

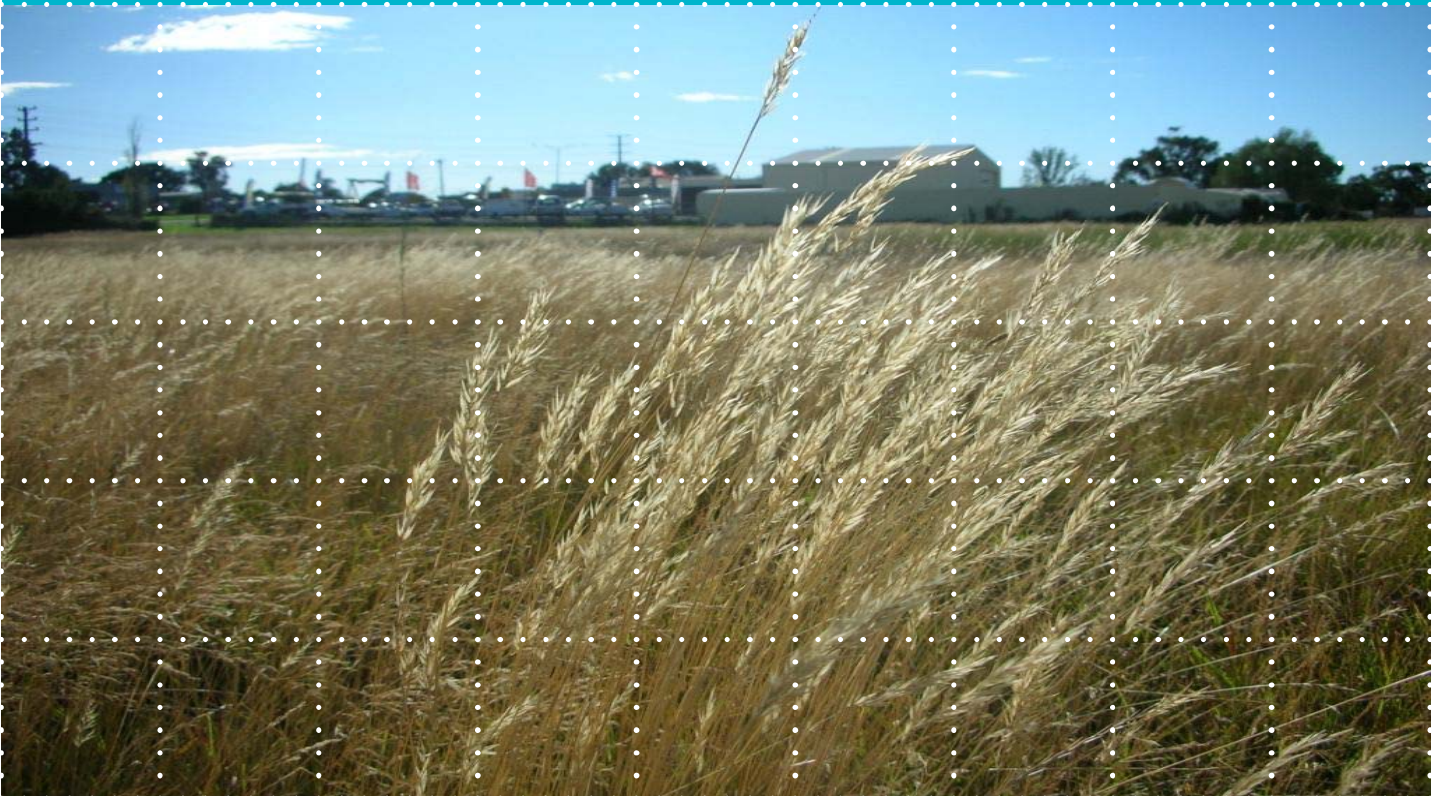
DRAFT REPORT:

# Biodiversity Assessment Report: Officer Precinct Structure Plan, Officer, Victoria

PREPARED FOR:

**Growth Areas Authority**

May 2011



**Ecology Partners Pty Ltd**

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**Cover Photos:** Ecological values within the study area (Ecology Partners Pty Ltd)

*The following personnel from Ecology Partners Pty Ltd were involved in the project: Aaron Organ, Andrew Taylor, Bryan Roberts, Jenna Forbes, Kailash Willis, Ian Wheatland, Matt Hatton, Cameron Amos, Ross Dennis, Simon Scott, and Amanda Feetham.*

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## SUMMARY

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### Introduction

Ecology Partners Pty Ltd was commissioned by Cardinia Shire Council on behalf of the Growth Areas Authority (GAA) to undertake flora and fauna surveys as part of the Officer Precinct Structure Plan (PSP), Officer, Victoria. This region is part of the much larger Casey-Cardinia growth area, which is located south-east of Melbourne. The surveys comprise two separate tasks; preliminary flora and fauna surveys and targeted surveys for significant threatened species.

