deans Creek and Barongarook Creek.

Results

Flora and Fauna

No significant flora species were recorded during the site assessment; however, there is potentially suitable habitat for flora species of State conservation significance along Deans and Barongarook Creeks.

Two regional significant fauna species, Whiskered Tern *Chlidonias hybrida* and Latham's Snipe *Gallinago hardwickii*, were observed during the assessment. There is potentially suitable habitat within the study area for further significant fauna species of national, state and regional conservation significance within all Special Investigation Areas and Deans and Barongarook Creeks.

Communities

One nationally listed ecological community was recorded within the study area, *Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains*, within the Lake Colac Bird Reserve.

Legislative and Policy Implications

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

One ecological community listed under the EPBC Act (*Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains*) was recorded within the study area within the Lake Colac Bird Reserve. Deans and Barongarook Creek and the Special Investigation Areas also provide potential habitat for Yarra Pygmy Perch, Dwarf Galaxias and Growling Grass Frog listed under the EPBC Act. Accordingly, there may be a requirement for further targeted surveys to inform the requirement for an EPBC Act referral to be submitted to the Commonwealth Environment Minister should these matters of National Environmental Significance be significantly impacted as part of future improvements within Deans Creek, Barongarook Creek and any Special Investigation Area.

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

There is suitable habitat within the study area for several species listed or protected under the FFG Act (daisies, wattles, heaths). A permit under the FFG Act will be required for removal of protected species or communities within public land i.e. roadsides. A permit under the FFG Act may also be required should the salvage/ translocation of fish species be required. The Responsible Authority may consider flora, fauna and communities listed under the FFG Act when making decisions regarding the use and development of the land.

Any development within the study area should also consider the following threatening processes, listed under the FFG Act:

- Alteration to the natural flow regimes of rivers and streams.
- Degradation of native riparian vegetation along Victorian rivers and streams.
- Habitat fragmentation as a threatening process for fauna in Victoria.
- Increase in sediment input into Victorian rivers and streams due to human activities.
- Input of toxic substances into Victorian rivers and streams.
- Wetland loss and degradation as a result of change in water regime, dredging, draining, filling and grazing.

Planning and Environment Act 1987

The Colac Otway Shire Council Planning scheme provides mechanisms for the protection of native vegetation and waterways.

Under Clause 52.17 of the Planning Schemes, a Planning Permit is required to remove, destroy or lop any native vegetation within the study area. As wetlands can be difficult to assess in all seasons, the Department of Environment, Land Water and Planning have developed predictive mapping of all Current Wetlands. Current Wetlands are mapped within the study area, including within Irrewarra Special Investigation Area and within the floodway of Deans and Barongarook Creeks. Any works within a Current Wetland also requires a planning permit, regardless of whether native vegetation is present at the time of assessment or not, and whether the wetland was artificially created or natural. Areas of planted indigenous species may also require a planning permit for their removal, as they are likely to have been planted for environmental purposes and are likely to have been publicly funded (ie. the exception within Clause 52.17-17 [planted vegetation] is not likely to be applicable).

Department of Environment, Land Water and Planning's *Permitted Clearing of Native Vegetation: Biodiversity Assessment Guidelines* provides a framework for assessing vegetation and permits to remove vegetation. To assist with the assessment process, the Department of Environment, Land Water and Planning have undertaken mapping of location risk. The study area falls into Location Risk A. As such, a permit to remove native vegetation may fall under the Low or Moderate Risk-based Pathways, dependant on the extent of removal. Applications under a Moderate Risk-based pathway require a statement of how impacts to biodiversity have been minimised, and may require Specific Offsets for threatened species.

In addition to the requirements under Clause 52.17 and the *Permitted Clearing of Native Vegetation: Biodiversity Assessment Guidelines*, Council has implemented its own planning controls, such as the Environmental Significance Overlay – Schedule 2 which provides specific protections for waterways. Any

development within the study covered by an ESO2 area must also consider the decision guidelines of the planning overlay

Recommendations

In order to maintain and improve ecological values within the study area through the development processes, the following recommendations should be considered as part of any future works surrounding the Colac township:

- Opportunities should be investigated to protect remnant vegetation patches of higher conservation value through planning controls (e.g. Environmental Significance Overlays/Vegetation Protection Overlays); these areas include:
 - Riparian vegetation;
 - Riparian and aquatic habitats within Deans Creek and Barongarook Creek (and Lake Colac Bird Reserve); this includes degraded areas containing little to no native vegetation. These aquatic habitats (even degraded areas) provide important dispersal, foraging and breeding habitat for locally common and significant fish, frog and bird species.

Opportunities should also be investigated to enhance waterways, including degraded areas, through planning controls relating to future development. For example through a Development Plan Overlay requiring a masterplan upon applications for a subdivision, which considers retention and enhancement of biodiversity values, and a rehabilitation plan, requiring revegetation within degraded riparian environments. Through these controls, future development has the opportunity to increase connectivity throughout the broader environment and increase biodiversity values within the study area.

- Detailed ecological assessments will be required within the Special Investigation Areas to further inform the implications of future development in regards to the Guidelines (DEPI 2013a).
- Detailed habitat assessments and/or targeted surveys are recommended to further inform the likelihood of the species being present and implication under the EPBC Act prior to any works within the vicinity of the creeks or artificial waterbodies which are likely to have a significant impact on Yarra Pygmy Perch, Dwarf Galaxias or Growling Grass Frog.
- It is recommended that any future maintenance or revegetation works within Deans Creek and Barongarook Creek considers the findings outlined by Heard et al. (2010 and 2014) for the future treatment and/or the creation of Growling Grass Frog habitat(s).

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1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was commissioned by Colac Otway Shire to conduct a Flora and Fauna Assessment of four Special Investigation Areas and the broader Deans Creek and Barongarook Creek riparian zones within the Colac township and surrounding areas. The purpose of the assessment was to get an understanding of the ecological values present within the investigation areas and riparian zones to inform future development and enable appropriate management to ensure ecological values are maintained and enhanced as part of any strategic planning in the region. This report presents the results of the assessment and discusses the potential ecological and legislative implications associated with the future development of the area.

1.2 Scope and Objectives

The objectives of the flora and fauna assessment were to:

- Review the relevant flora and fauna databases and available literature;
- Conduct a site assessment to identify flora and fauna values within the study area;
- Conduct broad targeted surveys for Growling Grass Frog *Litoria raniformis*;
- Provide maps showing any areas of remnant native vegetation and locations of any significant flora and fauna species, and/or fauna habitat (if present);
- Classify any flora and fauna species and vegetation communities identified or considered likely to occur within the study area in accordance with Commonwealth and State legislation;
- Document relevant environmental legislation and policy; and
- Document any opportunities and constraints associated with future development of the area.

1.3 Study Area

The study area includes Deans and Barongarook Creeks and four Special Investigation Areas, located in the surrounding region of Colac, Victoria; the investigation areas being (Figure 1):

- Irrewarra;
- Colac West;
- Forest Street; and
- Elliminyt.

Site assessments were restricted to the lower reaches of Deans and Barongarook Creeks and the four Special Investigation Areas. Assessments of the upper reaches of the creeks were restricted to desktop analysis.

According to the DELWP Native Vegetation Information Management Tool (DELWP 2015a), the study area occurs within the Victorian Volcanic Plain, Warrnambool Plain and Otway Plain bioregion (Figure 1). It is located within the jurisdiction of the Corangamite Catchment Management Authority (CMA) and the Colac Otway Shire municipality. Section 4.3.1 discusses zoning and overlays relevant to the study area.

2 METHODS

2.1 Desktop Assessment

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

- The Victorian Department of Environment, Land, Water and Planning (DELWP) Native Vegetation Information Management (NVIM) Tool (DELWP 2015a) for:
 - Modelled data for location risk, remnant vegetation patches, scattered trees and habitat for rare or threatened species; and,
 - The extent of historic and current EVCs.
- The VBA (DELWP 2015d), Flora Information System (FIS) (Viridans 2013a) and Atlas of Victorian Wildlife (AVW) (Viridans 2013b) for previously documented flora and fauna records within the project locality;
- The Federal Department of Environment (DoE) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DoE 2015);
- *Significant Impact Guidelines for the Vulnerable Growling Grass Frog (Litoria raniformis) EPBC Act Policy Statement 3.14* (DEWHA 2009);
- Guidelines for Managing the Endangered Growling Grass Frog in Urbanising Landscapes (Heard et al. 2010);
- Wetland Characteristics Influence Disease Risk for a Threatened Amphibian (Heard et al. 2014);
- The online resource Planning Maps Online to ascertain current zoning and environmental overlays (DELWP 2015f);
- Aerial photography of the study area;
- Relevant environmental legislation and policies; and
- Previous ecological assessments within the study area.

2.2 Site Assessment

A site assessment was undertaken between 1-3 December 2015 to obtain information on flora and fauna values within the study area. The special investigation areas and lower reaches of the creeks were assessed adjoining road reserves and public land, with all observed flora and fauna species recorded, any significant records mapped and the overall condition of vegetation and habitats noted. Ecological Vegetation Classes (EVCs) were determined with reference to DELWP pre-1750 and extant EVC mapping and their published descriptions (DELWP 2015b). All photos were taken during the field assessment (Plates 1-29).

Where remnant vegetation was identified, a quality assessment was undertaken to broadly classify the vegetation into categories of high, moderate or poor. Vegetation quality was defined with reference to the following criteria:

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

A habitat hectare assessment of remnant vegetation identified with the study areas was not undertaken as part of this assessment.

2.2.1 Targeted Growling Grass Frog Surveys

Targeted surveys for Growling Grass Frog were completed between 1-3 December 2015 with nocturnal surveys completed on 1 and 2 of December 2015 within the study area (Figure 4a-e).

A Zoologist experienced in amphibian surveys, including significant species such as the Growling Grass Frog, conducted nocturnal surveys during warm (over 15°C) conditions. Call playback was undertaken at 9-10 locations along each creek, including minor tributaries and drainage lines, traversing any public accessible roads within the study area. The margins of creeklines and drainage lines were carefully searched for active frogs using 30 watt 12 volt hand-held spotlights. Where further access was available (i.e. public footpaths along Barongarook Creek), additional sections of creekline were assessed using call playback and spotlighting methods. The advertisement call was broadcast during call playback to elicit a response from any adult males present. Suitable refuge sites such as logs, rocks and other ground debris were lifted opportunistically to locate inactive frogs where it was safe to do so.

A known reference site was visited along the Princes Highway (near Birregurra Road) prior to the commencement of each nocturnal survey. A male Growling Grass Frog was heard responding to call playback on both occasions the reference site was visited.

Given the limitations of access within the study area, broad habitat assessments were undertaken concurrently with the targeted surveys to further assess the suitability of habitats. The following attributes of habitat quality for the Growling Grass Frog were recorded:

- Habitat values at each site including the type (e.g. dam, creek etc.) flow (still, slow rapid), depth and presence of terrestrial refuge sites (e.g. rocks, logs, debris);
- Dominant vegetation cover (% cover of emergent, submergent and floating aquatic plants);
- Presence/ absence of predator fish (opportunistic); and
- Barriers to frog movement between waterbodies.

Habitat quality was defined with reference to the following criteria:

- **High quality habitat:** Areas that currently contain, or have a high likelihood to contain important habitat attributes required by the species for breeding as well as foraging and dispersal (e.g. permanent or semi-permanent, extensive aquatic vegetation, high water quality, connected to other occupied sites, absence or low densities of predatory fish, high cover of terrestrial refuge sites).
- **Moderate quality habitat:** Habitat that supports one or more key habitat characteristics outlined above, but not all (for example site may be important for dispersal or foraging but not breeding).
- **Low quality habitat:** Sites unlikely to be used by Growling Grass Frogs for breeding and a low likelihood for dispersal due to one or more of the following; absence or high cover of emergent in-stream vegetation, poor water quality, presence of predatory fish, lack or low cover of terrestrial refuge sites.
- **Degraded:** Areas consisting of open pasture have generally been cleared from previous landuse activities and are highly modified areas dominated by exotic vegetation (i.e. open pasture) in poor condition.

2.3 Assessment Qualifications and Limitations

Data and information held within the ecological databases and mapping programs reviewed in the desktop assessment (e.g. VBA, PMST, Biodiversity Interactive Maps etc.) are unlikely to represent all flora and fauna observations within, and surrounding, the study area. It is therefore important to acknowledge that a lack of documented records does not necessarily indicate that a species or community is absent.

Surveys were conducted from accessible public land; private land was assessed from the nearest accessible location. Vegetation and habitat quality was determined from accessible land and extrapolated across broader areas of similar habitat identified on site and by aerial photography interpretation.

Ecological values identified on site were recorded using a hand-held tablet using a combination of aerial photography and visual assessment with an accuracy of +/-5 metres. This level of accuracy is considered adequate to provide an accurate assessment of the ecological values present within the study area; however this data should not be used for detailed surveying purposes.

Access was restricted to public land and therefore vegetation mapping private land was indicative only. However, it was determined that additional access to private property would not have provided significant improvements to data accuracy, particularly within the Special Investigation Areas. The 'snap shot' nature of the assessment, meant that migratory, transitory or uncommon fauna species may have been absent from typically occupied habitats at the time of the site assessment. In addition, annual or cryptic flora species such as those that persist via underground tubers may also be absent. Nevertheless, the terrestrial flora and fauna data collected during the field assessment and information obtained from relevant desktop sources is considered adequate to provide an accurate assessment of the ecological values present within the study area for the purposes of broad scale opportunities and constraints mapping for future development.

2.3.1 Growling Grass Frog

Given the rapid survey approach for Growling Grass Frog within the study area, not all potential areas of habitat, such as artificial waterbodies on private property, could be surveyed in detail. The survey effort focused primarily at waterways and drainage lines which traversed public roads within the study area. This

assessment is therefore limited to what could be visually assessed or heard from roadsides and the results of the desktop assessment. Nevertheless, the terrestrial habitat data collected during the field assessment and information obtained from relevant desktop sources is considered adequate to provide an accurate assessment of the likelihood of Growling Grass Frog occurring within the study area for the purposes of broad scale opportunities and constraints mapping for future development.

3 RESULTS

3.1 Deans Creek

3.1.1 Vegetation condition

3.1.1.1 Desktop assessment

According to DELWP's pre-1750 EVC map (DELWP 2015b), the riparian zone of Deans Creek was likely to previously support predominantly Swamp Scrub (EVC 53) within the lower reaches, and Riparian Forest (EVC 18) integrating into Herb-rich Foothill Forest (EVC 23) within the upper reaches (Figure 2a).

Based on predictive mapping and aerial photography interpretation, Deans Creek is likely to support narrow, fragmented patches of these EVCs, primarily within the upper reaches of the creek (DELWP 2015b; Figure 2b).

3.1.1.2 Field assessment

Remnant vegetation patches in **poor-moderate condition** were recorded along Deans Creek, attributed to Swamp Scrub and Riparian Forest EVCs (Figure 4a,b). Both EVCs were similar in species composition and were attributed to each EVC based on landscape context. Species composition of vegetation patches in poor condition was typically restricted to Narrow-leaf Cumbungi *Typha domingensis* and/or Common Reed *Phragmites australis* (Plate 1). Vegetation patches in moderate condition contained these understorey species in addition to Blackwood *Acacia melanoxylon* and/or Manna Gum *Eucalyptus viminalis* (Plate 2). Scattered native species present along the length of the creek also included Water Ribbons *Triglochin procerum*, Common Tussock-grass *Poa labillardierei* and Small-leaf Bramble *Rubus parviflorus*. Ten scattered Manna Gums were also recorded within the area surveyed along Deans Creek.

Planted indigenous trees and shrubs were present along large sections of the creek, which included Manna Gum, Drooping Sheoak *Allocasuarina verticillata*, Black Wattle *Acacia mearnsii*, Blackwood and Woolly Tea-tree *Leptospermum lanigerum* (Figure 4a,b). It is likely that many of the plantings were publicly funded for environmental purposes.

A high diversity and cover of high threat weed species were present along the creek, including, Drain Flat-sedge *Cyperus eragrostis*, Field Bindweed *Convolvulus arvensis*, Hawthorn *Crataegus monogyna*, Willow *Salix* spp., Radiata Pine *Pinus radiata*, Blackberry *Rubus fruticosus* sp. agg., Spiny-rush *Juncus acutus*, Fennel *Foeniculum vulgare*, Gorse *Ulex europaeus* and Spear Thistle *Cirsium vulgare*.



Plate 1. Swamp Scrub along Deans Creek in poor condition. Deans Creek crossing Deans Creek Road (north of railway)



Plate 2. Riparian Scrub along Deans Creek in moderate condition (Colac West Investigation Area)



Plate 3. Planted indigenous vegetation along Deans Creek

3.1.2 Fauna Habitat

Deans Creek provides **low** to **moderate** quality habitat to native fauna including birds, arboreal and terrestrial mammals, micro-bats, frogs and reptiles throughout areas of woodland, planted vegetation and modified pastures containing tributaries of the creek line (Plates 1 – 8). Australian Magpie *Cracticus tibicen*, Grey Shrike-thrush *Colluricincla harmonica*, Willie Wagtail *Rhipidura leucophrys*, Grey Fantail *Rhipidura albiscarpa*, Superb Fairy-wren *Malurus cyaneus*, Grey Butcherbird *Cracticus torquatus* and introduced species Common Myna *Acridotheres tristis* were all observed using this habitat during the assessment.

Common Brushtail Possum *Trichosurus vulpecula* and Common Ringtail Possum *Pseudocheirus peregrinus* may also use woodland and planted vegetation for foraging or potential breeding habitat. The dense multifaceted ground layer comprising of planted vegetation, modified ground cover and fallen debris also has the potential to provide excellent refuge and foraging habitat for reptiles and small mammals.

3.1.3 Growling Grass Frog Surveys

No Growling Grass Frogs were detected within sections of Deans Creek during the targeted surveys despite weather conditions being conducive and the species heard calling at known reference sites (Appendix 3.2). No additional frog species were heard calling from within sections of Deans Creek during nocturnal surveys despite some sections of the river containing water (Plates 1, 4 and 6).

The majority of Deans Creek observed during diurnal habitat assessments were dominated by Common Reed and Narrow-leaf Cumbungi, tall emergent graminoids, growing approximately 1.5 – 2 metres in height (Plates 4 and 6). Subsequently, these sections are limited to less than 5% open water cover in most instances, with very few large pools observed during the assessment; however, this may not be applicable to all sections of Deans Creek given access was limited.

The potential for Growling Grass Frogs to successfully breed within this habitat is considered to be significantly constrained by the density of emergent vegetation and increased levels of shading provided by surrounding planted vegetation. The assessed reaches also have limiting potential to act as dispersal and refuge habitat for Growling Grass Frog as connectivity to potential higher quality habitat is likely to be restricted by the dense cover of emergent vegetation within the creek. Overall these sections of Deans Creek containing remnant woodland, planted vegetation and a high density of emergent vegetation provides **low quality** habitat for Growling Grass Frog.

Several tributaries (drainage lines) of Deans Creek were also in poor condition and highly modified as a result of agricultural practices such as grazing (Plates 5, 7 and 8). The majority of tributaries contained modified pasture grasses and were dry at the time of the assessment. Overall these types of habitat within tributaries of Deans Creek provide **degraded** habitat for Growling Grass Frog.

Based on the findings of targeted surveys and detailed habitat assessments, there is a low likelihood that the assessed section of Deans Creek currently supports a breeding population of Growling Grass Frogs or forms part of a dispersal corridor for the species.



Plate 4. Deans Creek crossing Princes Highway – looking south (west of Deans Creek Road) – Moderate quality fauna habitat



Plate 5. Tributary of Deans Creek intersecting Back Larpent Road (west of Deans Creek Road – looking south) – Low quality fauna habitat



Plate 6. Deans Creek intersecting Irrewillipe Road (looking south), adjacent to Colac West Investigation Area - Moderate quality fauna habitat



Plate 7. Tributary of Deans Creek intersecting Holmchase Road (looking south) – Low quality fauna habitat



Plate 8. Deans Creek intersecting Back Larpent Road (east of Deans Creek Road – looking south)

3.2 Barongarook Creek

3.2.1 Vegetation condition

3.2.1.1 Desktop assessment

According to DELWP's pre-1750 EVC map (DELWP 2015b), the riparian zone of Barongarook Creek was likely to previously support predominantly Swamp Scrub (EVC 53) and Grassy Woodland (EVC 175) within the lower reaches, and Swampy Riparian Woodland (EVC 83) within the upper reaches (Figure 2a).

Based on predictive mapping and aerial photography interpretation, Barongarook Creek is likely to support narrow, fragmented patches of remnant vegetation, attributed to these EVCs, particularly within the upper reaches of the creek (DELWP 2015b; Figure 2b).

3.2.1.2 Field assessment

Remnant vegetation patches in **poor-moderate condition** were recorded along Barongarook Creek, attributed to Floodplain Riparian Woodland (EVC 56) within the lower reaches and Swampy Riparian Woodland within the upper reaches (Figure 4c-f). Both EVCs were similar in species composition and were attributed to each EVC based on landscape context. The lower reaches of the creek were attributed to Floodplain Riparian Woodland, rather than Grassy Woodland predicted to occur within the area (DELWP 2015b), as the vegetation was located along a stream, prone to flooding (an attribute not considered to fit the description of Grassy Woodland). Species composition of vegetation patches in poor condition was typically restricted to Narrow-leaf Cumbungi and/or Common Reed (Plate 9). Vegetation patches in moderate condition contained these understorey species in addition to Blackwood and/or Manna Gum (Plates 10 & 11). Scattered native species present along the length of the creek also included Water Ribbons, Common Tussock-grass, Tall Spike-sedge *Eleocharis sphacelata* and Austral bracken *Pteridium esculentum*. Five scattered Manna Gums were also recorded along the length of the creek.

A high diversity and cover of high threat weed species were present along the creek, including, Drain Flat-sedge, Field Bindweed, Hawthorn, Willow, Radiata Pine, Blackberry, Spiny-rush, Fennel, Gorse and Spear Thistle.

Planted indigenous trees and shrubs were present along large sections of the creek, which included Manna Gum, Swamp Gum *Eucalyptus obliqua*, and River Red-gum *Eucalyptus camaldulensis* (Figure 4c-f; Plate 12). It is likely that many of the plantings were publicly funded for environmental purposes.

Lake Colac Bird Reserve (located beside Church Street and Lake Colac) contained Plains Sedgy Wetland in **good condition** (Figure 4c; Plate 13). The community was dominated by a diversity of native species, including Blunt Pondweed *Potamogeton ochreatus*, Water Ribbons *Triglochin procera*, Matted Lobelia *Lobelia pedunculata*, Pale Rush *Juncus pallidus* and Water Plantain *Alisma Plantago-aquatica*. Dominant and high threat weeds within the reserve included Kikuyu, Yorkshire Fog *Holcus lanatus*, Greater Bindweed, Fennel, Wild Aster *Aster subulatus*, Willows and Poplars *Populus*.



Plate 9. Floodplain Riparian Woodland along Barongarook Creek in poor condition



Plate 10. Floodplain Riparian Woodland along Barongarook Creek in moderate condition



Plate 11. Swampy Riparian Woodland along Barongarook Creek in moderate condition and high quality fauna habitat



Plate 12. Planted indigenous vegetation along Barongarook Creek



Plate 13. Plains Sedgy Wetland within Lake Colac Bird Reserve in good condition and high quality fauna habitat

3.2.2 Fauna Habitat

Barongarook Creek (and associated branches) provides a similar suite of habitats to Deans Creek ranging from **low** to **high** quality habitat for locally common fauna including birds, arboreal and terrestrial mammals, micro-bats, frogs and reptiles. For example, sections of Barongarook Creek throughout the Colac township containing planted and remnant vegetation provides **moderate** quality habitat for a range of locally common bird, frog and reptile species. Arboreal mammals are likely to utilise these corridors as dispersal and foraging routes within the local area. Striated Pardalote *Pardalotus striatus*, New Holland Honeyeater *Phylidonyris*, Red Wattlebird *Anthochaera carunculata*, Magpie-lark *Grallina cyanoleuca*, Silveryeye *Zosterops lateralis*, Fairy Martin *Petrochelidon ariel*, White-plumed Honeyeater *Lichenostomus penicillatus*, Clamorous Reed Warbler *Acrocephalus stentoreus*, Eastern Rosella *Platycercus eximius* and Galah *Eolophus roseicapilla* were all observed using this habitat during the assessment. The regionally listed Whiskered Tern *Chlidonias hybrida* was also observed foraging along Barongarook Creek within the Joseph Paatsch Reserve during the assessment.

Several sections of the upper reaches of Barongarook Creek provide larger remnant trees which are likely to provide **high** quality refuge or breeding habitat for a range of hollow-dependent species (Plate 11). A total of 51 hollow-dependent species have been recorded within 10 kilometres of the study area (DELWP 2015d). Species likely to utilise this habitat include; possums, Galah *Eolophus roseicapilla*, Long-billed Corella *Cacatua tenuirostris*, Little Corella *Cacatua sanguinea*, Sulphur-crested Cockatoo *Cacatua galerita*, Rainbow Lorikeet *Trichoglossus haematodus*, Musk Lorikeet *Glossopsitta concinna*, Little Lorikeet *Glossopsitta pusilla*, Crimson Rosella *Platycercus elegans*, Eastern Rosella *Platycercus eximius*, Australian Wood Duck *Chenonetta jubata*, Grey Teal *Anas gracilis* and Chestnut Teal *Anas castanea* which have been recorded within the local area (DELWP 2015d).

Areas of Plains Sedge Wetland at the Lake Colac Bird Reserve provides **high** quality foraging habitat within the study area for a range of waterbird species including the regionally listed Latham's Snipe *Gallinago hardwickii* which was observed foraging around the edges of the wetland. Additional waterbird species observed at this site included: Purple Swamphen *Porphyrio porphyrio*, Eurasian Coot *Fulica atra*, Yellow-billed Spoonbill *Platalea flavipes*, Hoary-headed Grebe *Poliiocephalus poliocephalus* and Black-winged Stilt *Himantopus himantopus*.

Lake Colac is also likely to provide suitable habitat for a range of State listed waterbirds including: Magpie Goose *Anseranas semipalmata*, Musk Duck *Biziura lobata*, Freckled Duck *Stictonetta naevosa*, Australasian Shoveler *Anas rhynchos*, Hardhead *Aythya australis*, Blue-billed Duck *Oxyura australis*, White-throated Needletail *Hirundapus caudacutus*, Baillon's Crake *Porzana pusilla palustris*, Eastern Great Egret *Ardea modesta* and Intermediate Egret *Ardea intermedia*.

The tributaries of Barongarook Creek in the upper reaches of the system were of **low** habitat quality for local fauna given their modified nature and lack of structural diversity. This habitat is likely to support generalist fauna species adapted to modified habitats.

3.2.3 Growling Grass Frog Surveys

No Growling Grass Frogs were detected within Barongarook Creek during the targeted surveys despite weather conditions being conducive and the species heard calling at known reference sites (Appendix 3.2).

Two species of common frog were heard; Striped Marsh Frog *Limnodynastes peronii* was heard calling within a tributary of Barongarook Creek south of Hearn Street (Plate 18), while Common Froglet *Crinia signifera* was heard calling from the Lake Colac Bird Reserve (Plate 13).

Lake Colac Bird Reserve currently provides **high quality** habitat for Growling Grass Frog as it provides a high cover of emergent, submergent and floating aquatic vegetation (Plate 13); however, no Growling Grass Frog were heard calling from this wetland during call playback.

It is apparent that significant restoration works have been undertaken along the lower reaches of Barongarook Creek (north of the Princes Highway) which has included significant woody weed removal and subsequent terrestrial plantings (Plates 14 and 15). This has improved the quality of habitat within these sections of the river by providing non-shaded open pools which have the potential to be used as potential dispersal and breeding habitat by Growling Grass Frog in the future. Overall, these management works have improved this habitat to provide **moderate quality** habitat for Growling Grass Frog. This habitat could be further improved by increasing the level of emergent, submergent and floating aquatic vegetation cover to greater than 30% (Heard et al. 2010).

Areas south of the Princes Highway towards Eastern Reserve and the west and east branches of the Barongarook Creek are either heavily shaded with planted vegetation and/or contain a high cover of emergent vegetation such as Common Reed and Narrow-leaf Cumbungi as observed within Deans Creek (Plates 16 and 17). The assessed reaches appear to have limiting potential to act as dispersal and refuge habitat for Growling Grass Frog as connectivity to potential higher quality habitat further north is likely to be restricted by the dense cover of emergent vegetation within the creek. Overall these sections of Barongarook Creek containing remnant woodland, planted vegetation and a high density of emergent vegetation which provides **low quality** habitat for Growling Grass Frog.

An ephemeral linear tributary of Barongarook Creek continuing south of Hearn Street is also in poor condition and highly modified (Plates 18 and 19). Overall this habitat provides **degraded** habitat for Growling Grass Frog.

Based on the findings of targeted surveys and detailed habitat assessments, there is a low likelihood that the assessed section of Barongarook Creek currently supports a breeding population of Growling Grass Frogs and is likely to be the result of a low population size within the local area. Areas providing **high** and **moderate quality** habitat north of the Princes Highway provides the most suitable habitat for Growling Grass Frog within Barongarook Creek. However, Growling Grass Frog was not recorded during targeted surveys, and due to limited connectivity to other potential habitat there is a low likelihood that these habitats currently support the species. Further predation pressures are likely to occur within the Barongarook Creek given European Carp *Cyprinus carpio* were observed during the assessment.



Plate 14. Barongarook Creek from Pollack Street (looking south from bridge crossing) – Moderate quality fauna habitat



Plate 15. Barongarook Creek from Pollack Street (looking north towards bridge crossing) – Moderate quality fauna habitat



Plate 16. Barongarook Creek from Wilson Street (west of Eastern Reserve – looking north) – Moderate quality fauna habitat



Plate 17. Barongarook Creek from Wilson Street (east of Eastern Reserve – looking north) – Moderate quality fauna habitat



Plate 18. Barongarook Creek from Hearn Street (looking south) – Low quality fauna habitat



Plate 19. Barongarook Creek from Aireys Street (looking south) – Low quality fauna habitat and degraded habitat for Growling Grass Frog

3.3 Irrewarra Special Investigation Area

3.3.1 Vegetation condition

According to DELWP’s pre-1750 EVC map (DELWP 2015b), the Irrewarra Special Investigation Area was likely to previously support predominantly Grassy Woodland (EVC 175) and Swamp Scrub (EVC 53), with areas of Plains Grassy Woodland (EVC 55) in the north-west (Figure 2).

3.3.1.1 Field assessment

The Irrewarra Special Investigation Area was largely dominated by predominantly introduced vegetation (Plate 20). However, one remnant native vegetation patch of Grassy Woodland was recorded within the south-west of the study area (Figure 3a; Plate 21). The vegetation patch was in **poor condition** and was dominated by Swamp Gum and Blackwood. Ten Scattered Trees (River Red-gum) were also recorded, scattered throughout the study area (Plate 22).

Planted indigenous trees and shrubs were present, which included Manna Gum, Swamp Gum, Drooping Sheoak and Blackwood. The trees were planted in windrows along property boundaries and fencelines; it is unlikely that the plantings were publicly funded for environmental purposes.

Dominant and high threat weeds included Toowoomba Canary-grass *Phalaris aquatica*, Rye-grass *Lolium spp.* and Montpellier Broom *Genista monspessulana*.



Plate 20. Typical landscape within the Irrewarra Special Investigation Area.



Plate 21. Grassy Woodland within the Irrewarra Special Investigation Area in poor condition



Plate 22. Scattered tree within the Irrewarra Special Investigation Area.

3.4 Colac West Special Investigation Area

3.4.1 Vegetation condition

According to DELWP's pre-1750 EVC map (DELWP 2015b), the Colac West Special Investigation Area was likely to previously support predominantly Grassy Woodland (EVC 175) and Swamp Scrub (EVC53) (Figure 2).

3.4.1.1 Field assessment

The Colac West Special Investigation Area was largely dominated by predominantly introduced vegetation (Plate 23). However, several remnant native vegetation patches of Floodplain Riparian Woodland were recorded along Deans Creek (Figure 3b). The vegetation patches were in **poor-moderate condition**. Species composition of vegetation patches in poor condition was typically restricted to either Narrow-leaf Cumbungi, Common Reed or Blackwood (Plate 24). Vegetation patches in moderate condition contained both

Blackwood in addition to an understorey of Narrow-leaf Cumbungi or Common Reed (Plate 2). Four Scattered Trees (Manna Gum) were also recorded, scattered throughout the study area.

Planted indigenous trees and shrubs were present along sections of the creek, which included Manna Gum, and Blackwood (Figure 3b; Plate 7). It is likely that the plantings were publicly funded for environmental purposes. Dominant and high threat weeds included Toowoomba Canary-grass, Rye-grass, Peppercorn *Schinus molle*, African Boxthorn *Lycium ferocissimum*, Blackberry, Spear Thistle *Cirsium vulgare* and Willows.



Plate 23. Typical landscape within the Colac West Special Investigation Area.



Plate 24. Grassy Woodland within the Irrewarra Special Investigation Area in poor condition



Plate 25. Scattered tree within the Colac West Special Investigation Area.

3.5 Forest Street Special Investigation Area

3.5.1 Vegetation condition

According to DELWP's pre-1750 EVC map (DELWP 2015b), the Forest Street Special Investigation Area was likely to previously support predominantly Grassy Woodland (EVC 175) and Swamp Scrub (EVC 53) (Figure 2).

3.5.1.1 Field assessment

The Forest Street Special Investigation Area was largely dominated by predominantly introduced vegetation (Plate 26). No patches of remnant vegetation were recorded within the study area. However, two Scattered Trees (Swamp Gums) were recorded, within the north and south of the study area (Figure 3c).

Dominant and high threat weeds included Toowoomba Canary-grass, Rye-grass, Peppercorn *Schinus molle*, African Boxthorn *Lycium ferocissimum*, Blackberry, Spear Thistle and Willows.



Plate 26. Typical landscape within the Forest Street Special Investigation Area – low quality fauna habitat

3.6 Elliminyt Special Investigation Area

3.6.1 Vegetation condition

According to DELWP's pre-1750 EVC map (DELWP 2015b), the Elliminyt Special Investigation Area was likely to previously support predominantly Grassy Woodland (EVC 175) and Swamp Scrub (EVC 53) (Figure 2).

3.6.1.1 Field assessment

The Elliminyt Special Investigation Area was largely dominated by predominantly introduced vegetation. No patches of remnant vegetation were recorded within the study area. However, six Scattered Trees (Manna Gums) were recorded throughout the study area (Figure 3d; Plate 27).

Dominant and high threat weeds included Toowoomba Canary-grass, Rye-grass, Peppercorn, African Boxthorn, Blackberry, Spear Thistle and Willows.



Plate 27. Typical landscape within the Elliminyt Special Investigation Area, scattered tree in background.

3.7 Fauna Habitat within Special Investigation Areas

The Special Investigation Areas provides **low** to **high** quality habitat for locally common fauna including birds, arboreal and terrestrial mammals, micro-bats, frogs and reptiles. The four Special Investigation Areas were typically uniform in their available fauna habitat and have therefore been combined into one section. The majority of the Special Investigation Areas consisted of open paddocks which contain improved exotic pastures as a result of agricultural practices such as cropping and stock grazing.

The Special Investigation Areas are regularly used as a foraging resource by common generalist bird species which are tolerant of modified open areas and provide **low** quality habitat for local fauna. Fauna observed using this habitat included; Australian Magpie, Common Blackbird, Eurasian Goldfinch *Carduelis carduelis*, Common Starling *Sturnus vulgaris*, Crested Pigeon *Ocyphaps lophotes*, Red-rumped Parrot *Psephotus haematonotus*, Masked Lapwing *Vanellus miles*, Australasian Pipit *Anthus novaeseelandiae*, Little Raven *Corvus mellori*, Magpie-lark *Grallina cyanoleuca*, Willie Wagtail and introduced species House Sparrow *Passer domesticus*, Eurasian Skylark *Alauda arvensis*, Red Fox *Vulpes vulpes* and European Rabbit *Oryctolagus cuniculus*.

Artificial farm dams (namely larger dams with permanent water) are also likely to support a range of State listed bird species which are likely to use such habitats for foraging whilst dispersing between preferred habitats. Diurnal and nocturnal raptors are also likely to forage across these areas, with Wedge-Tailed Eagle *Aquila audax*, Brown Falcon *Falco berigora* and Black-shouldered Kite *Elanus axillaris* observed during the site assessment.

Open areas (including Deans Creek and Barongarook Creek) are also likely to provide excellent foraging and roosting habitat for local bat species amongst planted windrows, intact woodlands, bridge structures and disused farming sheds or equipment. White-striped Freetail Bat *Tadarida australis*, Southern Freetail bat *Mormopterus sp4*, Gould's Wattled Bat *Chalinolobus gouldi*, Chocolate Wattled Bat *Chalinolobus morio*, Eastern Falsistrellus *Falsistrellus tasmaniensis*, Large Forest Bat *Vespadelus darlingtoni*, Southern Forest Bat *Vespadelus regulus* and Little Forest Bat *Vespadelus vulturnus* are likely to frequent the local area for foraging purposes.

3.8 Growling Grass Frog within Special Investigation Areas

No Growling Grass Frogs were detected within the four Special Investigation Areas during targeted surveys despite weather conditions being conducive and the species heard calling at known reference sites (Appendix 3.2). No additional frog species were heard calling from within private properties located within the four Special Investigation Areas during nocturnal surveys despite there being suitable habitat in the form of artificial farm dams.

Given site access was limited within private property, not all habitats could be surveyed and subsequently assessed during diurnal or nocturnal surveys. However, it is likely that artificial waterbodies within private property have the highest likelihood of supporting Growling Grass Frog within the overall study area (Plates 28 and 29). This is due to the species ability to persist within larger farm dams which have a permanent hydroperiod, a clean water source, good connectivity to other similar habitats throughout the local landscape and suitable levels of emergent, submergent and floating vegetation (Heard et al. 2010).

While the lower reaches of Barongarook Creek provides **moderate** to **high** quality habitat for the species, this habitat provides poor dispersal opportunities south of the Princes Highway and is fragmented by the Colac township which is likely to act as an additional barrier to dispersal to the surrounding areas.



Plate 28. Artificial Waterbody within a Special Investigation Area.



Plate 29. Artificial Waterbody within a Special Investigation Area.

Previous targeted surveys associated with the Princes Highway Duplication (Winchelsea to Colac) recorded Growling Grass Frog within artificial farm dams adjoining the road reserve that contained good quality water and a variety of emergent, submergent and floating vegetation (Ecology and Heritage Partners Pty Ltd 2012). The species has also been historically recorded around Birregurra Creek and the local surrounds. While no Growling Grass Frog were heard calling from roadsides within the four Special Investigation Areas, the lack of previous records within the local area is likely to be associated with the low level of survey effort undertaken throughout private properties rather than the potential absence of the species.