### Preliminary Flora and Fauna Surveys

The purpose of the preliminary flora and fauna assessment was to:

- Identify terrestrial and aquatic flora or fauna species and ecological communities of conservation significance within the study area; and,
- Identify potential impacts and mitigation measures associated with the proposed development of the Precinct.

### Targeted Flora and Fauna Surveys

Significant species are defined as those currently listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Flora and Fauna Guarantee Act 1988* (FFG Act) and the Department of Sustainability and Environment's (DSE) *Threatened Species Advisory List*.

Targeted surveys were undertaken to identify any areas within the study area that may currently support significant species and to provide information in relation to potential impacts and mitigation measures associated with the future development of the study area.

### Study Area

The Officer Precinct is approximately 50 kilometres south-east of the Melbourne CBD. It encompasses the area bound by Brown Road to the north, Cardinia Creek and the suburb of Beaconsfield to the west, Gum Scrub Creek to the east and Pakenham Bypass to the south.

### Methods

A range of techniques were used to record the flora and fauna of the study area. All of the methods used are commonly implemented in surveys such as the present study and result in a comprehensive representation of the ecological values of the study area. Other techniques were employed to detect significant species.

These techniques were in accordance with the DSE guidelines outlined in the *Biodiversity Precinct Planning Kit 2010* (DSE 2010a).

## Results

### *Preliminary Flora and Fauna Assessment*

#### *Flora*

A total of 327 plant taxa (215 indigenous and 112 exotic) were recorded in the study area during the current assessment (Appendix 2.1).

Planted trees and shrubs were not recorded unless they were seen to be naturally spreading on site.

The majority of the study area has been highly modified by past and current agricultural practices; as a result much of the area is dominated by exotic pasture grasses. Remnant native vegetation within the study area typically occurs within small isolated patches along roadsides and within rail reserves. However, a few larger, fragmented patches of remnant vegetation do occur, predominantly in the north and north-west of the Precinct. Indigenous species in these patches comprise Swamp Gum *Eucalyptus ovata*, Narrow-leaved Peppermint *Eucalyptus radiata*, Blackwood *Acacia melanoxylon*, Black Wattle *Acacia mearnsii*, Swamp Paperbark *Melaleuca ericifolia* and Spiny-headed Mat-rush *Lomandra longifolia*. However, these species are generally sparse within the study area.

#### *Fauna*

Eighty-four fauna species (64 native birds and seven introduced) were recorded in the current survey. In addition, three native mammal species (Common Brushtail Possum *Trichosurus vulpecula*, White-striped Freetail Bat *Tadarida australis*, Black Wallaby *Wallabia bicolor*) and four introduced mammals (Red Fox *Vulpes vulpes*, European Hare *Lepus europeus*, European Rabbit *Oryctolagus cuniculus* and House Mice *Mus musculus*) were recorded within the study area.

There were six native frog species including Southern Bullfrog *Limnodynastes dumerilii*, Striped Marsh Frog *Limnodynastes peronii* and Spotted Marsh Frog *Limnodynastes tasmaniensis* were recorded within the study area. Additional species adapted to modified areas are likely to use the study area.

### *Targeted Flora and Fauna Surveys*

#### *Flora*

Targeted surveys were undertaken for significant flora species including Matted Flax-lily *Dianella amoena*, Green Scentbark *Eucalyptus fulgens*, Swamp Everlasting *Xerochrysum palustre*, River Swamp Wallaby-grass *Amphibromus fluitans*, Veined Spear-grass

*Austrostipa rudis* subsp. *australis*, Arching Flax-lily *Dianella* sp. aff. *longifolia* and Maroon Leek-orchid *Prasophyllum frenchii*.

Four significant species were recorded within the Precinct: Matted Flax-lily, Arching Flax-lily, Veined Spear-grass and Green Scentbark. Significant species previously recorded within the Precinct include Purple Diuris *Diuris punctata*, Maroon Leek-orchid, Veined Spear-grass; Matted Flax-lily. The lack of suitable habitat for significant flora species not detected during the surveys, and the high level of survey intensity, suggests that there is a low likelihood of any additional significant flora species to occurring within the Precinct.

### *Fauna*

No significant fauna were recorded within the precinct during the current targeted surveys. There are previous records for the nationally significant Growling Grass Frog, focused around the south east of the precinct, with Dwarf Galaxias in the waterbodies and anabranches in the floodplain of Cardinia Creek.

There is also suitable habitat for other significant fauna species including Glossy Grass Skink, Southern Brown Bandicoot, Swamp Skink and Southern Toadlet.

A number of state significant bird species including; Eastern Great Egret *Ardea modesta*, Australian Shoveler *Anas rhynchos*, Freckled Duck *Stictonetta naevosa*, Blue-billed Duck *Oxyura australis*, Hardhead *Aythya australis*, Baillon's Crake *Porzana pusilla* and Royal Spoonbill *Platalea regia* may occasionally use farm dams, drainage lines and other low lying areas within the study for foraging purposes. Powerful Owl *Ninox strenua* may also use remnant vegetation in the north west corner of the Precinct for roosting or foraging purposes on the occasional basis.

Latham's Snipe *Gallinago hardwickii* were recorded during recent surveys along the Cardinia Creek corridor within freshwater wetlands. Spotted Harrier *Circus assimilis* may forage over open grassland, crops and windbreaks throughout the study area. Spotted Quail-thrush *Cinlosoma punctatum* may enter preferred habitat in the north western section of the study area on the occasional basis.

There is a low likelihood that other significant species use areas of the Precinct on a permanent basis for breeding or foraging purposes.

### **Conclusion**

As a number of threatened flora and fauna species have been recorded within or adjacent to the study area, any development within the study area may have a significant impact on one or more of these species.



Melbourne's Strategic Assessment applies to the Officer precinct as it is included in the existing 28 precincts that were approved by the Commonwealth Government for urban development in July 2010. Future planning for the precinct must be in accordance with Melbourne's Strategic Assessment including the approved prescriptions and *Delivering Melbourne's Newest Sustainable Communities Program Report, (The Program)* (DPCD 2009).

## 1 INTRODUCTION

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### 1.1 Project Background

Ecology Partners Pty Ltd was commissioned by Cardinia Shire Council on behalf of the Growth Areas Authority (GAA) to undertake flora and fauna surveys as part of the Officer Precinct Structure Plan (PSP), Officer, Victoria. This region is a part of the much larger Casey-Cardinia growth area, which is located in the south-eastern suburbs of Melbourne. The surveys comprised two separate tasks; preliminary flora and fauna surveys and targeted surveys for significant threatened species.

### 1.2 Preliminary Flora and Fauna Surveys

The purpose of the preliminary flora and fauna assessment was to:

- Identify terrestrial and aquatic flora and fauna species within the study area
- Identify ecological communities of conservation significance within the study area; and,
- Identify potential impacts and mitigation measures associated with the proposed development of the Precinct.

#### 1.2.1 Targeted Flora and Fauna Surveys

Significant species are defined as those currently listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Flora and Fauna Guarantee Act 1988* (FFG Act) and the Department of Sustainability and Environment's (DSE) *Threatened Species Advisory List*.

Targeted surveys were undertaken to identify any areas within the study area which may currently support significant species, and to provide information in relation to potential impacts and mitigation measures associated with the future development of the study area.

##### 1.2.1.1 Flora

Targeted surveys were undertaken for significant flora species including; Matted Flax-lily *Dianella amoena*, Green Scentbark *Eucalyptus fulgens*, Swamp Everlasting *Xerochrysum palustre*, River Swamp Wallaby-grass *Amphibromus fluitans*, Veined Spear-grass *Austrostipa rudis* subsp. *australis*, Arching Flax-lily *Dianella* sp. aff *longifolia* and Maroon Leek-orchid *Prasophyllum frenchii*.

### 1.2.1.2 Fauna

Targeted surveys were undertaken for significant fauna species including; Southern Brown Bandicoot *Isoodon obesulus obesulus*, Growling Grass Frog *Litoria raniformis*, Dwarf Galaxias *Galaxias pusilla*, Australian Grayling *Prototoctes maraena*, Swamp Skink *Egernia coventryi*, Glossy Grass Skink *Pseudemoia rawlinson* and Southern Toadlet *Pseudophryne semimarmorata*.

## 1.3 Objectives

The objectives of this report are in accordance with the prescriptions outlined within the *Biodiversity Precinct Planning Kit* (DSE 2010a).