Given Growling Grass Frog are a mobile species, it is possible to detect frogs ‘passing through’ an area during surveys which may imply the use of a dam (DEPI 2012; 2013b); however, the dam may not be adequate for prolonged occupancy or breeding. Rather these sites should be considered as ‘stepping stone’ habitat for an individual dispersing between more suitable breeding habitats (DEPI 2012; 2013b).

A proportion of artificial waterbodies within the four Special Investigation Areas may provide **low quality** habitat in terms of poor water quality and low levels of aquatic and semi-aquatic vegetation, and are therefore unlikely to support Growling Grass Frog for prolonged periods. However, they may provide important dispersal habitat for Growling Grass Frog and opportunistic breeding habitat under suitable conditions and should be considered potential habitat for any future planning within the Special Investigation Areas.

Overall, the landscape associated with the four Special Investigation Areas provides a high number of artificial waterbodies (≥ 40 using aerial photography), of ranging habitat qualities, which have the potential to provide potential breeding or dispersal habitat for Growling Grass Frog.

3.9 Significance Assessment

3.9.1 Flora

The VBA and FIS contain records of two nationally significant and 17 additional State significant flora species within 10 kilometres of the study area (DELWP 2015d; Viridans 2013a) (Appendix 2.1; Figure 5). The PMST nominated an additional 10 nationally significant species which have not been recorded in the locality but have the potential to occur (DoE 2015).

National

The nationally significant Spiny Peppercross *Lepidium aschersonii* was recorded within one kilometre of the Irrewarra Special Investigation Area in 2009. However, based on habitat present, the species is unlikely to occur within the Irrewarra Special Investigation Area, any of the other Special Investigation Areas, or Deans Creek and Barongarook Creek.

State

One State significant species, Netted Daisy-bush *Olearia speciosa*, has previously been recorded (1979) within the Colac West Special Investigation Area. Based on the current conditions observed during this assessment and the lack of recent records within the area, the species is unlikely to remain within the study area.

There is a low likelihood of three State significant species, Showy Lobelia *Lobelia beaugleholei*, Yarra Gum *Eucalyptus yarraensis* and Currant-wood *Monotoca glauca*, occurring along Deans and Barongarook Creek. Based on the modified nature of the study area, these species are unlikely to occur within the Special Investigation Areas (Appendix 2.1).

No additional national or State significant flora species are considered likely to occur within the study area.

3.9.2 Fauna

The VBA and AVW contain records of 18 nationally significant, 30 State significant and 15 regionally significant fauna species previously recorded within 10 kilometres of the study area (DELWP 2015d; Viridans 2013b) (Appendix 3.1; Figure 6). The PMST nominated an additional 6 nationally significant species which have not been recorded in the locality but have the potential to occur (DoE 2016). Of these species, there is suitable habitat within the study area for a range of significant fauna species.

National

Grey-headed Flying-fox *Pteropus poliocephalus* may visit sections of the study area on an occasional basis or when dispersing to preferred foraging locations; however, is unlikely to make significant use of the study area.

Sections of Deans Creek and Barongarook Creek containing suitable instream vegetation and permanent water may provide potentially suitable habitat for the nationally significant Yarra Pygmy Perch *Nannoperca obscura* and Dwarf Galaxias *Galaxiella pusilla*.

There are six records of Growling Grass Frog within 10 kilometres of the study area (DELWP 2015d; Figure 5). While there is a low likelihood of Growling Grass Frog occurring within Deans Creek or Barongarook Creek (with the exception of the Lake Colac Bird Reserve), the species may reside within artificial waterbodies located throughout the four Special Investigation Areas (Section 3.8).

There is a low likelihood of the study area currently supporting Striped Legless Lizard *Delma impar* or Golden Sun Moth *Synemon plana* due to the highly modified nature of the study areas.

State

Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris* is likely to forage throughout the study area as the species has been recorded nearby during recent targeted surveys (A, Taylor pers. obs.).

A variety of State listed waterbirds are likely to visit the study area on an occasional basis whilst dispersing to preferred sites (refer to Sections 3.2.2 and 3.7). Brolga *Grus rubicunda* may visit open paddocks located throughout the study area on an occasional basis during non-breeding periods; however, there did not appear to be any suitable breeding habitat located within the study area.

Black Falcon *Falco subniger* and Grey Goshawk *Accipiter novaehollandiae novaehollandiae* may forage over open areas within the study area on occasional basis while larger remnant trees along the upper reaches of the Barongarook Creek may provide potential breeding or roosting habitat.

Sections of Deans Creek and Barongarook Creek containing suitable instream vegetation and permanent water may provide potentially suitable habitat for Southern Pygmy Perch *Nannoperca australis* and Freshwater Catfish *Tandanus tandanus*.

Regional

Two regional listed species, Latham's Snipe and Whiskered Tern, were recorded within the Barongarook Creek system during the assessment. Latham's Snipe is unlikely to disperse throughout the remainder of the study area from suitable habitat located within the Lake Colac Bird Reserve. Whiskered Tern may move throughout the study area opportunistically; however, the species is likely to utilise larger open areas of Lake Colac rather than smaller sections of Barongarook Creek.

Pied Cormorant *Phalacrocorax varius* and Royal Spoonbill *Platalea* may utilise artificial farm dams throughout the four Special Investigation Areas for foraging purposes and potentially open sections of Deans Creek and Barongarook Creek along with Azure Kingfisher *Alcedo azurea*.

Long-necked Turtle *Chelodina longicollis*, Golden Perch *Macquaria ambigua* and River Blackfish *Gadopsis marmoratus* may use Deans Creek and Barongarook Creek as potential foraging and breeding habitat where permanent water and structural habitats are present (i.e. fallen logs and aquatic vegetation).

3.9.3 Communities

Four nationally listed ecological communities are predicted to occur within 10 kilometres of the study area (DoE 2015):

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

One nationally listed ecological community was recorded within the study area, *Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains*, within the Lake Colac Bird Reserve. This ecological community correlates with areas mapped as Plains Sedgy Wetland within the general field investigation area and meets to the condition and extent thresholds as described in the listing advice for this community (TSSC 2012) (Figure 4c; Section 3.2.1.2).

Based on the modified nature of the study area, landscape context and EVCs recorded/predicted to occur additional the remainder of the study area is unlikely to meet the diagnostic characteristics and/or condition thresholds that define national or State significant ecological communities (DELWP 2015b). The nationally significant communities *Grassy Eucalypt Woodland of the Victorian Volcanic Plain* and *Natural Temperate Grassland of the Victorian Volcanic Plain* are restricted to the Victorian Volcanic Plains bioregion; within the study areas, the Victorian Volcanic Plain is restricted to the Irrewarra Special Investigation Area. Remnant vegetation within the Irrewarra Special Investigation Area was dominated by Manna Gum, which can be a representative species of the nationally significant *Grassy Eucalypt Woodland of the Victorian Volcanic Plain*; however, this community, which could be accessed and assessed in detail, did not meet the condition thresholds that define this community due to lack of size and dominance of weeds in the understorey (TSSC 2008). The *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* is restricted to the Highlands – Northern Fall, Northern Inland Slopes, Riverina and Goldfields bioregions, and therefore will not occur within the study area (TSSC 2006).

3.10 Site Ecological Significance

The criteria adopted for assessing the ecological significance of the study area is presented in Appendix 1.3.

3.10.1 Deans and Barongarook Creek

Based on available information and the results of the desktop and site assessment, ecological values along the creeks are considered to be of **Regional ecological significance** for the following reasons:

- The creeks form a biolink across the landscape, from the foothills of the Otway Ranges to Lake Colac;
- The creeks support vegetation listed as Endangered (Swamp Scrub) and Vulnerable (Riparian Forest) within the Warrnambool Plain bioregion and Endangered within the Otway Plain bioregion (Floodplain Riparian Woodland, Swampy Riparian Woodland). The upper reaches of Deans Creek, outside the field assessment area, is also likely to support Herb-rich Foothill (listed

as Vulnerable in the Otway Plain bioregion) and the upper reaches of Barongarook Creek is likely to support Sedgy Riparian Woodland listed as Depleted with the Otway Plain bioregion) ; and

- Provides potentially suitable habitat for a range of significant listed fauna species (Section 3.9.2).

3.10.2 Special Investigation Areas

3.10.2.1 Irrewarra

Based on available information and the results of the desktop and site assessment, ecological values within the Irrewarra Special Investigation Areas are considered to be of **Local ecological significance** for the following reasons:

- The study area contains scattered indigenous trees providing habitat to locally significant fauna species;
- The study area supports vegetation listed as Endangered (Grassy Woodland) within the Otway Plain bioregion; and
- The study area provides potentially suitable habitat for a range of significant listed fauna species (Section 3.9.2).

3.10.2.2 Colac West

Based on available information and the results of the desktop and site assessment, ecological values within the Colac West Special Investigation Areas are considered to be of **Regional ecological significance** for the following reasons:

- The study area contains Deans Creek, which forms a biolink across the landscape, from the foothills of the Otway Ranges to Lake Colac;
- The study area contains scattered indigenous trees providing habitat to locally significant fauna species; and,
- The study area supports vegetation listed as Endangered (Grassy Woodland and Floodplain Riparian Woodland) within the Otway Plain bioregion; and
- The study area provides potentially suitable habitat for a range of significant listed fauna species (Section 3.9.2).

3.10.2.3 Forest Street

Based on available information and the results of the desktop and site assessment, ecological values within the Forest Street Special Investigation Areas are considered to be of **Local ecological significance** for the following reasons:

- The study area contains scattered indigenous trees providing habitat to locally significant fauna species;
- The study area contains minor drainage lines which provide temporary habitat and aid movement across the landscape for locally significant fauna species; and

- The study area provides potentially suitable habitat for a range of significant listed fauna species (Section 3.9.2).

3.10.2.4 Elliminyt

Based on available information and the results of the desktop and site assessment, ecological values within the Elliminyt Special Investigation Areas are considered to be of **Local ecological significance** for the following reasons:

- The study area contains scattered indigenous trees providing habitat to locally significant fauna species;
- The study area contains minor drainage lines which form a habitat corridor for locally significant fauna species; and,
- The study area contains minor drainage lines which provide temporary habitat and aid movement across the landscape for locally significant fauna species; and
- The study area provides potentially suitable habitat for a range of significant listed fauna species (Section 3.9.2).

4 LEGISLATIVE AND POLICY IMPLICATIONS

4.1 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes a Commonwealth process for the assessment of proposed actions likely to have a significant impact on any matters of National Environmental Significance (NES), described in Table 1.

Table 1. Potential impacts to matters of National Environmental Significance (NES)

Matter of NES	Potential Impacts
World Heritage properties	Any proposed future development will not impact any properties listed for World Heritage.
National heritage places	Any proposed future development will not impact any places listed for national heritage.
Ramsar wetlands of international significance	The study area occurs upstream of two Ramsar wetlands, <i>Port Phillip Bay (Western Shoreline)</i> and <i>Bellarine Peninsula and Western District Lakes</i> (DoE 2015). Provided management practices and construction techniques are consistent with Construction Techniques for Sediment Pollution Control (EPA 1991) and Environmental Guidelines for Major Construction Sites (EPA 1996), any proposed future development is unlikely to impact the ecological character of any Ramsar wetland.
Threatened species and ecological communities	There is suitable habitat within the study area for several fauna species listed under the EPBC Act (Section 3.9.2). One ecological community listed under the EPBC Act (<i>Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains</i>) was recorded within the study area (Section 3.9.3).
Migratory and marine species	Migratory species are protected under the international agreements to which Australia are a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Seventy five Migratory and/or Marine species have been recorded within 10 kilometres of the study area (DELWP 2015d). Plains Sedgy Wetland was found to provide suitable foraging habitat for Latham's Snipe and may provide suitable foraging habitat for additional Migratory species, especially given that many existing comparable habitats have either been destroyed or degraded through ongoing agricultural practices. However, the study area would not be classed as an 'important habitat' as defined under the <i>EPBC Act Policy Statement 1.1 Principal Significant Impact Guidelines</i> (DoE 2013), in that it does not contain: <ul style="list-style-type: none"> Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; Habitat utilised by a migratory species which is at the limit of the species range; or Habitat within an area where the species is declining.
Commonwealth marine area	Any proposed future development will not impact any Commonwealth marine areas.
Nuclear actions (including uranium mining)	Any proposed future development is not a nuclear action.
Great Barrier Reef Marine Park	Any proposed future development will not impact the Great Barrier Reef Marine Park.
Water resources impacted by coal seam gas or mining development	Any proposed future development would not be a coal seam gas or mining development.

4.1.1 Implications

4.1.1.1 *Deans and Barongarook Creeks*

One ecological community listed under the EPBC Act (*Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains*) was recorded within the study area within the Lake Colac Bird Reserve (Section 3.7.3). The study area also provide potential habitat for Yarra Pygmy Perch, Dwarf Galaxias and Growling Grass Frog listed under the EPBC Act (Section 3.9.2). Accordingly, there may be a requirement for an EPBC Act referral to be submitted to the Commonwealth Environment Minister should these matters of NES be significantly impacted as part of any future developments within Deans Creek and Barongarook Creek. Given access was restricted within much of the study area, detailed habitat assessments and/or targeted surveys are recommended to further inform the likelihood of the species being present and implication under the EPBC Act prior to any works within the vicinity of the creeks which are likely to have a significant impact on Yarra Pygmy Perch, Dwarf Galaxias or Growling Grass Frog.

4.1.1.2 *Special Investigation Areas*

EPBC Act listed flora or communities are unlikely to occur within the Special Investigation Areas. The study area provides potential habitat for Yarra Pygmy Perch (Colac West), Dwarf Galaxias (Colac West) and Growling Grass Frog (all Special Investigation Areas and Deans and Barongarook Creeks) listed under the EPBC Act (Section 3.9.2). Accordingly, there may be a requirement for an EPBC Act referral to be submitted to the Commonwealth Environment Minister should these matters of NES be significantly impacted as part of future improvements within the four Special Investigation Areas. Given access was restricted within much of the study area, detailed habitat assessments and/or targeted surveys are recommended to further inform the likelihood of the species being present and implication under the EPBC Act prior to any works within the vicinity of the creeks or artificial waterbodies which are likely to have a significant impact on Yarra Pygmy Perch, Dwarf Galaxias or Growling Grass Frog.

4.2 Flora and Fauna Guarantee Act 1988 (Victoria)

Proponents are required to apply for an FFG Act Permit to 'take' protected flora species, vegetation communities (or representative species of a community) and fish species in areas of public land (i.e. within road reserves, drainage lines and public reserves) (Appendix 1.6). An FFG Act permit is generally not required for removal of species or communities on private land, or for the removal of habitat for a listed terrestrial fauna species.

No species threatened and/or protected under the FFG Act were recorded within the study area. However, the study area contains habitat for several protected species (Wattles *Acacia* spp., daisies [members of the Asteraceae family] and heaths [members of the Ericaceae family]).

4.2.1 Implications

There is suitable habitat within the study area for several species listed or protected under the FFG Act (daisies, wattles, heaths). A permit under the FFG Act will be required for removal of protected species or communities within public land i.e. roadsides. A permit under the FFG Act may also be required should the salvage/ translocation of fish species be required. The Responsible Authority may consider flora, fauna and

communities listed under the FFG Act when making decisions regarding the use and development of the land.

Any development within the study area should also consider the following threatening processes, listed under the FFG Act:

- Alteration to the natural flow regimes of rivers and streams.
- Degradation of native riparian vegetation along Victorian rivers and streams.
- Habitat fragmentation as a threatening process for fauna in Victoria.
- Increase in sediment input into Victorian rivers and streams due to human activities.
- Input of toxic substances into Victorian rivers and streams.
- Wetland loss and degradation as a result of change in water regime, dredging, draining, filling and grazing.

4.3 Planning and Environment Act 1987 (Victoria)

The *Planning and Environment Act 1987* outlines the legislative framework for planning in Victoria and for the development and administration of planning schemes. All planning schemes contain native vegetation provisions at Clause 52.17 which require a planning permit from the relevant local Council to remove, destroy or lop native vegetation on a site of more than 0.4 hectares, unless an exemption under clause 52.17-7 of the Victorian Planning Schemes applies (Appendix 1.5.3) or a subdivision is proposed with lots less than 0.4 hectares¹. Local planning schemes may contain other provisions in relation to the removal of native vegetation (Section 4.3.1).

4.3.1 Local Planning Schemes

The study area is located within the Colac Otway Shire municipality. The following zoning and overlays apply (DELWP 2015f):

- Irrewarra Special Investigation Area:
 - Heritage Overlay (HO), applying to an area in the north west of the study area
 - Farm Zone (FZ);
 - Public Use Zone, Schedule 4 (PUZ4).
- Colac West Investigation Area:
 - Environmental Significance Overlay, Schedule 2 (ESO2);
 - Land Subject to Inundation Overlay (LSIO);
 - Farm Zone (FZ).

¹ In accordance with the Victorian Civil and Administrative Tribunal's (VCAT) decision *Villawood v Greater Bendigo CC* (2005) VCAT 2703 (20 December 2005) all native vegetation is considered lost where proposed lots are less than 0.4 hectares in area and must be offset at the time of subdivision.

- Forest Street Investigation Area:
 - Environmental Significance Overlay, Schedule 2 (ESO2);
 - Land Subject to Inundation Overlay (LSIO);
 - Farm Zone (FZ);
- Elliminyt Special Investigation Area:
 - Farm Zone (FZ).

The ESO2 relates to the protection of lakes, wetlands and watercourses. An application to construct, or carry out works, subdivide land or remove native vegetation must consider the impacts of the proposal on water quality, vegetated buffers, habitat quality and flood risk.

4.3.2 The Guidelines

The State Planning Policy Framework and the decision guidelines at Clause 52.17 (Native Vegetation) and Clause 12.01 require Planning and Responsible Authorities to have regard for ‘Permitted clearing of native vegetation - Biodiversity assessment guidelines’ (the Guidelines) (DEPI 2013a). Where the clearing of native vegetation is permitted, the quantity and type of vegetation to be offset is determined using methodology specified in the Guidelines. The primary objective of the regulations is “no net loss in the contribution made by native vegetation to Victoria’s biodiversity”.

A permit will be referred to DELWP as a ‘recommending authority’ if vegetation removal meets one or more of the below thresholds (Table 2).

Table 2. Permit to remove native vegetation – application referral triggers (Clause 66, Referral and Notice Provisions)

Native Vegetation	<ul style="list-style-type: none"> • Remove, destroy or lop native vegetation where the area to be cleared is 0.5 hectares or more • Remove, destroy or lop native vegetation which is to be considered under the High Risk-based pathway
Other Circumstances	<ul style="list-style-type: none"> • Remove, destroy or lop native vegetation if a property vegetation plan applies to the site • Remove, destroy or lop native vegetation on Crown land which is occupied or managed by the responsible authority

To assist with the assessment of planning permit applications, the Guidelines provides a framework based on risk of impacts to biodiversity (Risk-based Pathways), including location risk mapping (Table 3).

Table 3. Risk-based pathways for applications to remove native vegetation (DEPI 2013a)

		Location		
		A	B	C
Native Vegetation	Extent			
	< 0.5 hectares	Low	Low	High
	≥ 0.5 hectares and < 1 hectare	Low	Moderate	High
	≥ 1 hectare	Moderate	High	High
Scattered Trees	< 15 scattered trees	Low	Moderate	High
	≥ 15 scattered trees	Moderate	High	High

4.3.3 Implications

Under Clause 52.17 of the Planning Schemes, a Planning Permit is required to remove, destroy or lop any native vegetation within the study area. As wetlands can be difficult to assess in all seasons, DELWP have developed predictive mapping of all Current Wetlands. Current Wetlands are mapped within the study area, including within Irrewarra Special Investigation Area and within the floodway of Deans and Barongarook Creeks. Any works within a Current Wetland also requires a planning permit, regardless of whether native vegetation is present at the time of assessment or not, and whether the wetland was artificially created or natural (DELWP 2015e; Nick Jaschenko, DELWP, pers. com.). Areas of planted indigenous species may also require a planning permit for their removal, as they are likely to have been planted for environmental purposes and are likely to have been publicly funded (ie. the exception within Clause 52.17-17 [planted vegetation] is not likely to be applicable).