The scope of work included the following:

- Identify, assess, and map significant flora, fauna and habitat in the study area and their level of conservation significance.
- Review the relevant flora and fauna databases [e.g. Atlas of Victoria Wildlife (AVW) and Flora Information System (FIS)] and available literature.
- Conduct site surveys to identify flora and fauna habitat values within the study area and ensure significant values are integrated within the planning and development of the study area.
- Identify any significant communities or populations of indigenous flora and fauna species to a sufficient level of detail to enable a Precinct Structure Plan to be developed.
- Recommend relevant mitigation measures to ensure biodiversity values within the study area are designed and maintained to reduce the potential impact on biodiversity values.
- Ensure the development of the study area is able to comply with Government legislative and policy requirements on the protection of indigenous fauna and flora species and communities.

## 1.4 Study Area

The Officer Precinct is approximately 50 kilometres south-east of the Melbourne CBD. It encompasses the area bounded by Browns Road to the north, Cardinia Creek and the suburb of Beaconsfield to the west, Gum Scrub Creek to the east and Pakenham Bypass to the south, (Figure 1). The study area, to the north and south of the Princess Highway, consists of predominantly privately owned agricultural land, homesteads, and low density residential blocks.

While most of the Precinct is relatively flat, it gently slopes from north to south. There are more than 30 dams, multiple drainage lines along the rail corridor (which are mostly ephemeral), as well as Cardinia and Gum Scrub Creeks.

The study area is divided between two bioregions (DSE 2010b). The flats within the Precinct are within the Gippsland Plain Bioregion, which extends from Port Phillip Bay in the west, to Bairnsdale in the east, between the southern slopes of the Great Dividing Range and Wilsons Promontory, excluding the Strzelecki Ranges. The hills within the Precinct, which rise to the north of the study area, are within the Highlands – Southern Fall Bioregion which includes the mountain ranges and associated foothills on the southern aspect of the Great Dividing Range and extends from Melbourne in the west to close to the NSW border in the east.

## 1.5 Threatened Flora Species

### 1.5.1 Matted Flax-lily *Dianella amoena*

Plate 1: Matted Flax-lily, *Dianella amoena* (Ecology Partners Pty Ltd 2008)

- *EPBC Act Conservation Status:*  
Endangered
- *DSE 2005 Conservation Status:*  
Endangered
- *FFG Act Conservation Status:* Listed



#### 1.5.1.1 Species Description

Matted Flax-lily is a tufted perennial lily which can form loose ‘mats’ up to five metres wide or grow individually (Carr and Horsfall 1995).

The leaves are grey-green in colour, narrow and linear approximately 40 centimetres in length (relatively small for a *Dianella* spp.) and taper to point (Plate 1). Ranging between 4–12 millimetres in width, leaves are broadly V-shaped to flat and the margins of leaf blades, sheaths and midribs exhibit distinguishing small, irregularly-spaced teeth (Carr and Horsfall 1995; FIS 2009).

Flowering occurs from October to April with flower stems reaching 20 to 90 centimetres long. The flowers are large, star-shaped, nodding and sweetly fragrant with petals that are pale to deep blue violet and bend backwards towards the stem.

Each flower has six stamens with bright orange strumae before the anther; the anther is lime yellow (Plate 1). The species can be summer deciduous, depending on conditions and will die back to a tuberous rootstock (Gray and Knight 2001).

#### **1.5.1.2 Habitat**

Matted Flax-lily typically occur in grasslands, grassy woodlands and in grassy wetlands in Victoria and Tasmania (Carter 2005). Grasses typically dominate the understorey layer (Carr and Horsfall 1995), including native species such as Kangaroo Grass *Themeda triandra*, Weeping Grass *Microlaena stipoides* var. *stipoides*, Common Wheat Grass *Elymus scaber* var. *scaber*, Common Tussock-Grass *Poa labillardierei*, and Stiped Wallaby-grass *Austrodanthonia racemosa* var. *racemosa*. In grassy woodlands, a variety of eucalypt species dominate, with Blackwood *Acacia melanoxylon* a common understorey plant at many sites (Carter 2005).

The Matted Flax-lily is a plant of well-drained, to seasonally waterlogged, fertile, sandy loams, to heavy cracking clays: most Victorian populations have been recorded from within volcanic geology (Carr and Horsfall 1995).

Extant populations are clearly fragments of much larger populations that have persisted in highly degraded vegetation, with most known populations recorded within extremely weedy and grossly degraded vegetation on occasion with a known a history of stock grazing and regular mowing (Carr and Horsfall 1995).

#### **1.5.1.3 Distribution**

The current known distribution of Matted Flax-lily extends from Mortlake in western Victoria to Sale in east Gippsland, with further disjunct populations in the north east of Victoria around Benambra (FIS 2009) and in Canberra (Geoff Carr pers. com.).

#### **1.5.1.4 Threats**

As Matted Flax-lily populations commonly occur within highly degraded, semi-urban grassland areas, threats to the survival of the species are similar to threats faced by other rare or threatened grassland flora species associated with native grassland communities.

Typical threats listed in the *Draft Recovery Plan* for the species (Carter 2005) include:

- Weed invasion;
- Reservation status;
- Vegetation clearance for urban development;
- Small population size;
- Inappropriate roadside/railway maintenance; and,
- Inappropriate biomass reduction/fire regimes.

## 1.5.2 Green Scentbark *Eucalyptus fulgens*

- *DSE 2005 Conservation Status*: Rare

**Plate 2:** Green Scentbark *Eucalyptus fulgens* (Ecology Partners Pty Ltd)



### 1.5.2.1 *Species Description*

Green Scentbark is a spreading tree which grows to 20 metres tall. Its leaves are a dark glossy green, which grow to 18 centimetres long and 1.8 centimetres wide (Plate 2). Buds occur in clusters of seven, and fruiting capsules take a hemispherical, cup-like shape. Flowering period is in autumn, with pale flowers. The trunk is covered with fissured, brittle bark, which covers all but the smallest branches. The bark is aromatic when handled, producing a distinct eucalyptus scent (Costermans 2000; FIS 2009).

### 1.5.2.2 *Habitat*

While habitat preferences is largely unknown, it has been noted that the tree is more likely to occur at the bottom of a slope where ground moisture is greater, than on a hill or incline (this study).

### 1.5.2.3 *Distribution*

The current known distribution of Green Scentbark is confined to south east Victoria, with populations existing from Healesville to the Latrobe Valley (Walsh and Entwisle 1996). There are 18 previously documented records of Green Scentbark within a 10 kilometre radius of Officer (FIS 2009; Figure 4).

### 1.5.2.4 *Threats*

Possible threats include damage to the root zone by livestock such as horses and cattle, and damage to limbs from urban development.

### 1.5.3 Swamp Everlasting *Xerochrysum palustre*

**Plate 3:** Swamp Everlasting *Xerochrysum palustre* (DSE 2009a).

- *EPBC Act Conservation Status:* Vulnerable
- *FFG Act:* Listed
- *DSE 2005 Conservation Status:* Vulnerable



#### 1.5.3.1 *Species Description*

The Swamp Everlasting is a perennial herb with a flowering stem which grows to one metre tall (FIS 2009). Leaves grow from three to 10 centimetres long and have hairs on the margins. Flowering season ranges from November to March, flowers consisting of a tight button of yellow florets surrounded by bright yellow papery bracts one to 2.5 centimetres long, forming a flower up to five centimetres across (Plate 3).

#### 1.5.3.2 *Habitat*

The Swamp Everlasting inhabits lowland swamps, wetlands and black cracking clay soils.

#### 1.5.3.3 *Distribution*

Distribution of the Swamp Everlasting in Victoria is restricted to the southern areas of high rainfall, from Portland in the west, to Bairnsdale in the east.

#### 1.5.3.4 *Threats*

The Swamp Everlasting was once widespread across Victoria, however due to removal of native vegetation throughout its distribution it is now listed as rare by the DSE. The biggest threat to remnant populations is the further habitat depletion across the state.

### 1.5.4 River Swamp Wallaby-grass *Amphibromus fluitans*

- *EPBC Act Conservation Status:* Vulnerable

#### 1.5.4.1 *Species Description*

River Swamp Wallaby-grass is a perennial aquatic grass with stoloniferous (sprawling), tufted stems to 1.2 metres long. Leaves are smooth and flat, and the inflorescence is open and often drooping, with five to twelve flowers per spikelet.

#### **1.5.4.2 Habitat**

The grass is confined to swamps and waterbodies, and is commonly found growing around farm dams, or seasonally swampy ground.

#### **1.5.4.3 Distribution**

The species has a scattered distribution within the Melbourne region, with only several records through the local area. River Swamp Wallaby-grass has not previously been recorded within the Officer area, however it has been found in nearby Cranbourne. Within Victoria it has a much greater distribution north of the divide along rivers and within associated floodplains and billabongs. It is also known from New South Wales, Tasmania and South Australia.

#### **1.5.4.4 Threats**

Loss of habitat is the primary threat to populations of River Swamp Wallaby-grass.

### **1.5.5 Veined Spear-grass      *Austrostipa rudis* subsp. *australis***

- *DSE 2005 Conservation Status*: Vulnerable

#### **1.5.5.1 Species Description**

Veined Spear-grass is a tufted grass which grows to 1.3 metres tall. Leaves are usually rough, sometimes with small hairs. Inflorescences are open panicles to 50 centimetres long. Flowering period is typically from November to January.