The study area falls into Location A. As such, a permit to remove native vegetation may fall under the Low or Moderate Risk-based Pathways, dependant on the extent of removal (Table 3). Applications under a Moderate Risk-based pathway require a statement of how impacts to biodiversity have been minimised, and may require Specific Offsets for threatened species.

In addition to the requirements under Clause 52.17 and the Permitted Clearing of Native Vegetation: Biodiversity Assessment Guidelines, Council has implemented its own planning controls, such as the Environmental Significance Overlay – Schedule 2 which provides specific protections for waterways. Any development within the study covered by an ESO2 area must also consider the decision guidelines of the planning overlay

4.4 Wildlife Act 1975 and Wildlife Regulations 2013 (Victoria)

The *Wildlife Act 1975* (and associated *Wildlife Regulations 2013*) is the primary legislation in Victoria providing for protection and management of wildlife. Authorisation for habitat removal may be obtained under the *Wildlife Act 1975* through a licence granted under the *Forests Act 1958*, or under any other Act such as the *Planning and Environment Act 1987*. Any persons engaged to remove, salvage, hold or relocate native fauna during construction must hold a current Management Authorisation under the *Wildlife Act 1975*, issued by DELWP.

4.5 Water Act 1989 (Victoria)

The purposes of the *Water Act 1989* are manifold but (in part) relate to the orderly, equitable, efficient and sustainable use of water resources within Victoria. This includes the provision of a formal means of protecting and enhancing environmental qualities of waterways and their in-stream uses as well as catchment conditions that may affect water quality and the ecological environments within them.

A 'works on waterways' permit from the Corangamite CMA is likely to be required where any action impacts on waterways (Deans or Barongarook Creeks, or their tributaries) within the study area. Additionally, where structures are installed within or across waterways that potentially interfere with the passage of fish or the quality of aquatic habitat, these activities should be referred to DELWP with the Corangamite CMA included for comment.

4.6 Catchment and Land Protection Act 1994 (Victoria)

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

A number of weeds listed as noxious under the CaLP Act were recorded during the assessment (Willow, Blackberry, Hawthorn, Spiny Rush, Fennel, Gorse, Spear Thistle and African Boxthorn). Similarly, there is evidence that the study area is currently occupied by several pest fauna species listed under the CaLP Act (European Rabbit and Red Fox).

5 RECOMMENDATIONS

The study area exists in a rural environment which is under increasing pressure from the effects of expanding development, including habitat fragmentation, the introduction and spread of weed and pest species, and impacts on local waterways. An important element of the effective implementation and planning for the Colac township is the ongoing communication from Council, public land managers (i.e. Parks Victoria and Catchment Management Authorities), DELWP and specialist consultants experienced in undertaking monitoring and management of significant flora and fauna and associated habitats.

In order to maintain and improve ecological values within the study area into the future, the following recommendations should be considered as part of any future works surrounding the Colac township:

- Opportunities should be investigated to protect remnant vegetation patches of higher conservation value through planning controls (e.g. Environmental Significance Overlays/Vegetation Protection Overlays); these areas include:
 - Riparian vegetation (Swamp Scrub, Riparian Forest, Floodplain Riparian Woodland and Swampy Riparian Woodland) along Deans Creek and Barongarook Creek. The retention of terrestrial habitat is important for the following reasons:
 - Areas of woodland and planted trees maintain important dispersal, foraging and breeding habitat for a range of ground-dwelling and arboreal fauna species that depend on wildlife corridors to move throughout the landscape. Wildlife corridors occur in the form of scattered trees, remnant patches and the dissecting creeks and drainage lines (Figure 4; Sections 3.1.1 and 3.2.1).
 - Retention of mature hollow-bearing trees throughout the study area is also important as they provide breeding habitat for over 50 locally common species (DELWP 2015d) (Figure 4; Sections 3.1 to 3.6).
 - Riparian and aquatic habitats within Deans Creek and Barongarook Creek (and Lake Colac Bird Reserve); this includes degraded areas containing little to no native vegetation. These aquatic habitats (even degraded areas) provide important dispersal, foraging and breeding habitat for locally common and significant fish, frog and bird species (Section 3.9.2).

Opportunities should also be investigated to enhance waterways, including degraded areas, through planning controls relating to future development. For example through a Development Plan Overlay requiring a masterplan upon applications for a subdivision, which considers retention and enhancement of biodiversity values, and a rehabilitation plan, requiring revegetation within degraded riparian environments. Through these controls, future development has the opportunity to increase connectivity throughout the broader environment and increase biodiversity values within the study area.

- It is recommended that any future maintenance or revegetation works within Deans Creek and Barongarook Creek considers the findings outlined within Heard et al. (2010 and 2014) for the future treatment and/or the creation of Growling Grass Frog habitat(s).

- Detailed ecological assessments will be required within the Special Investigation Areas to further inform the implications of future development in regards to the Guidelines (DEPI 2013a).
- Detailed habitat assessments and/or targeted surveys are recommended to further inform the likelihood of the species being present and implication under the EPBC Act prior to any works within the vicinity of the creeks or artificial waterbodies which are likely to have a significant impact on Yarra Pygmy Perch, Dwarf Galaxias or Growling Grass Frog.

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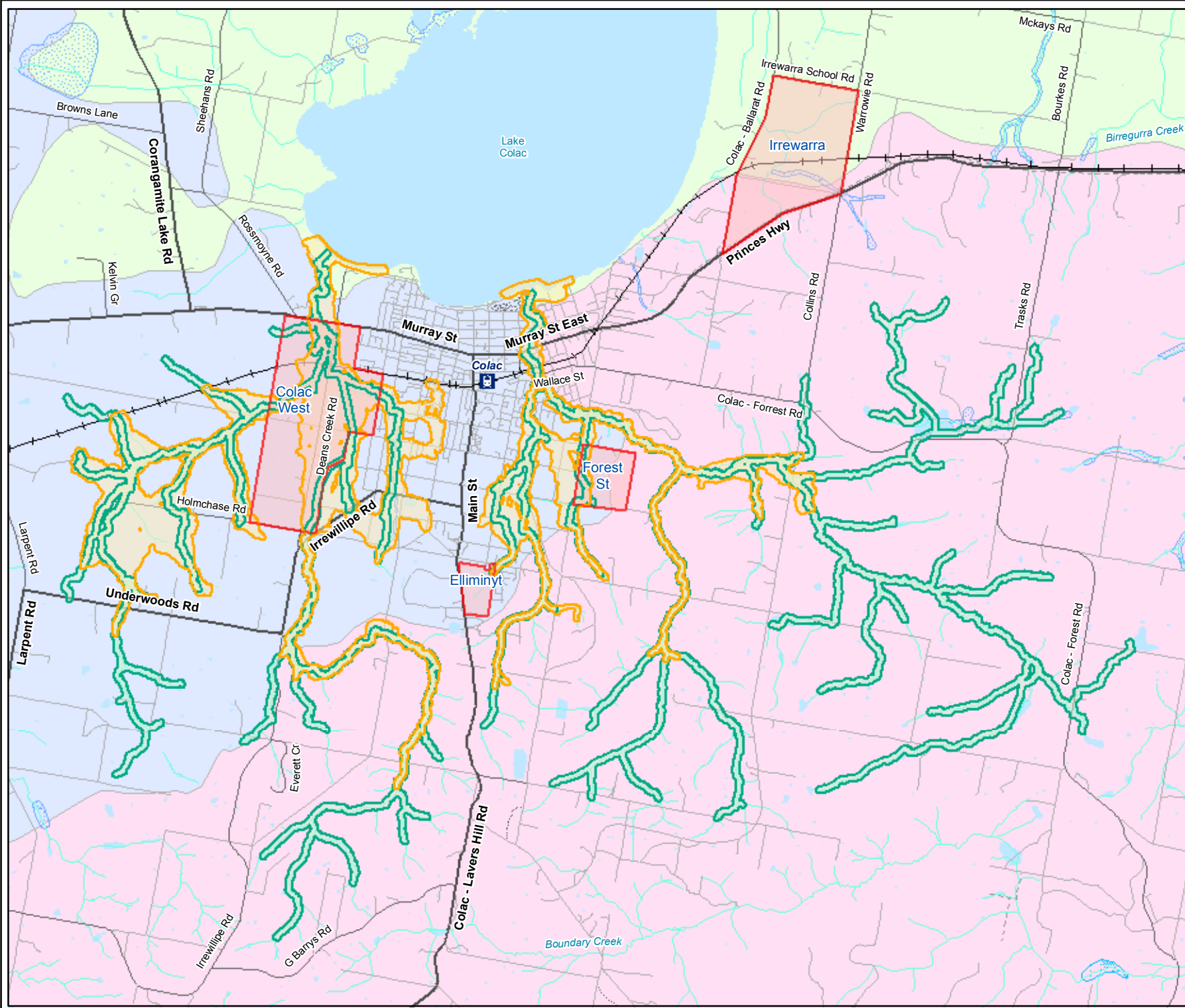
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FIGURES



Legend

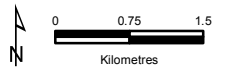
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- Field Assessment - General
- Desktop Assessment - General
- Railway
- Minor Watercourse
- Permanent Waterbody
- Land Subject to Inundation
- Wetland/Swamp

Bioregions

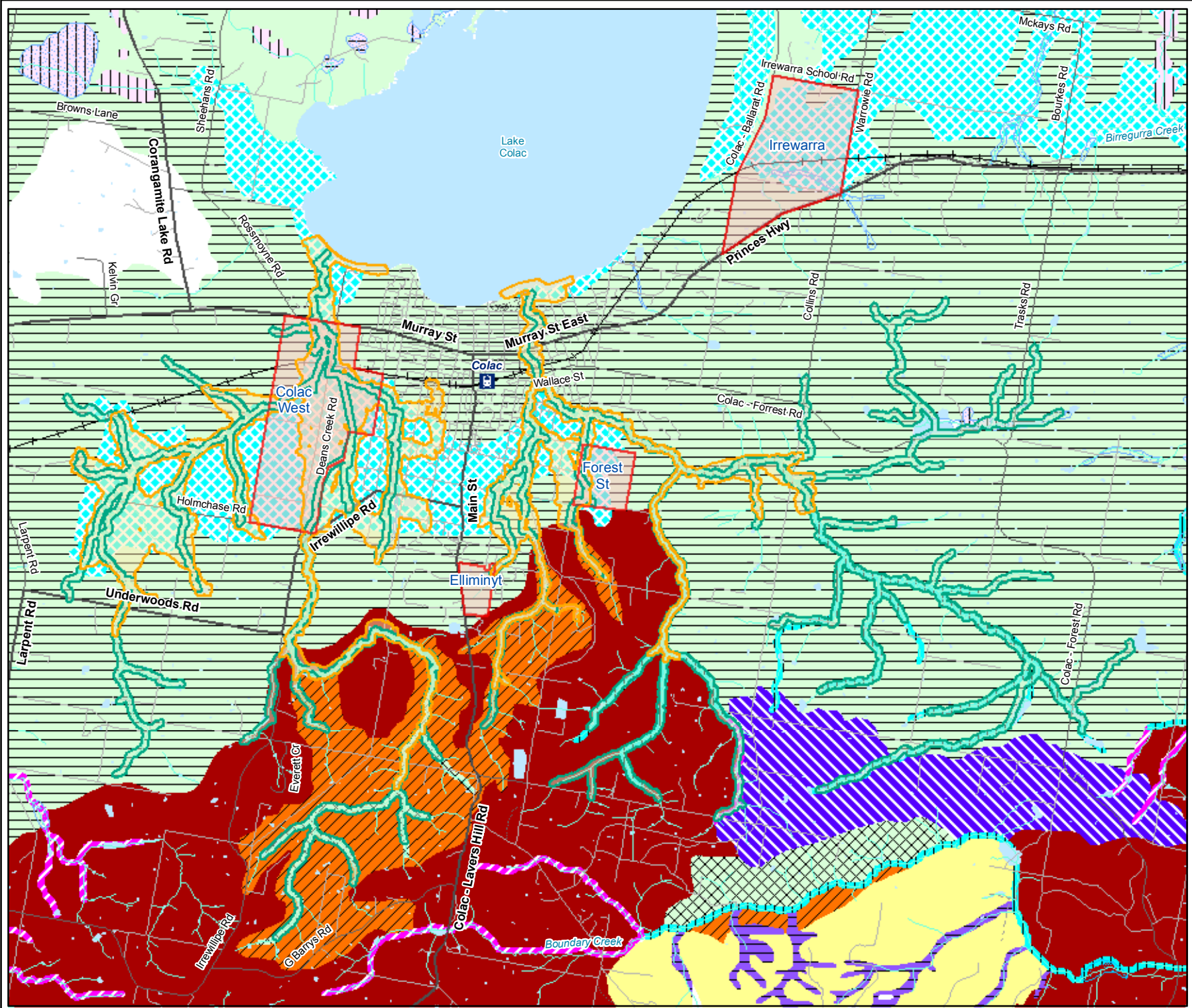
- Otway Plain
- Victorian Volcanic Plain
- Warrnambool Plain



Figure 1
Location of the study area
Deans Creek and Barongarook Creek Flora and Fauna Assessment

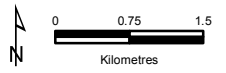


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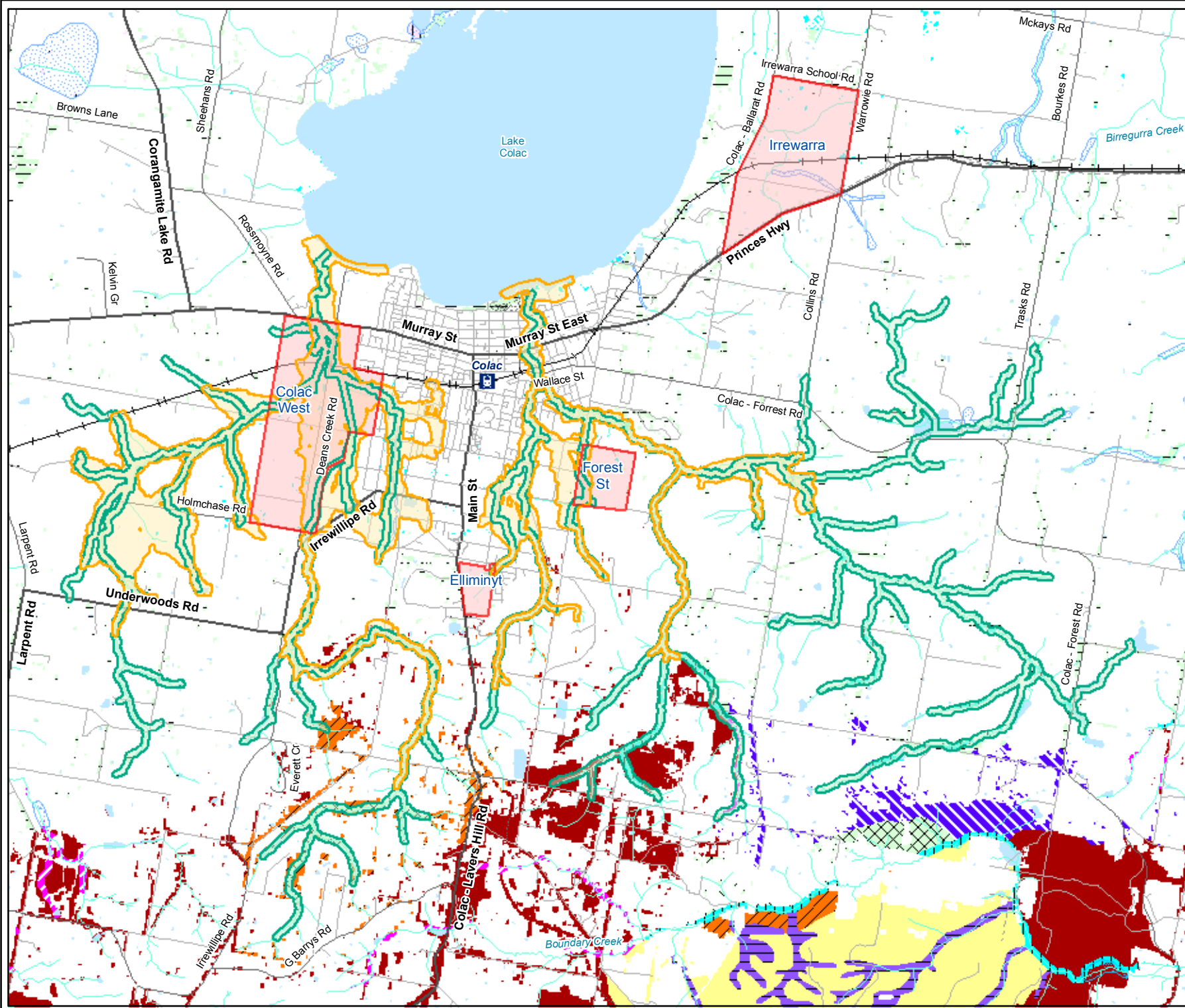
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- Pre 1750 EVC**
- Damp Sand Herb-rich Woodland
 - Lowland Forest
 - Riparian Scrub Complex
 - Riparian Forest
 - Herb-rich Foothill Forest
 - Heathy Woodland
 - Swamp Scrub
 - Plains Grassy Woodland
 - Swampy Riparian Woodland
 - Plains Grassy Wetland
 - Grassy Forest
 - Grassy Woodland
 - Sedgy Riparian Woodland
 - Plains Sedgy Wetland

Figure 2a
Pre 1750 EVCs within the study area
Deans Creek and Barongarook Creek Flora and Fauna Assessment



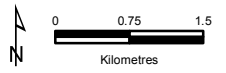
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- Legend**
- Field Assessment - Special Investigation Areas
 - Field Assessment - General
 - Desktop Assessment - General
- Extant 2005 EVCs**
- Damp Sands Herb-rich Woodland
 - Lowland Forest
 - Riparian Scrub Complex
 - Riparian Forest
 - Herb-rich Foothill Forest
 - Heathy Woodland
 - Swamp Scrub
 - Plains Grassy Woodland
 - Swampy Riparian Woodland
 - Plains Grassy Wetland
 - Grassy Woodland
 - Sedgy Riparian Woodland
 - Plains Sedgy Wetland

Figure 2b
Extant 2005 EVCs within the study area
Deans Creek and Barongarook Creek Flora and Fauna Assessment





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7387_Fig02b_2005_EVC_18/02/2016_rqjles





Legend

 Field Assessment - Special Investigation Areas

 Current Wetlands (DELWP 2016)