#### **1.5.5.2 Habitat**

Veined Spear-grass prefers sandy soils in areas of cool climate and moderate altitudes (Walsh and Entwisle 1994a; 1996), and has been recorded in open-forest environments.

#### **1.5.5.3 Distribution**

The current known distribution of Veined Spear-grass is across southern Victoria, from Nelson in the west to Mallacoota in the east.

It is regarded as uncommon by Walsh and Entwisle (1994a; 1996). There are five previous records listed on the FIS (2009) of Veined Spear-grass in the Officer area, and more recently the species has been recorded during previous flora and fauna surveys (Biosis Research Pty Ltd 2004) (Figure 3a–3d).

Veined Spear-grass is known to occur along Stephens Road and Rix Road Reserves, and also in areas of Plains Grassland within the Precinct.



#### 1.5.5.4 Threats

Like many grassland species, Veined Spear-grass is under threat from ongoing loss of habitat throughout the species' distribution.

#### 1.5.6 Arching Flax-lily *Dianella* sp. aff. *longifolia* (Benambra)

- *DSE 2005 Conservation Status*: Vulnerable

**Plate 4:** Arching Flax-lily *Dianella* sp. aff. *longifolia* (Benambra) (Ecology Partners Pty Ltd 2008b).



##### 1.5.6.1 Species Description

Plants grow in a loose colony that can spread to a metre and can be composed of up to 10 tufts consisting of three or four leaves connected by underground rhizomes. Leaves are generally blue, 20–50 centimetres long, thick with sparse teeth on the margins and underside midrib. Flowers are pale to sky blue-violet and sepals creamy-green and have large yellow swellings (strumae) on the lower anthers (Plate 4). Flowers open in mid afternoon in warm and humid conditions from mid-November to early January. Flowering culmens are two to three times the height of the leaves, normally exceed one metre and are arching, while its berries remain green unlike other *Dianella* species.

##### 1.5.6.2 Habitat

Arching Flax-lily prefers rocky outcrops in open forests, and is found at higher altitudes than other variations of Pale Flax-lily.

##### 1.5.6.3 Distribution

The current known distribution of this species may well underestimate its spread across the state, which is currently thought to be north of Melbourne and the districts surrounding Omeo and Benambra. A more accurate description of this species' distribution will become available as the species becomes better known.

Several Arching Flax-lily specimens have previously been recorded on Rix Road, McMullen Road, and along the railway line within the Precinct (FIS 2009; Figure 3a–3d).

#### 1.5.6.4 Threats

Lack of species description and knowledge could make it more susceptible to habitat and population loss in the future.

### 1.5.7 Maroon Leek Orchid *Prasophyllum frenchii*

- *EPBC Act Conservation Status*: Endangered
- *DSE 2005 Conservation Status*: Vulnerable
- *FFG Act Conservation Status*: Listed

#### 1.5.7.1 Species Description

The Maroon Leek-orchid emerges annually from an underground tuber, and is pollinated by nectarivorous insects. Leaves are generally solitary or located at the base of the plant to 20 centimetres long (Walsh and Entwisle 1994a; 1996) (Plate 5). Flowering season lasts from October to November, and plants have robust flowering stems to 60 centimetres tall, and occasionally to one metre.

Flowers are green with maroon markings, or entirely maroon, and are fragrant, variable in colour, and can be in a loose or dense spike arrangement (Plate 5). Numbers of flowers range between 20 and 60 per plant (FIS 2009).

**Plate 5:** Maroon Leek Orchid *Prasophyllum frenchii* (DSE 2003).



#### **1.5.7.2 Habitat**

Maroon Leek-orchid prefers coastal or near-coastal swamps, usually not located more than 10 kilometres inland from these areas.

#### **1.5.7.3 Distribution**

The currently known distribution is restricted to southern Victoria, and ranges from the Victorian–South Australian border, to Bairnsdale in the east. One specimen of Maroon Leek-orchid has been previously recorded within Officer, along Browns Road (Figure 3a–3d). It is possible that there are other specimens present further along this road, or along the Gippsland railway line.

#### **1.5.7.4 Threats**

Threats to populations of the Maroon Leek-orchid include loss of habitat, associated with disturbances such as weed invasion, soil disturbance, vegetation clearance, urban development, and grazing by stock or introduced pests such as rabbits.