Vegetation

 Grassy Woodland

 Scattered Trees

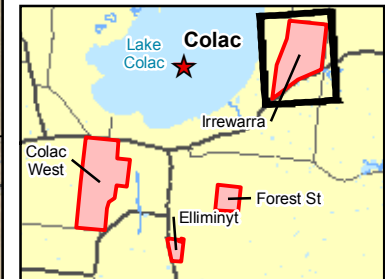
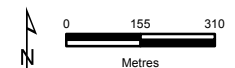
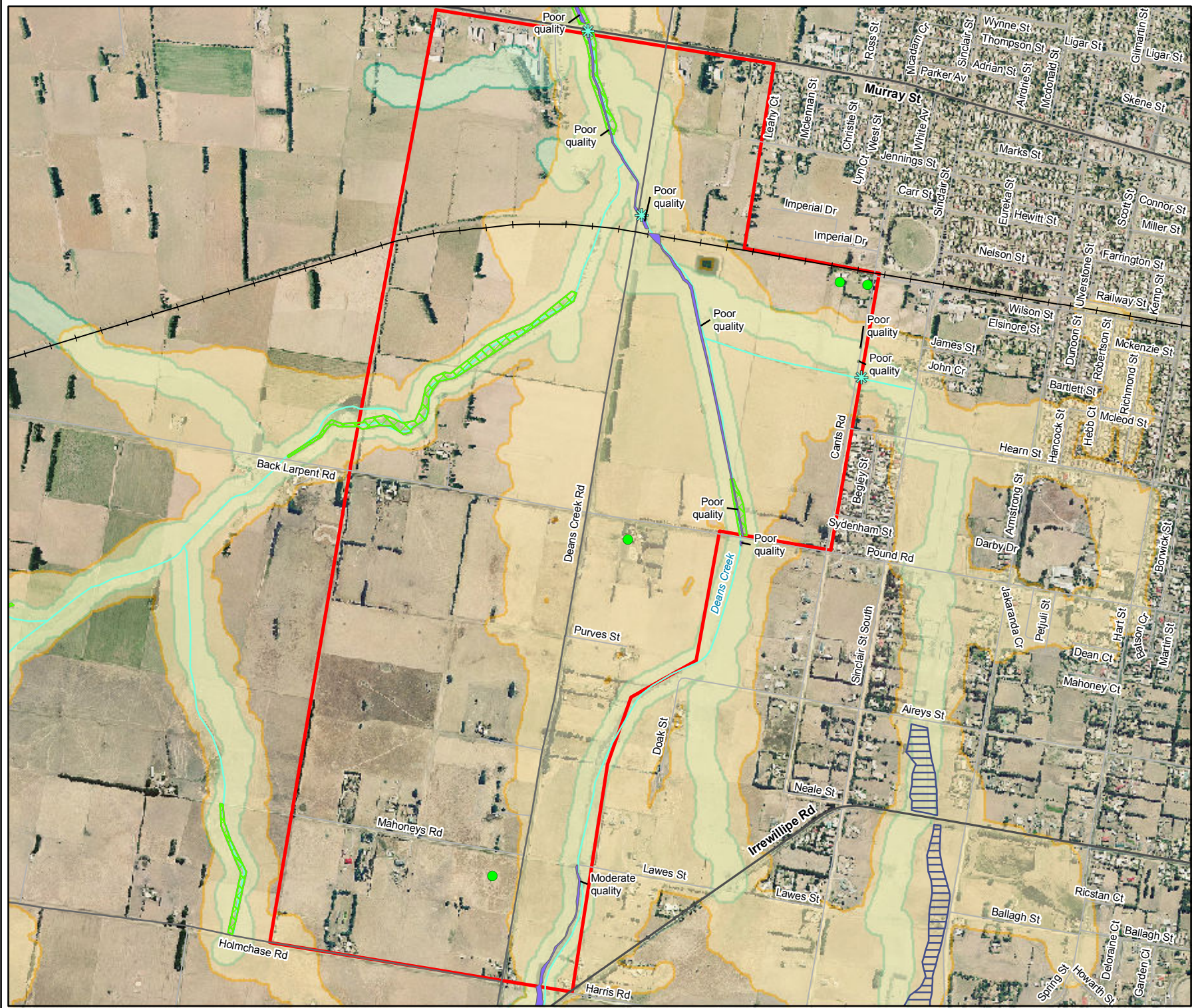


Figure 3a
Ecological features within the Irrewarra Special Investigation Area
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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Legend

- Field Assessment - Special Investigation Areas
 - Field Assessment -
 - Desktop Assessment -
 - Current Wetlands (DELWP 2016)
- Vegetation**
- Grassy Woodland
 - Floodplain Riparian Woodland
 - Planted vegetation
 - Scattered Trees

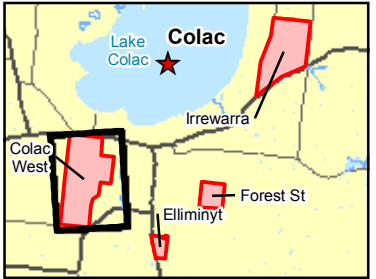
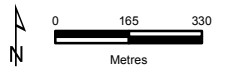
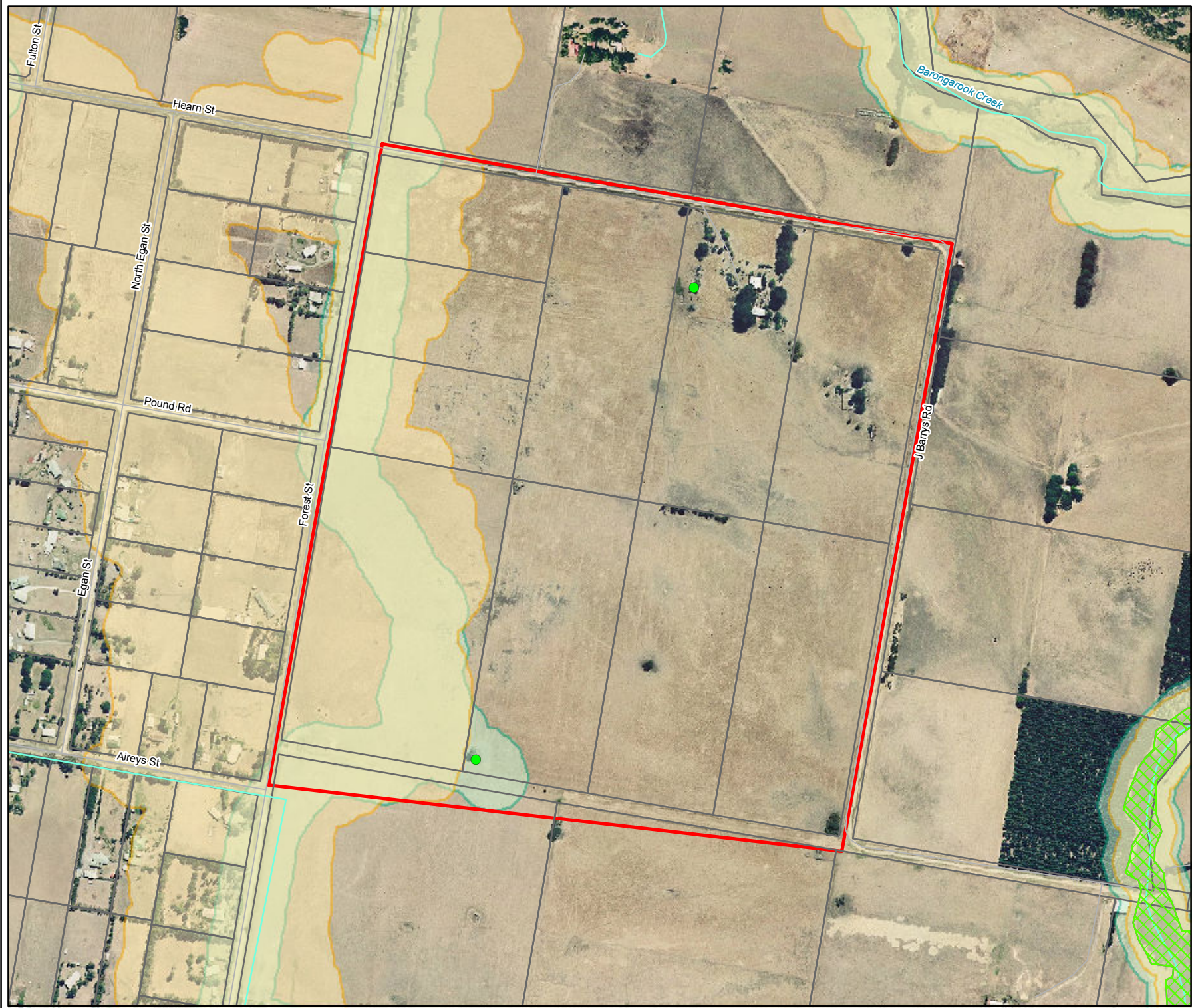


Figure 3b
Ecological features within the Colac West Special Investigation Area
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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- Legend**
- Field Assessment - Special Investigation Areas
 - Field Assessment -
 - Desktop Assessment -
 - Planted vegetation
 - Scattered Trees

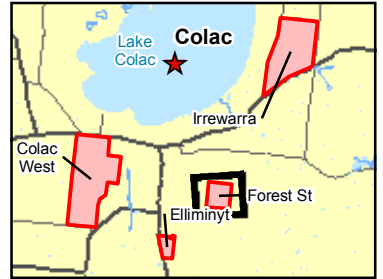
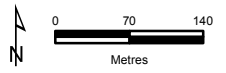


Figure 3c
Ecological features within the Forest Road Special Investigation Area
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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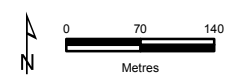
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- Legend**
- Field Assessment - Special Investigation Areas
 - Field Assessment - General
 - Desktop Assessment - General
 - Current Wetlands (DELWP 2016)
 - Floodplain Riparian Woodland
 - Scattered Trees

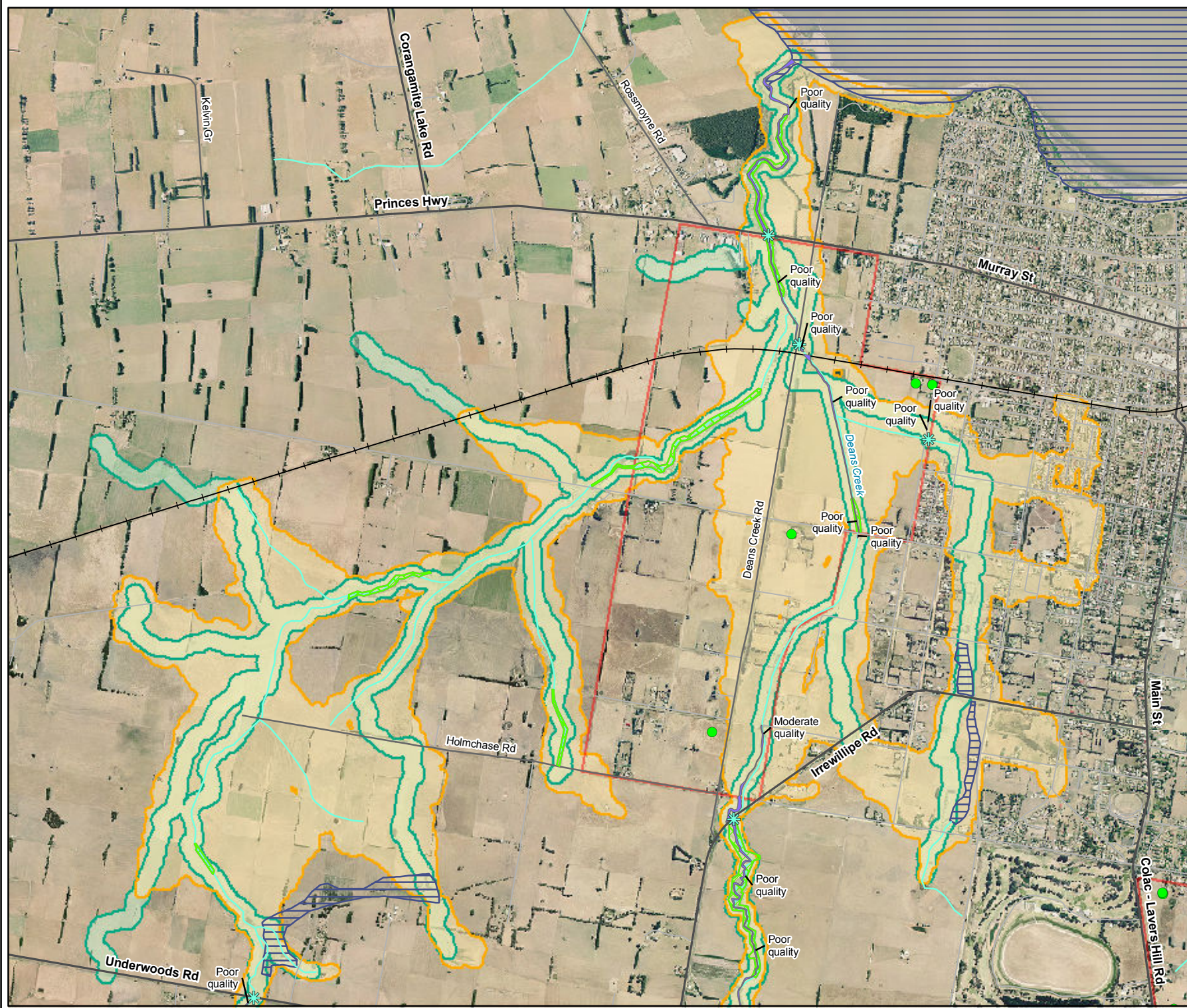


Figure 3d
Ecological features within the Eliminyt Special Investigation Area
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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- Legend**
- Field Assessment - General
 - Desktop Assessment - General
 - Field Assessment - Special Investigation Areas
- Vegetation**
- Grassy Woodland
 - Floodplain Riparian Woodland
 - Planted vegetation
 - Current Wetlands
 - Scattered Trees
 - Growling Grass Frog Survey Location

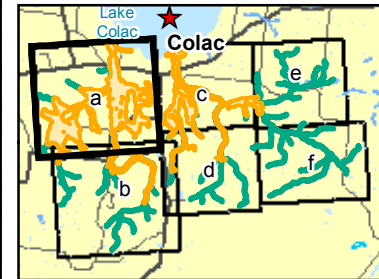
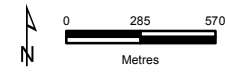
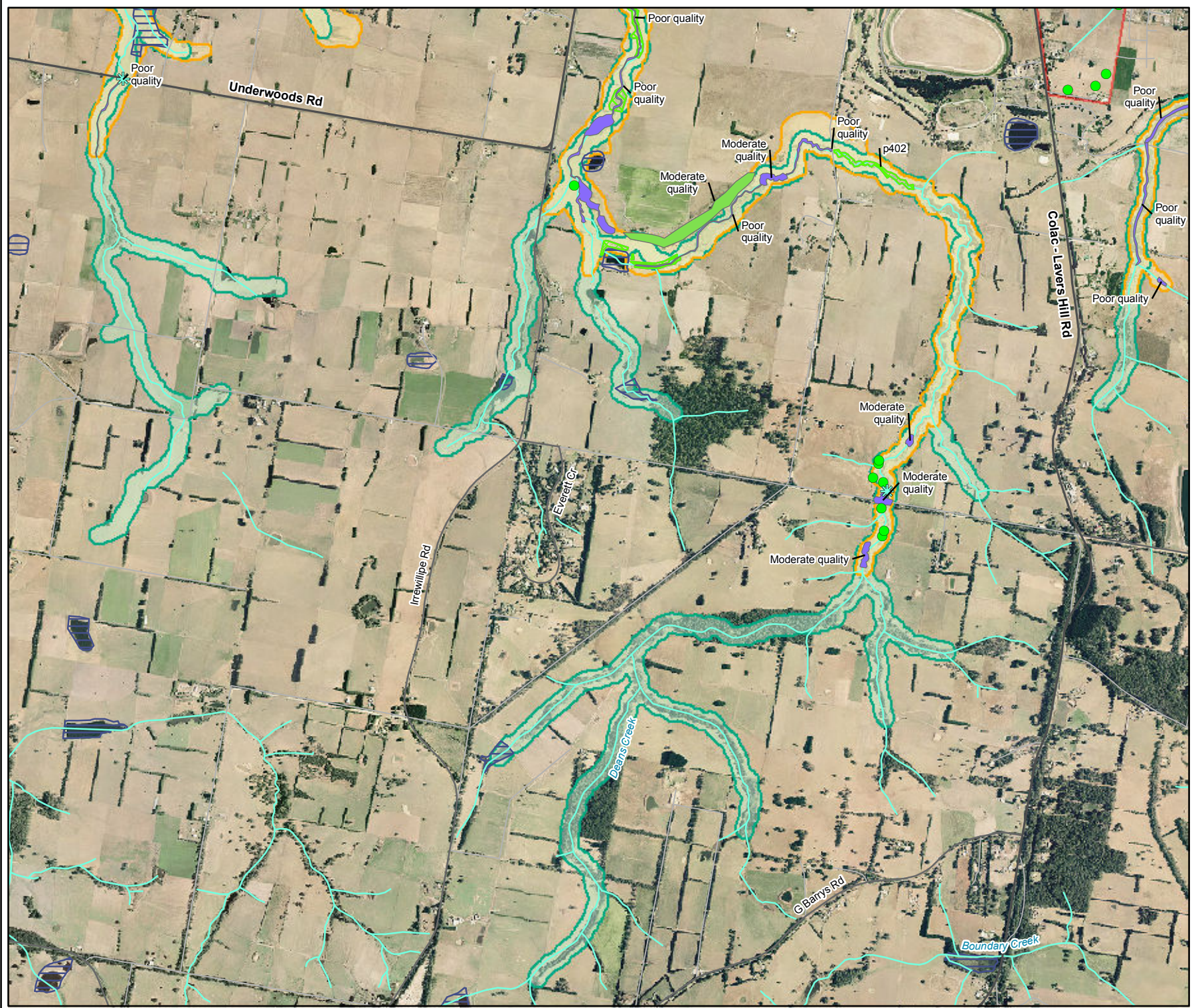


Figure 4a
Ecological features within the Field and Desktop Assessment areas
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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- Legend**
- Field Assessment - General
 - Desktop Assessment - General
 - Field Assessment - Special Investigation Areas
- Vegetation**
- Grassy Woodland
 - Floodplain Riparian Woodland
 - Planted vegetation
 - Current Wetlands
 - Scattered Trees
 - Growling Grass Frog Survey Location