### **1.5.8 Purple Diuris *Diuris punctata* var *punctata***

*DSE 2005 Conservation Status:* Vulnerable

*FFG Act Conservation Status:* Listed

#### **1.5.8.1 Species Description**

Purple Diuris is considered to be vulnerable within Victoria and is also listed under the FFG Act (DSE 2005b). Purple Diuris is a deciduous, terrestrial orchid which grows to 50 centimetres in height with 1–10 large, purple flowers on erect, hairless stems. The leaves are linear to 25 centimetres long and 5 millimetres wide, and number between 1–3. The flowers are pale purple and 50 millimetres across and flower in October and November (FIS 2009).

#### **1.5.8.2 Occurrence within the Precinct**

This species has previously been recorded between 1982 and 1986 within the southern section of the rail reserve, west of Brunt Road (FIS 2009) (Figure 3c). However previous surveys by both Biosis Research (2004, 2006) and Ecology Partners (2010a) have failed to locate any Purple Diuris individuals at this location, or anywhere else within the Precinct. Like the Maroon Leek-orchid, it will be noted that this is a small and inconspicuous species and therefore individuals may still be present within the Precinct.

### 1.5.8.3 Distribution

Together with the FIS record within the Precinct, there are a total of ten records of this species in the local area (i.e. within a 10 kilometre radius).

The date of these records range from 1887 to 1968. Therefore the persistence of this species within the Precinct is considered unlikely, due to the threatening processes listed below.

### 1.5.8.4 Threats

Threats to populations of the Purple Diuris include loss of habitat associated with disturbances such as weed invasion, soil disturbance, vegetation clearance, urban development, and grazing by stock or introduced pests such as rabbits.

## 1.6 Threatened Fauna Species

### 1.6.1 Southern Brown Bandicoot *Isoodon obesulus obesulus*

- *EPBC Act Conservation Status*: Endangered
- *FFG Act Conservation Status*: Invalid
- *DSE 2007 Conservation Status*: Near Threatened
- *National Action Plan Conservation Status*: Near Threatened

**Plate 6:** Southern Brown Bandicoot, *Isoodon obesulus obesulus* (Strahan 2004).



Southern Brown Bandicoot has coarse, brindled, dark grey to yellow-brown fur on its back, with creamy white feet and underbelly (Plate 6). Ears are short and rounded, barely extending above the head.

Animals tend to be 28–35 centimetres in length (head-body), with an 8–13 centimetre long tail. Females weigh 400–1000 grams, whilst males weigh 500–1500 grams (Menkhorst and Knight 2004). Southern Brown Bandicoots are solitary and nocturnal, usually foraging alone. Their diet consists largely of soil invertebrates, seeds and underground fungi.

Breeding is usually seasonal, with most births occurring between July and December. Young remain in the pouch for two months, and become sexually mature at seven months, with females able to give birth to over eight young per year. The death rate of juveniles is usually high, while adults may live up to 3.5 years (Strahan 2004).

The Southern Brown Bandicoot is listed as endangered under the Environment Protection and Biodiversity Conservation Act 1999, and as near threatened under the Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2003) and the Action Plan for Australian Marsupials and Monotremes (Maxwell *et al.* 1996).

Southern Brown Bandicoot may be found throughout most of the mainland States and Tasmania, but has a very patchy distribution, even in continuous habitat, and occurs in a series of regionally isolated populations. In Victoria, it has been found on coastal or fluvial plains, rarely more than 50 kilometres from the coast (Menkhorst and Seebeck 1990).

### **1.6.2 Growling Grass Frog *Litoria raniformis***

- *EPBC Act Conservation Status*: Vulnerable
- *FFG Act Conservation Status*: Listed
- *DSE 2007 Conservation Status*: Endangered
- *National Action Plan Conservation Status*: Vulnerable

The Growling Grass Frog is listed as endangered in Victoria (DSE 2003) and vulnerable nationally (Tyler 1997) (Plate 7). It is also listed as a threatened taxon under the EPBC Act and the Victorian FFG Act. A draft Flora and Fauna Guarantee Action Statement (Robertson 2003) and a draft National Recovery Plan have been developed for the species. Overall the species is of national conservation significance.

Although formally widely distributed across south eastern Australia, including Tasmania, the species has declined markedly across much of its former range (Littlejohn 1963; 1982; Hero *et al.* 1991).

**Plate 7:** Growling Grass Frog *Litoria raniformis* (Ecology Partners Pty Ltd).



This has been most evident over the past two decades and in many areas, particularly in south and central Victoria, populations have experienced apparent declines and local extinctions (Mahony 1999; AVW 2009).