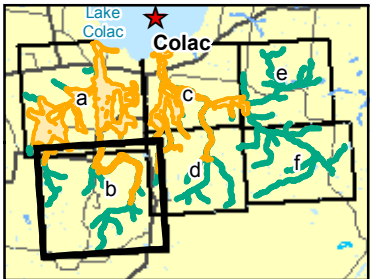
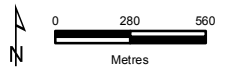
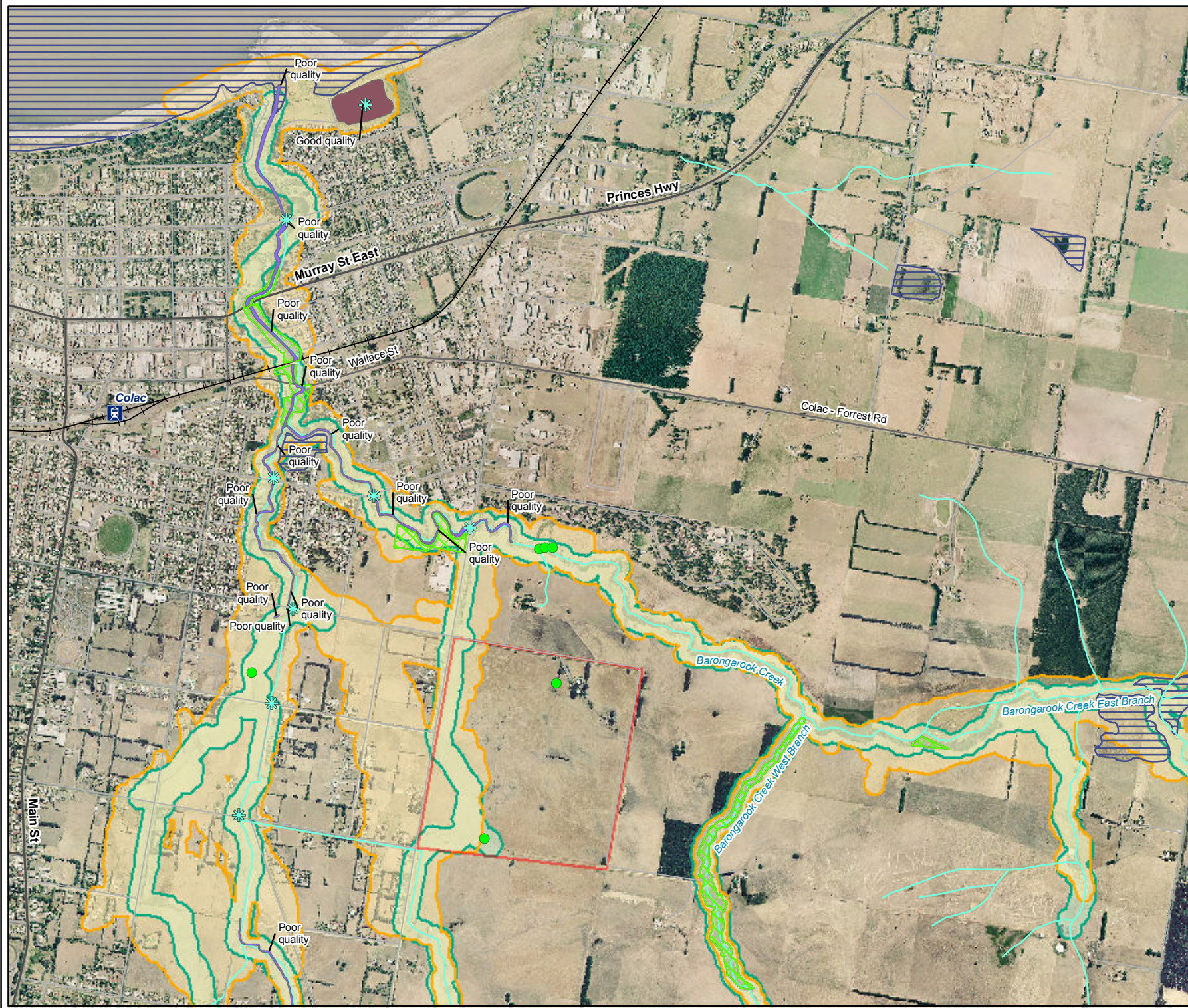


Figure 4b
Ecological features within the Field and Desktop Assessment areas
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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7387_Fig04_Eco_features_18/02/2016_rqiles



Legend

- Field Assessment - General
- Desktop Assessment - General
- Field Assessment - Special Investigation Areas

Vegetation

- Floodplain Riparian Woodland
- Plains Sedy Wetland
- Planted vegetation
- Current Wetlands
- Scattered Trees
- Growling Grass Frog Survey Location

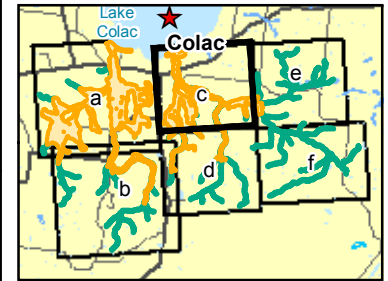
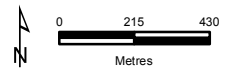
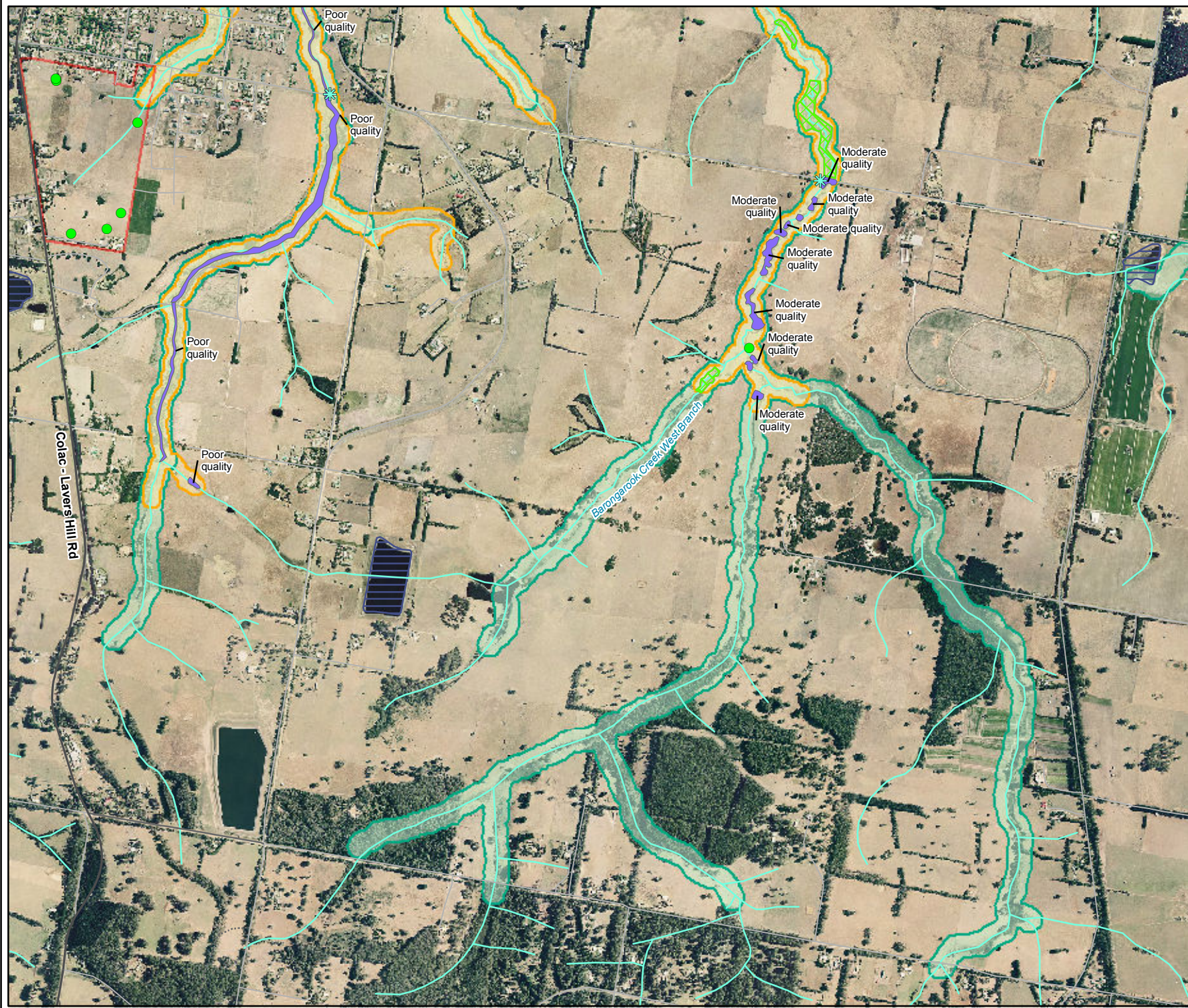


Figure 4c
Ecological features within the Field and Desktop Assessment areas
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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- Legend**
- Field Assessment - General
 - Desktop Assessment - General
 - Field Assessment - Special Investigation Areas
- Vegetation**
- Floodplain Riparian Woodland
 - Planted vegetation
 - Current Wetlands
 - Scattered Trees
 - Growing Grass Frog Survey Location

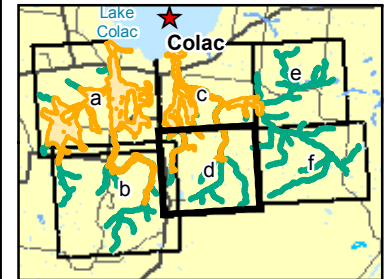
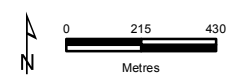
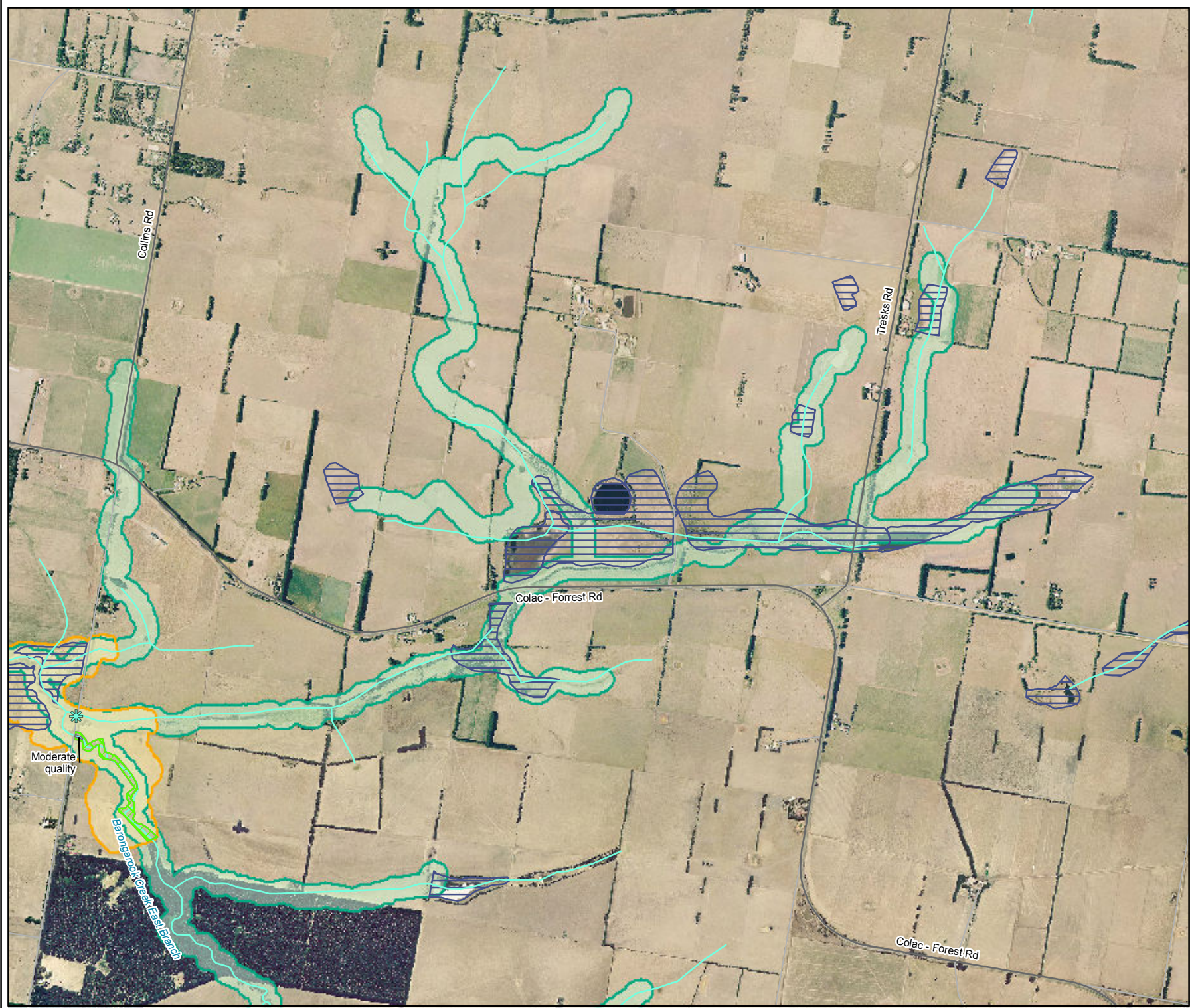


Figure 4d
Ecological features within the Field and Desktop Assessment areas
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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7387_Fig04_Eco_features_18/02/2016.rqiles



- Legend**
- Field Assessment - General
 - Desktop Assessment - General
- Vegetation**
- Swampy Riparian Woodland
 - Planted vegetation
 - Current Wetlands
 - Growing Grass Frog Survey Location

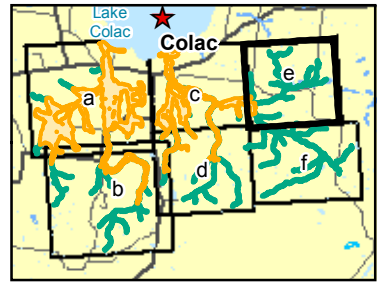
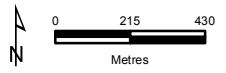
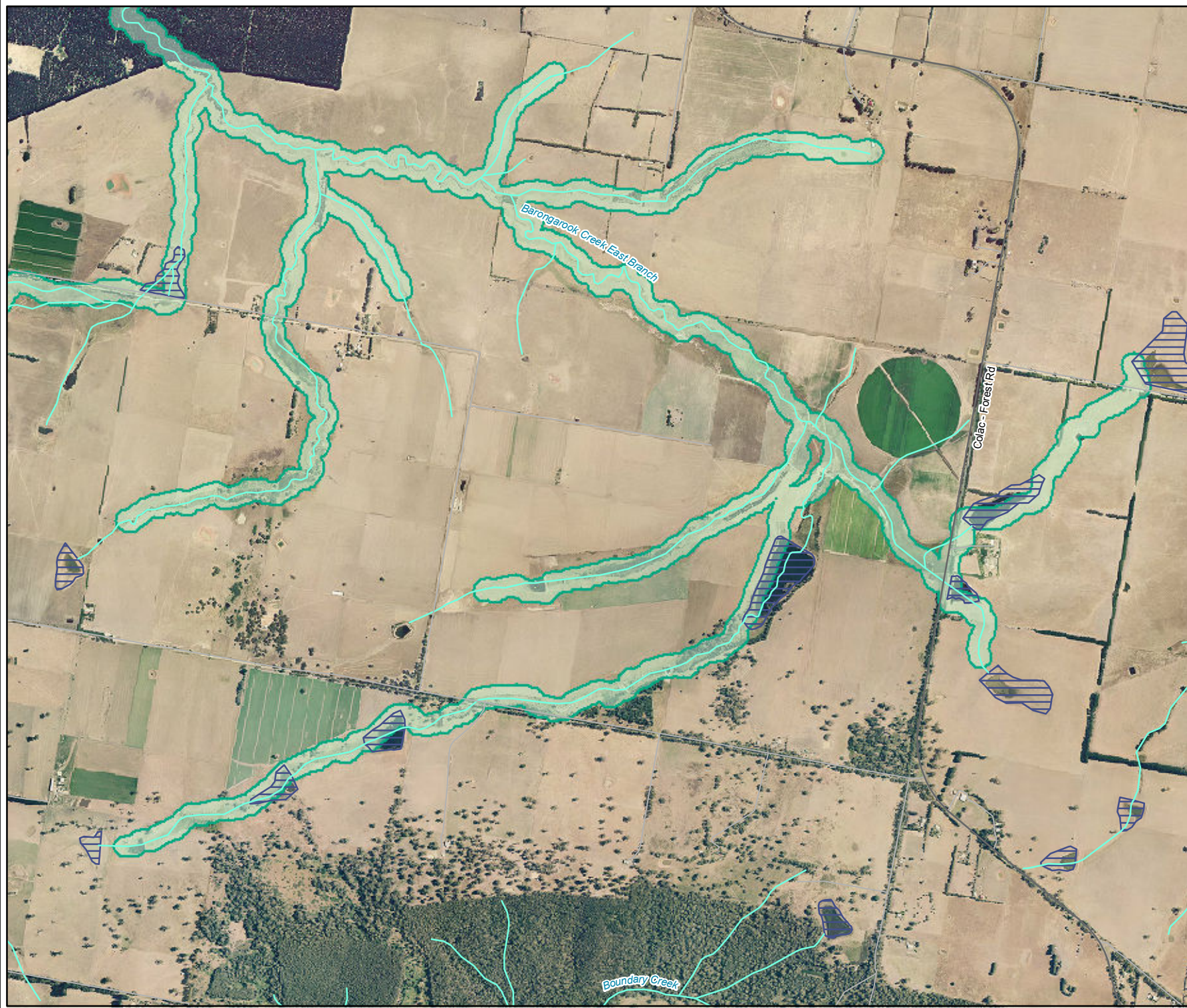


Figure 4e
Ecological features within the Field and Desktop Assessment areas
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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7387_Fig04_Eco_features_18/02/2016_rjiles



- Legend**
- Desktop Assessment - General
 - Current Wetlands

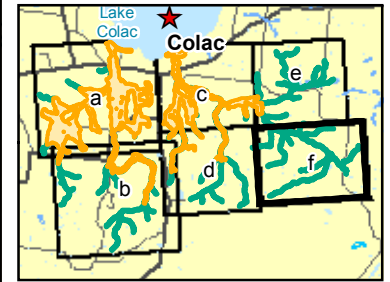
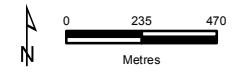
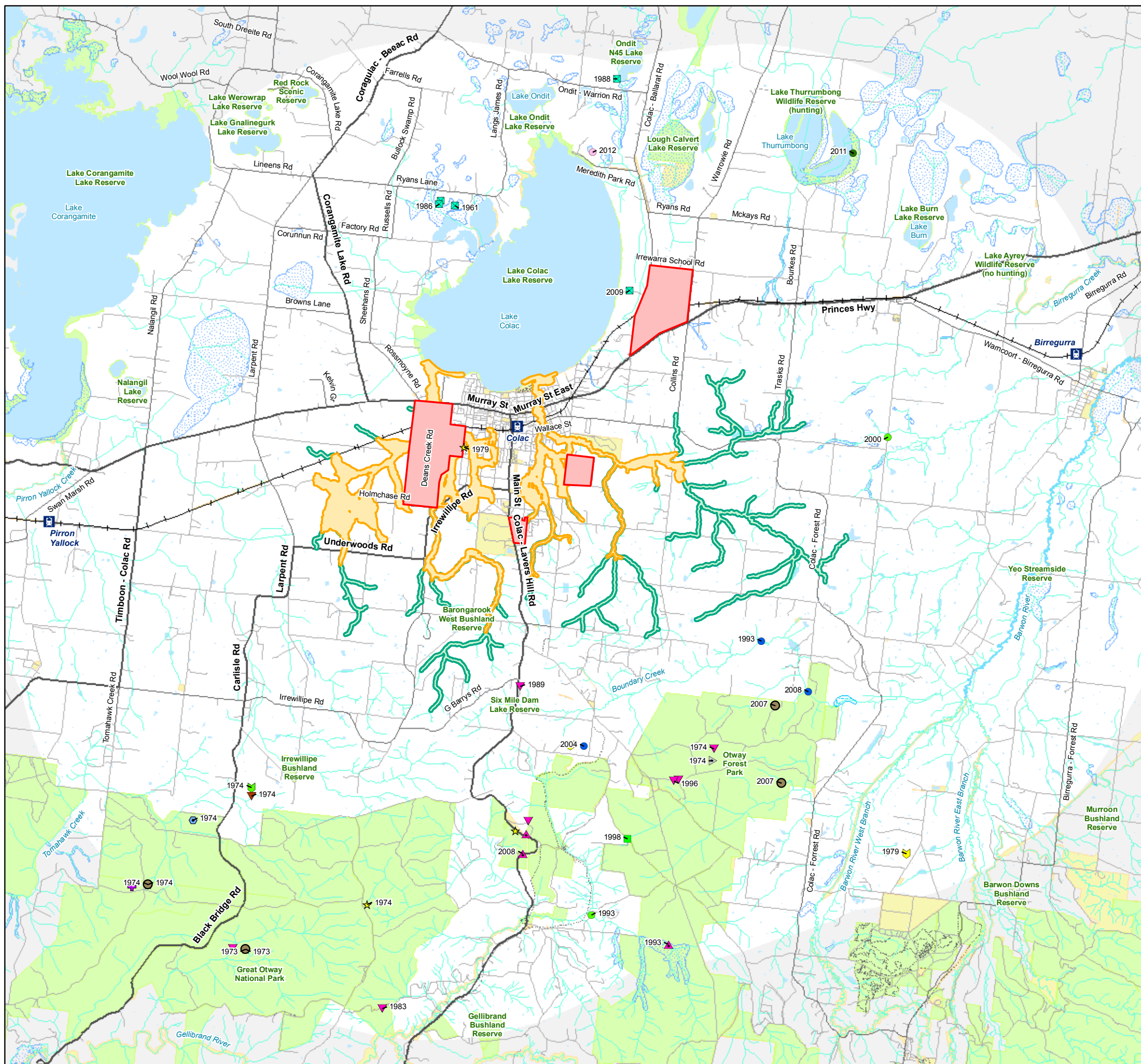


Figure 4f
Ecological features within the Field and Desktop Assessment areas
Deans Creek and Barongarook Creek Flora and Fauna Assessment



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7387_Fig04_Eco_features_18/02/2016_rjiles



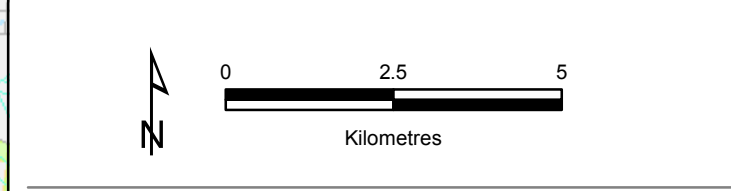
Legend

- Alpine Crane's-bill
- ▲ Brooker's Gum
- ▼ Coast Stork's-bill
- ▼ Currant-wood
- + Hoary Sun-orchid
- Ivy-leaf Duckweed
- Large River Buttercup
- ★ Netted Daisy-bush
- ▼ Parsley Xanthosia
- ▶ Short Water-starwort
- Showy Lobelia
- ▼ Slender Bitter-cress
- ☒ Spiny Peppercross
- Starry Daisy-bush
- Swamp Fireweed
- Western Peppermint
- ▲ Wiry Bossiaea
- Yarra Gum

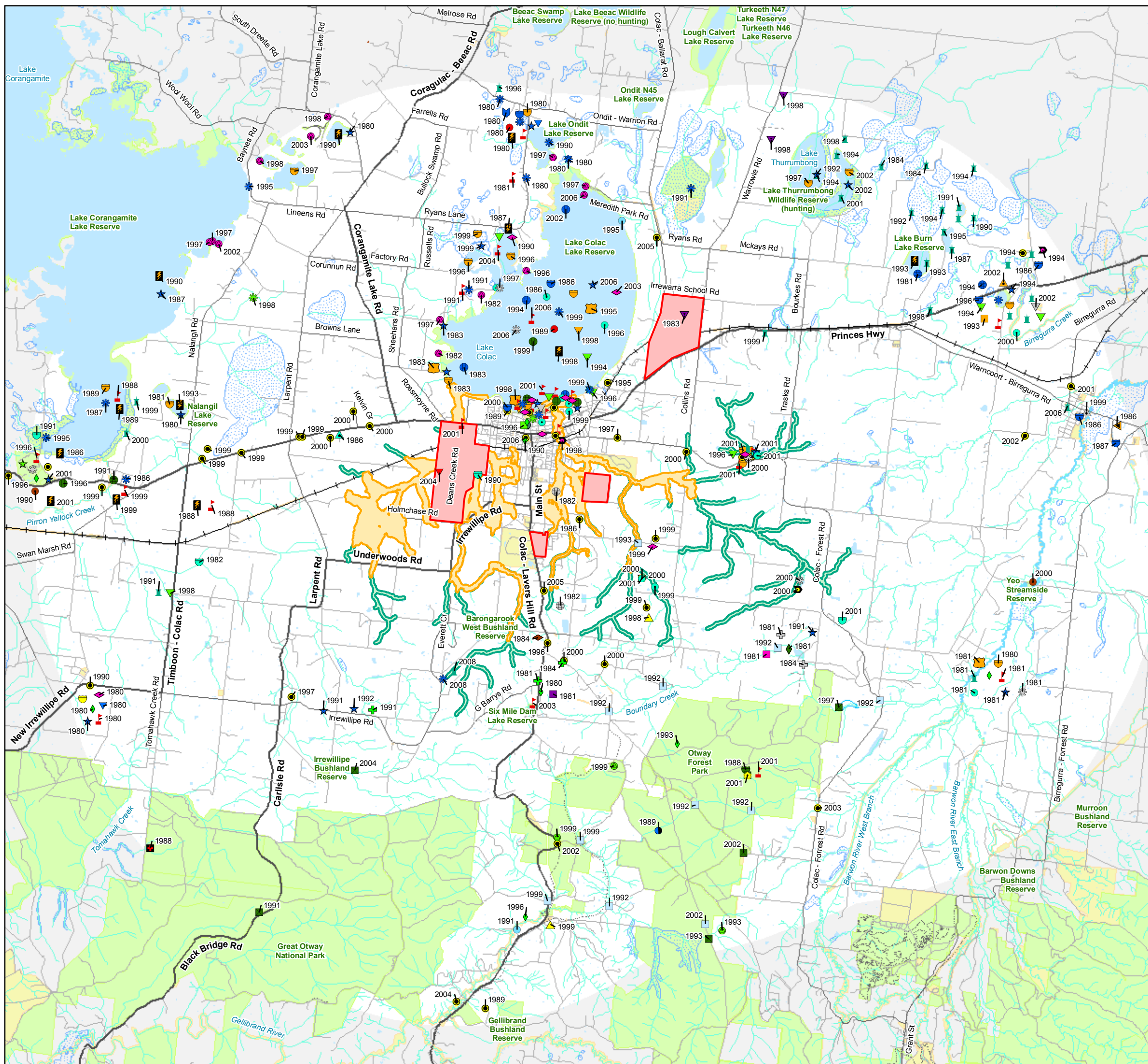
- Field Assessment - Special Investigation Areas
- Field Assessment - General
- Desktop Assessment - General



Figure 5
Previously documented significant flora within 10km of the study area
Deans Creek and Barongarook Creek Flora and Fauna Assessment



VBA 2016. Victorian Biodiversity Atlas. // Sourced from: 'VBA_FLORA25' and 'VBA_FLORA100', January 2016 © The State of Victoria, Department of Environment, Land, Water and Planning. Records prior to 1949 not shown. Ecology and Heritage Partners recorded species have been submitted to but are not yet included in the VBA as at October 2014. VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.



- ### Legend
- | | |
|----------------------------|--|
| ▶ Australasian Bittern | ▽ Little Egret |
| ▶ Australasian Shoveler | ● Long-nosed Potoroo |
| ▶ Australian Painted Snipe | ▼ Macquarie Perch |
| ▶ Azure Kingfisher | ▼ Magpie Goose |
| ▶ Baillon's Crake | ■ Marsh Sandpiper |
| ▶ Black Falcon | ▶ Masked Owl |
| ▶ Blue-billed Duck | ◆ Murray Cod |
| ▶ Broad-shelled Turtle | ▶ Musk Duck |
| ● Broad-toothed Rat | ● Nankeen Night Heron |
| ▶ Brolga | ■ Otway Bush Yabby |
| ▶ Caspian Tern | ▶ Pacific Gull |
| ● Common Greenshank | ▶ Pectoral Sandpiper |
| ● Corangamite Water Skink | ● Pied Cormorant |
| ▶ Curlew Sandpiper | ▶ Plains-wanderer |
| ★ Eastern Barred Bandicoot | ■ Powerful Owl |
| ▶ Eastern Great Egret | ▶ Red Knot |
| ● Eastern Pygmy-possum | ● Regent Honeyeater |
| ● Fairy Prion | ▶ Royal Spoonbill |
| ▶ Fat-tailed Dunnart | ▶ Rufous Bristlebird |
| ● Freckled Duck | ▶ Rufous Bristlebird (Otway) |
| ▶ Freshwater Catfish | ▶ Southern Brown Bandicoot |
| ▶ Golden Perch | ● Southern Toadlet |
| ● Grey Goshawk | ● Spot-tailed Quoll |
| ▶ Grey-headed Flying-fox | ■ Superb Parrot |
| ▶ Growling Grass Frog | ■ Swamp Skink |
| ▶ Gull-billed Tern | ▶ Whiskered Tern |
| ★ Hardhead | ▶ White-footed Dunnart |
| ▶ Intermediate Egret | ▶ White-throated Needletail |
| ● Latham's Snipe | ● Yarra Pygmy Perch |
| | ▶ Yellow-bellied Sheathtail Bat |
| | ■ Field Assessment - Special Investigation Areas |
| | ■ Field Assessment - General |
| | ■ Desktop Assessment - General |

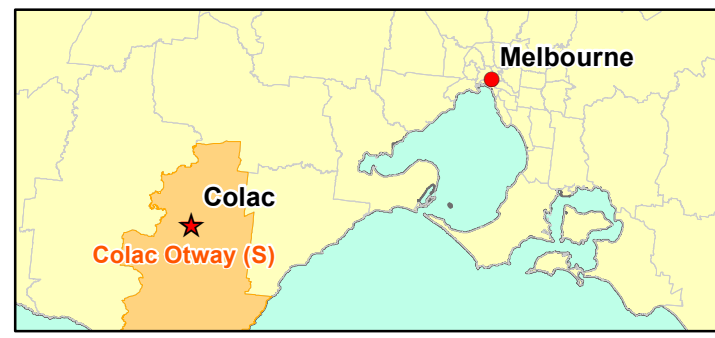
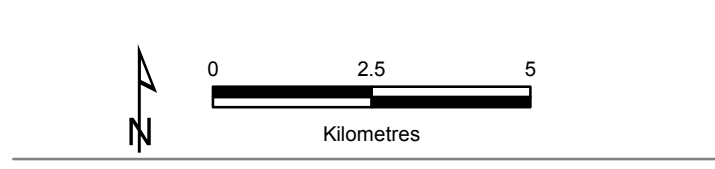


Figure 6
 Previously documented significant fauna within 10km of the study area
Deans Creek and Barongarook Creek Flora and Fauna Assessment



VBA 2016. Victorian Biodiversity Atlas. // Sourced from: 'VBA_FAUNA25' and 'VBA_FAUNA100', January 2016 © The State of Victoria, Department of Environment, Land, Water and Planning. Records prior to 1980 not shown. Ecology and Heritage Partners recorded species have been submitted to but are not yet included in the VBA as at October 2014. VicMap Data: The State of Victoria does not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that the State of Victoria shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

APPENDICES

APPENDIX 1

Appendix 1.1 – Rare or Threatened Categories for Listed Victorian Taxa

Table A1.1. Rare or Threatened categories for listed Victorian taxa.

Rare or Threatened Categories
Conservation Status in Australia (Based on the EPBC Act 1999)
EX - Extinct: Extinct is when there is no reasonable doubt that the last individual of the species has died.
CR - Critically Endangered: A species is critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
EN - Endangered: A species is endangered when it is not critically endangered but is facing a very high risk of extinction in the wild in the near future.
VU - Vulnerable: A species is vulnerable when it is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future.
R* - Rare: A species is rare but overall is not currently considered critically endangered, endangered or vulnerable.
K* - Poorly Known: A species is suspected, but not definitely known, to belong to any of the categories extinct, critically endangered, endangered, vulnerable or rare.
Conservation Status in Victoria (Based on DSE 2005, DSE 2009, DSE 2013)
x - Presumed Extinct in Victoria: not recorded from Victoria during the past 50 years despite field searches specifically for the plant, or, alternatively, intensive field searches (since 1950) at all previously known sites have failed to record the plant.
e - Endangered in Victoria: at risk of disappearing from the wild state if present land use and other causal factors continue to operate.
v - Vulnerable in Victoria: not presently endangered but likely to become so soon due to continued depletion; occurring mainly on sites likely to experience changes in land-use which would threaten the survival of the plant in the wild; or, taxa whose total population is so small that the likelihood of recovery from disturbance, including localised natural events such as drought, fire or landslip, is doubtful.
r - Rare in Victoria: rare but not considered otherwise threatened - there are relatively few known populations or the taxon is restricted to a relatively small area.
k - Poorly Known in Victoria: poorly known and suspected, but not definitely known, to belong to one of the above categories (x, e, v or r) within Victoria. At present, accurate distribution information is inadequate.

Appendix 1.2 – Defining Ecological Significance

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

National Significance
<p>Flora: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. extinct, critically endangered, endangered, vulnerable).</p>
<p>Fauna: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. Extinct, Critically Endangered, Endangered, Vulnerable). Fauna listed as Extinct, Critically Endangered, Endangered, Vulnerable, or Rare under National Action Plans for terrestrial taxon prepared for DoE: mammals (Woinarski <i>et al.</i> 2014), bats (Duncan <i>et al.</i> 1999), birds (Garnett <i>et al.</i> 2011), reptiles (Cogger <i>et al.</i> 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).</p>
<p>Communities: Vegetation communities considered critically endangered, endangered or vulnerable under the EPBC Act and considering vegetation condition.</p>
State Significance
<p>Flora: Threatened taxa listed under the provisions of the FFG Act. Flora listed in the State Government’s Advisory List of Rare or Threatened Plants in Victoria (DSE 2005).</p>
<p>Fauna: Threatened taxon listed under Schedule 2 of the FFG Act. Fauna listed as Extinct, Critically Endangered, Endangered and Vulnerable on the State Government’s Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013). Listed as Lower Risk (Near Threatened, Conservation Dependent or Least concern) or Data Deficient under National Action Plans for terrestrial species prepared for the DoE: mammals (Woinarski <i>et al.</i> 2014), bats (Duncan <i>et al.</i> 1999), birds (Garnett <i>et al.</i> 2011), reptiles (Cogger <i>et al.</i> 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).</p>
<p>Communities: Ecological communities listed as threatened under the FFG Act. EVC listed as threatened (i.e. endangered, vulnerable) or rare in a Native Vegetation Plan for a particular bioregion (DSE 2013c) and considering vegetation condition.</p>
Regional Significance
<p>Fauna: Fauna with a disjunct distribution, or a small number of documented recorded or naturally rare in the particular Bioregion in which the study area is located. A particular taxon that is has an unusual ecological or biogeographical occurrence or listed as Lower Risk – Near Threatened, Data Deficient or Insufficiently Known on the State Government’s Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013).</p>
<p>Communities: EVC listed as depleted or least concern in a Native Vegetation Plan for a particular bioregion (DSE 2013c) and considering vegetation condition. EVC considered rare by the author for a particular bioregion.</p>
Local Significance
<p>Local significance is defined as flora, fauna and ecological communities indigenous to a particular area, which are not considered rare or threatened on a national, state or regional level.</p>

Appendix 1.3 – Defining Site Significance

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

National Significance
<p>A site is of National significance if:</p> <ul style="list-style-type: none"> • It regularly supports, or has a high probability of regularly supporting individuals of a taxon listed as ‘Critically Endangered’ or ‘Endangered’ under the EPBC Act and/or under National Action Plans for terrestrial taxon prepared for the DoE. • It regularly supports, or has a high probability of supporting, an ‘important population’ as defined under the EPBC Act of one or more nationally ‘vulnerable’ flora and fauna taxon. • It is known to support, or has a high probability of supporting taxon listed as ‘Vulnerable’ under National Action Plans. • It is known to regularly support a large proportion (i.e. greater than 1%) of a population of a taxon listed as ‘Conservation Dependent’ under the EPBC Act and/or listed as Rare or Lower Risk (near threatened, conservation dependent or least concern) under National Action Plans. • It contains an area, or part thereof designated as ‘critical habitat’ under the EPBC Act, or if the site is listed under the Register of National Estate compiled by the Australian Heritage Commission. • It is a site which forms part of, or is connected to a larger area(s) of remnant native vegetation or habitat of national conservation significance such as most National Park, and/or a Ramsar Wetland(s).
State Significance
<p>A site is of State significance if:</p> <ul style="list-style-type: none"> • It occasionally (i.e. every 1 to 5 years) supports, or has suitable habitat to support taxon listed as ‘Critically Endangered’ or ‘Endangered’ under the EPBC Act and/or under National Action Plans. • It regularly supports, or has a high probability of regularly supporting (i.e. high habitat quality) taxon listed as ‘Vulnerable’, ‘Near threatened’, ‘Data Deficient’ or ‘Insufficiently Known’ in Victoria (DSE 2005, 2013), or species listed as ‘Data Deficient’ or ‘Insufficiently Known’ under National Action Plans. • It contains an area, or part thereof designated as ‘critical habitat’ under the FFG Act. • It supports, or likely to support a high proportion of any Victorian flora and fauna taxa. • It contains high quality, intact vegetation/habitat supporting a high species richness and diversity in a particular bioregion. • It is a site which forms part of, or connected to a larger area(s) of remnant native vegetation or habitat of state conservation significance such as most State Parks and/or Flora and Fauna Reserves.
Regional Significance
<p>A site is of Regional significance if:</p> <ul style="list-style-type: none"> • It regularly supports, or has a high probability of regularly supporting regionally significant fauna as defined in Table 1.2. • It contains a large population (i.e. greater than 1% or 5%) of flora considered rare in any regional native vegetation plan for a particular bioregion. • It supports a fauna population with a disjunct distribution, or a particular taxon that has an unusual ecological or biogeographical occurrence. • It is a site which forms part of, or is connected to a larger area(s) of remnant native vegetation or habitat of regional conservation significance such as most Regional Parks and/or Flora and Fauna Reserves.
Local Significance
<p>Most sites are considered to be of at least local significant for conservation, and in general a site of local significance can be defined as:</p> <ul style="list-style-type: none"> • An area which supports indigenous flora species and/or a remnant EVC, and habitats used by locally significant fauna species. • An area which currently acts, or has the potential to act as a wildlife corridor linking other areas of higher conservation significance and facilitating fauna movement throughout the landscape.

Appendix 1.4 – Vegetation Condition and Habitat Quality

Table A1.4.1 Defining Vegetation Condition ratings.

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

Table A1.4.2 Defining Habitat Quality.

Criteria for defining Habitat Quality
<p>High Quality:</p> <ul style="list-style-type: none"> • High degree of intactness (i.e. floristically and structurally diverse), containing several important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • High species richness and diversity (i.e. represented by a large number of species from a range of fauna groups). • High level of foraging and breeding activity, with the site regularly used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing low levels of disturbance and/or threatening processes (i.e. weed invasion, introduced animals, soil erosion, salinity). • High contribution to a wildlife corridor, and/or connected to a larger area(s) of high quality habitat. • Provides known, or likely habitat for one or more rare or threatened species listed under the EPBC Act, FFG Act, or species considered rare or threatened according to DSE 2005; 2009 or 2013.
<p>Moderate Quality:</p> <ul style="list-style-type: none"> • Moderate degree of intactness, containing one or more important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • Moderate species richness and diversity - represented by a moderate number of species from a range of fauna groups. • Moderate levels of foraging and breeding activity, with the site used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing moderate levels of disturbance and/or threatening processes. • Moderate contribution to a wildlife corridor, or is connected to area(s) of moderate quality habitat. • Provides potential habitat for a small number of threatened species listed under the EPBC Act, FFG Act, or species considered rare or threatened according to DSE 2005; 2009 or 2013.
<p>Low Quality:</p> <ul style="list-style-type: none"> • Low degree of intactness, containing few important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • Low species richness and diversity (i.e. represented by a small number of species from a range of fauna groups). • Low levels of foraging and breeding activity, with the site used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing high levels of disturbance and/or threatening processes. • Unlikely to form part of a wildlife corridor, and is not connected to another area(s) of habitat. • Unlikely to provide habitat for rare or threatened species listed under the EPBC Act, FFG Act, or considered rare or threatened according to DSE 2005; 2009 or 2013.

Appendix 1.5 – Exemptions

Table A1.5. Summary of offset requirements (DEPI 2013a)

Risk –based Pathway	Offset Type	Offset Amount (Risk adjusted biodiversity equivalence score)	Habitat for Species	Offset Attributes	
				Vicinity	Strategic Biodiversity Score
Low Risk	General offset	1.5 times the general biodiversity equivalence score of the native vegetation to be removed.	No restrictions	In the same Catchment Management Authority or Local Government Area boundary as the native vegetation to be removed.	At least 80 per cent of the strategic biodiversity score of the native vegetation to be removed.
Moderate or High Risk	General offset	1.5 times the general biodiversity equivalence score of the native vegetation to be removed.	No restrictions	In the same Catchment Management Authority or Local Government Area boundary as the native vegetation to be removed.	At least 80 per cent of the strategic biodiversity score of the native vegetation to be removed.
Moderate or High Risk	Specific offset	For each species impacted, 2 times the specific biodiversity equivalence score of the native vegetation to be removed.	Likely habitat for each rare or threatened species that a specific offset is required for, according to the specific-general offset test.	No restrictions	No restrictions

Appendix 1.6 – FFG Act protected species

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

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

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

Table A1.5 provides a list of plant groups (Families, Genera and Kingdom Divisions) protected under the FFG Act. For threatened plant species likely to occur within the study area refer to Appendix 2 (Significant Flora Species) and for listed communities (or representative species) likely to occur within the study area refer to Section 3.4.3 (State Significant Assessment: Communities).

Table A1.5. Plant groups (Families, Genera and Kingdom Divisions) protected under the FFG Act.

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

APPENDIX 2 - FLORA

Appendix 2.1 – Significant Flora Species

Table A2.2 Significant flora recorded within 10 kilometres of the study area

Likelihood: Habitat characteristics of significant flora species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area were assessed to determine their likelihood of occurrence. The likelihood of occurrence rankings are defined below.

1 - Known occurrence

- Recorded within the study area recently (i.e. within ten years)

2 - High Likelihood

- Previous records of the species in the local vicinity; and/or,
- The study area contains areas of high quality habitat.

3 - Moderate Likelihood

- Limited previous records of the species in the local vicinity; and/or,
- The study area contains poor or limited habitat.

4 - Low Likelihood

- Poor or limited habitat for the species however other evidence (such as a lack of records or environmental factors) indicates there is a very low likelihood of presence.

5 – Unlikely

- No suitable habitat and/or outside the species range.

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	DEPI	Likely occurrence in study area		
							Deans Creek	Barongarook Creek	Special Investigation Areas
NATIONAL SIGNIFICANCE									
<i>Lepidium aschersonii</i>	Spiny Peppergrass	7	2013	VU	L	e	4	4	5

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	DEPI	Likely occurrence in study area		
							Deans Creek	Barongarook Creek	Special Investigation Areas
<i>Senecio psilocarpus</i>	Swamp Fireweed	2	1974	VU	-	v	5	5	5
<i>Dianella amoena</i> #	Matted Flax-lily	-	-	EN	L	e	5	5	5
<i>Eucalyptus strzeleckii</i> #	Strzeleckii Gum	-	-	VU	L	v	5	5	5
<i>Glycine latrobeana</i> #	Clover Glycine	-	-	VU	L	v	5	5	5
<i>Lepidium aschersonii</i> #	Spiny Peppergrass	-	-	VU	L	e	5	5	5
<i>Leucochrysum albicans</i> var. <i>tricolor</i> #	Hoary Sunray	-	-	EN	-	e	5	5	5
<i>Pimelea spinescens</i> subsp. <i>pubiflora</i> #	Wimmera Rice-flower	-	-	CR	L	e	5	5	5
<i>Poa sallacustris</i> #	Salt-lake Tussock-grass	-	-	VU	L	v	5	5	5
<i>Prasophyllum frenchii</i> #	Maroon Leek-orchid	-	-	EN	L	e	5	5	5
<i>Pterostylis cucullata</i> #	Leafy Greenhood	-	-	VU	L	v	5	5	5
<i>Thelymitra matthewsii</i> #	Spiral Sun-orchid	-	-	VU	L	v	5	5	5
STATE SIGNIFICANCE									
<i>Bossiaea cordigera</i>	Wiry Bossiaea	3	2008	-	-	r	5	5	5

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	DEPI	Likely occurrence in study area		
							Deans Creek	Barongarook Creek	Special Investigation Areas
<i>Burnettia cuneata</i>	Lizard Orchid	1	1894	-	-	r	5	5	5
<i>Callitriche brachycarpa</i>	Short Water-starwort	1	1974	-	L	v	5	5	5
<i>Cardamine tenuifolia</i>	Slender Bitter-cress	1	1974	-	-	P	5	5	5
<i>Eucalyptus brookeriana</i>	Brooker's Gum	1	1995	-	-	r	5	5	5
<i>Eucalyptus falciformis</i>	Western Peppermint	4	2007	-	-	r	5	5	5
<i>Eucalyptus yarraensis</i>	Yarra Gum	3	2000	-	-	r	4	4	5
<i>Geranium brevicaule</i>	Alpine Crane's-bill	1	2012	-	-	r	5	5	5
<i>Lemna trisulca</i>	Ivy-leaf Duckweed	1	1979	-	-	k	5	5	5
<i>Lobelia beaugleholei</i>	Showy Lobelia	3	2008	-	-	r	4	5	5
<i>Monotoca glauca</i>	Currant-wood	7	1996	-	-	r	4	5	5
<i>Olearia speciosa</i>	Netted Daisy-bush	5	1979	-	-	k	5	5	4
<i>Olearia stellulata</i>	Starry Daisy-bush	1	1998	-	-	k	5	5	5
<i>Pelargonium littorale</i>	Coast Stork's-bill	1	1974	-	-	k	5	5	5

Scientific name	Common name	Total # of documented records	Last documented record	EPBC	FFG	DEPI	Likely occurrence in study area		
							Deans Creek	Barongarook Creek	Special Investigation Areas
<i>Pleurosorus subglandulosus</i>	Glandular Blanket-fern	1	1770	-	-	k	5	5	5
<i>Ranunculus papulentus</i>	Large River Buttercup	1	2011	-	-	k	5	5	5
<i>Thelymitra orientalis</i>	Hoary Sun-orchid	1	1974	-	-	v	5	5	5
<i>Xanthosia leiophylla</i>	Parsley Xanthosia	2	1979	-	-	r	5	5	5

Notes: EPBC = Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), FFG = Flora and Fauna Guarantee Act 1988 (FFG Act), DSE = Advisory List of Threatened Flora in Victoria (DSE 2005), L = Listed, # = Records identified from EPBC Act Protected Matters Search Tool, * = Records identified from the FIS. Data source: Victorian Biodiversity Atlas (DELWP 2015); Protected Matters Search Tool (DoE 2015). Order: Alphabetical.

APPENDIX 3 - FAUNA

Appendix 3.1 – Significant Fauna Species

Table A3.2. Significant fauna within 10 kilometres of the study area.

Likelihood: Habitat characteristics of significant fauna species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area were assessed to determine their likelihood of occurrence. The likelihood of occurrence rankings are defined below.

1 - High Likelihood

- Known resident in the study area based on site observations, database records, or expert advice; and/or,
- Recent records (i.e. within five years) of the species in the local area (DELWP 2015); and/or,
- The study area contains the species' preferred habitat.

2 - Moderate Likelihood

- The species is likely to visit the study area regularly (i.e. at least seasonally); and/or,
- Previous records of the species in the local area (DELWP 2015); and/or,
- The study area contains some characteristics of the species' preferred habitat.

3 - Low Likelihood

- The species is likely to visit the study area occasionally or opportunistically whilst en route to more suitable sites; and/or,
- There are only limited or historical records of the species in the local area (i.e. more than 20 years old); and/or,
- The study area contains few or no characteristics of the species' preferred habitat.

4 - Unlikely

- No previous records of the species in the local area; and/or,
- The species may fly over the study area when moving between areas of more suitable habitat; and/or,
- Out of the species' range; and/or,
- No suitable habitat present.

Common Name	Scientific Name	Last Documented Record (VBA)	# Records (VBA)	EPBC Act	FFG ACT	DSE (2013)	National Action Plan	Likelihood		
								Deans Creek	Barongarook Creek and LCBR (*)	Special Investigation Areas
NATIONAL SIGNIFICANCE										
Spot-tailed Quoll	<i>Dasyurus maculatus maculatus</i>	1989	7	EN	L	EN	VU	4	4	4
Southern Brown Bandicoot	<i>Isodon obesulus obesulus</i>	1974	2	EN	L	NT	NT	4	4	4
Eastern Barred Bandicoot	<i>Perameles gunnii</i>	1997	16	EN	L	WX	CR	4	4	4
Long-nosed Potoroo	<i>Potorous tridactylus tridactylus</i>	2001	13	VU	L	NT	EN	4	4	4
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	2004	3	VU	L	VU	VU	3	3	3
Smoky Mouse #	<i>Pseudomys fumeus</i>	-	-	EN	L	EN	RA	4	4	4
Fairy Prion	<i>Pachyptila turtur</i>	2000	1	VU	-	VU	-	4	4	4
Southern Bent-wing Bat #	<i>Miniopterus schreibersii bassanii</i>	-	-	CR	L	CR	CD	4	4	4
Australasian Bittern	<i>Botaurus poiciloptilus</i>	2000	4	EN	L	EN	VU	4	4	4
Plains-wanderer	<i>Pedionomus torquatus</i>	1984	1	CR	L	CR	EN	4	4	4
Australian Painted Snipe	<i>Rostratula australis</i>	1980	1	VU	L	CR	VU	4	4	4
Superb Parrot	<i>Polytelis swainsonii</i>	1996	1	VU	L	EN	VU	4	4	4
Swift Parrot #	<i>Lathamus discolor</i>	-	-	EN	L	EN	EN	4	4	4
Rufous Bristlebird (Otways subsp.)	<i>Dasyornis broadbenti caryochrous</i>	1991	4	-	L	NT	VU	4	4	4
Regent Honeyeater	<i>Anthochaera phrygia</i>	1982	2	CR	L	CR	EN	4	4	4
Painted Honeyeater #	<i>Grantiella picta</i>	-	-	VU	L	VU	NT	4	4	4

Common Name	Scientific Name	Last Documented Record (VBA)	# Records (VBA)	EPBC Act	FFG ACT	DSE (2013)	National Action Plan	Likelihood		
								Deans Creek	Barongarook Creek and LCBR (*)	Special Investigation Areas
Striped Legless Lizard #	<i>Delma impar</i>	-	-	VU	L	EN	VU	4	4	3
Corangamite Water Skink	<i>Eulamprus tympanum marnieae</i>	2006	15	EN	L	CR	-	4	4	4
Growling Grass Frog	<i>Litoria raniformis</i>	2001	6	VU	L	EN	VU	3	3*	2
Dwarf Galaxias #	<i>Galaxiella pusilla</i>	-	-	VU	L	EN	VU	3	3*	3
Australian Grayling	<i>Prototroctes maraena</i>	1867	1	VU	L	VU	VU	4	4	4
Murray Cod	<i>Maccullochella peelii</i>	1981	3	VU	L	VU	-	4	4	4
Macquarie Perch	<i>Macquaria australasica</i>	1970	1	EN	L	EN	DD	4	4	4
Yarra Pygmy Perch	<i>Nannoperca obscura</i>	2000	3	VU	L	VU	VU	3	3*	3
Golden Sun Moth #	<i>Synemon plana</i>	-	-	CR	L	CR	-	4	4	3
STATE SIGNIFICANCE										
White-footed Dunnart	<i>Sminthopsis leucopus</i>	1963	1	-	L	NT	DD	4	4	4
Yellow-bellied Sheathtail Bat	<i>Saccolaimus flaviventris</i>	1969	1	-	L	DD	LC	3	3	3
Broad-toothed Rat	<i>Mastacomys fuscus mordicus</i>	1971	1	-	L	EN	-	4	4	4
Magpie Goose	<i>Anseranas semipalmata</i>	1998	13	-	L	NT	-	4	4	3
Musk Duck	<i>Biziura lobata</i>	2001	60	-	-	VU	-	4	3*	3
Freckled Duck	<i>Stictonetta naevosa</i>	2002	14	-	L	EN	-	4	3*	3
Australasian Shoveler	<i>Anas rhynchos</i>	2005	81	-	-	VU	-	4	3*	3

Common Name	Scientific Name	Last Documented Record (VBA)	# Records (VBA)	EPBC Act	FFG ACT	DSE (2013)	National Action Plan	Likelihood		
								Deans Creek	Barongarook Creek and LCBR (*)	Special Investigation Areas
Hardhead	<i>Aythya australis</i>	2006	79	-	-	VU	-	4	3*	3
Blue-billed Duck	<i>Oxyura australis</i>	2000	13	-	L	EN	-	4	3*	3
White-throated Needletail	<i>Hirundapus caudacutus</i>	2001	21	-	-	VU	-	4	4	4
Eastern Great Egret	<i>Ardea modesta</i>	2006	99	-	L	VU	-	3	3*	3
Intermediate Egret	<i>Ardea intermedia</i>	2000	2	-	L	EN	-	3	3*	3
Little Egret	<i>Egretta garzetta nigripes</i>	2002	3	-	L	EN	-	3	3	3
Grey Goshawk	<i>Accipiter novaehollandiae novaehollandiae</i>	2006	50	-	L	VU	-	3	3	3
Black Falcon	<i>Falco subniger</i>	1986	2	-	-	VU	-	3	3	2
Brolga	<i>Grus rubicunda</i>	2008	67	-	L	VU	-	4	4	2
Baillon's Crake	<i>Porzana pusilla palustris</i>	1980	1	-	L	VU	-	3	3*	4
Common Greenshank	<i>Tringa nebularia</i>	1989	4	-	-	VU	-	4	4	4
Marsh Sandpiper	<i>Tringa stagnatilis</i>	1979	3	-	-	VU	-	4	4	4
Red Knot	<i>Calidris canutus</i>	1980	1	-	-	EN	-	4	4	4
Gull-billed Tern	<i>Gelochelidon nilotica macrotarsa</i>	2000	11	-	L	EN	-	4	4	4
Caspian Tern	<i>Hydroprogne caspia</i>	2001	5	-	L	NT	-	4	4	4
Powerful Owl	<i>Ninox strenua</i>	2004	8	-	L	VU	-	4	4	4
Masked Owl	<i>Tyto novaehollandiae novaehollandiae</i>	1956	1	-	L	EN	NT	3	3	4

Common Name	Scientific Name	Last Documented Record (VBA)	# Records (VBA)	EPBC Act	FFG ACT	DSE (2013)	National Action Plan	Likelihood		
								Deans Creek	Barongarook Creek and LCBR (*)	Special Investigation Areas
Swamp Skink	<i>Lissolepis coventryi</i>	1988	1	-	L	VU	-	3	3	4
Southern Toadlet	<i>Pseudophryne semimarmorata</i>	2001	14	-	-	VU	-	3	3	4
Freshwater Catfish	<i>Tandanus tandanus</i>	1981	2	-	L	EN	-	3	3	4
Southern Pygmy Perch	<i>Nannoperca australis</i>	2007	62	-	-	-	-	2	2*	4
Otway Crayfish	<i>Geocharax gracilis</i>	2002	14	-	-	EN	-	4	4	4
Riffle Beetles	<i>supf. Byrrhoidea fam. Elmidae</i>	1999	1	-	-	-	-	4	4	4
REGIONAL SIGNIFICANCE										
Fat-tailed Dunnart	<i>Sminthopsis crassicaudata</i>	1998	4	-	-	NT	-	4	4	3
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	1988	2	-	-	NT	-	4	4	4
Pied Cormorant	<i>Phalacrocorax varius</i>	2006	27	-	-	NT	-	3	3	2
Nankeen Night Heron	<i>Nycticorax caledonicus hillii</i>	2002	20	-	-	NT	-	3	3*	4
Glossy Ibis	<i>Plegadis falcinellus</i>	2002	3	-	-	NT	-	3	3*	4
Royal Spoonbill	<i>Platalea regia</i>	2003	25	-	-	NT	-	3	3	2
Latham's Snipe	<i>Gallinago hardwickii</i>	2003	19	-	-	NT	-	4	1 *	4
Pectoral Sandpiper	<i>Calidris melanotos</i>	1986	1	-	-	NT	-	4	4	4
Whiskered Tern	<i>Chlidonias hybridus javanicus</i>	2008	45	-	-	NT	-	4	1	4
Pacific Gull	<i>Larus pacificus pacificus</i>	1993	1	-	-	NT	-	4	4	4

Common Name	Scientific Name	Last Documented Record (VBA)	# Records (VBA)	EPBC Act	FFG ACT	DSE (2013)	National Action Plan	Likelihood		
								Deans Creek	Barongarook Creek and LCBR (*)	Special Investigation Areas
Azure Kingfisher	<i>Alcedo azurea</i>	1999	2	-	-	NT	-	2	2	4
Long-necked Turtle	<i>Chelodina longicollis</i>	1995	2	-	-	DD	-	2	2	4
River Blackfish	<i>Gadopsis marmoratus</i>	2002	14	-	-	-	-	2	2	4
Golden Perch	<i>Macquaria ambigua</i>	1981	3	-	-	NT	-	3	3	4
Whirligig Beetles	<i>supf. Caraboidea fam. Gyrinidae</i>	1999	1	-	-	-	-	4	4	4

Note (1): LCBR = Lake Colac Bird Reserve (*)

Note (2) : EPBC = Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), FFG = Flora and Fauna Guarantee Act 1988 (FFG Act), DSE = Advisory List of Threatened Flora in Victoria (DSE 2014), # = Records identified from EPBC Act Protected Matters Search Tool, L = Listed. Data sources: Victorian Biodiversity Atlas (DELWP 2015); Victorian Fauna Database (Viridans 2014b); Protected Matters Search Tool (DoE 2015). Taxonomic order: Mammals (Strahan 1995 in Menkhorst & Knight 2004); Birds (Christidis & Boles, 2008); Reptiles and Amphibians (Cogger et al. 1983 in Cogger 1996); Fish (Nelson 1994); Mussels & Crustaceans (Alphabetical); Invertebrates (Alphabetical).

Data source: Victorian Biodiversity Atlas (DELWP 2015); Victorian Fauna Database (Viridans 2011b); Protected Matters Search Tool (DoE 2015).

Appendix 3.2 – Growling Grass Frog Survey Conditions

Table S3.2. Climatic survey results during targeted surveys

Survey/ Date	Weather conditions ¹						Growling Grass Frog
	Survey Temp °C (max/min)	Wind direction	Wind speed (km/hr)	Relative Humidity (%)	Cloud Cover (%)	Rain (mm)	
1 - 1/12/2015	19.6 (20.4/8.5)	NNW	15	63	60	0.4	0
2 - 2/12/2015	16 (17.8/4.1)	SW	10	69	5	0.2	0

Note: 1. Bureau of Meteorology (BOM) weather Colac (Mt Gellibrand – Station 090035 for December 2015), Australian Government, ACT. **Note:** temperatures are likely to be cooler than the actual temperatures within Colac given the altitude of the weather station.