This species is largely associated with permanent or semi-permanent still or slow flowing waterbodies (i.e. streams, lagoons, farm dams and old quarry sites) (Hero *et al.* 1991; Barker *et al.* 1995; Cogger 1996; Ashworth 1998). Frogs can also use temporarily inundated waterbodies for breeding purposes, providing they contain water over the breeding season (Organ 2003a).

There is a strong correlation between the presence of the species and key habitat attributes at a given waterbody. For example, the species is typically associated with waterbodies supporting extensive cover of emergent, submerged and floating vegetation (Robertson *et al.* 2002; Organ 2004; Organ 2005). Emergent vegetation provides basking sites for frogs and protection from predators, while floating vegetation provides suitable calling stages for adult males, and breeding and oviposition sites.

Terrestrial vegetation (e.g. grass and sedges), rocks and other ground debris around a wetland perimeter also provide foraging, dispersal and over-wintering sites for frogs. Waterbodies supporting the above mentioned habitat characteristics and which are located within at least 500 metres of each other are more likely to support a population of Growling Grass Frog, compared with isolated sites lacking important habitat features.

Indeed, recent studies have revealed that the spatial orientation of waterbodies across the landscape is one of the most important habitat determinants influencing the presence of the species at a given site (Robertson *et al.* 2002; Heard *et al.* 2004a, 2004b; Hamer and Organ 2008).

For example, there is a positive correlation between the presence of the species and the distance of freestanding waterbodies to another occupied site. This is comparable to the spatial dynamics of many amphibian populations, including the closely related Green and Golden Bell Frog *Litoria aurea* (Hamer *et al.* 2002).

### 1.6.3 Dwarf Galaxias *Galaxiella pusilla*

- *EPBC Act Conservation Status*: Vulnerable
- *FFG Act Conservation Status*: Vulnerable
- *DSE 2007 Conservation Status*: Vulnerable

Dwarf Galaxias are known to occur through the western region of Victoria, western Gippsland and isolated locations around Melbourne (Plate 8). The AVW lists records of Dwarf Galaxias within the Cardinia catchment from 1983 to 1999. There is a self sustaining Dwarf Galaxias population within the Cardinia Creek Retarding Basin (McGuckin 2008; Saddlier *et al.* 2008).

The population within the Cardinia Creek Retarding Basin is considered an important population within the Recovery Plan requiring high priority for active management actions (Saddlier *et al.* 2008).

**Plate 8:** Dwarf Galaxias (Ecology Partners Pty Ltd).



During construction of the Pakenham bypass, a population of Dwarf Galaxias was discovered. This population requires ongoing monitoring and management to ensure the species persistence (McGuckin 2008). The ANGFA Aquatic Survey Database also shows that the Dwarf Galaxias has recently been collected from Cardinia Creek near Beaconsfield within the Flora and Fauna Reserve in January 2009 (ANGFA website; McGuckin 2008).

Dwarf Galaxias are considered ‘Vulnerable’ nationally (EPBC Act 1999; IUCN 2009), ‘Vulnerable’ in Victoria (DSE 2007a) and is listed under the FFG Act. Dwarf Galaxias are generally found in isolated pools of ephemeral waterways and slow flowing waterways. They prefer waterways with a high percentage of cover of aquatic vegetation and trailing bank vegetation.

The Final Draft Dwarf Galaxias National Recovery Plan (Saddler *et al.* 2008) lists the following as threats to the survival of the species:

- Degradation and loss of habitat;
- Alteration to flow regime;
- Climate change;
- Introduced aquatic species; and,
- Illegal collection.

Wetland degradation may occur as a result of drainage, inundation by damming, trampling and fouling by stock, pollution by chemicals or silt, ploughing of temporary wetlands, surface and groundwater abstraction, and changes to catchment hydrology by tree plantations (Jackson 2003).

#### **1.6.4 Australian Grayling      *Prototroctes maraena***

- *EPBC Act Conservation Status*: Vulnerable
- *FFG Act Conservation Status*: Vulnerable
- *DSE 2007 Conservation Status*: Vulnerable

Australian Grayling are found in coastal flowing waterways through isolated sites through Victoria. The AVW shows records of this species occurring within Cardinia Creek near Thompson Road in 1985 and anecdotal evidence from the Fish Victoria website: [http://www.fishvictoria.com/pyoursay/reports/cardinia\\_ck\\_berwick\\_sp050821.php](http://www.fishvictoria.com/pyoursay/reports/cardinia_ck_berwick_sp050821.php) This website indicates that an Australian Grayling was accidentally collected in 2003, downstream of Chasemore Road, Officer.

Australian Grayling are considered nationally ‘Vulnerable’ (IUCN 2009, EPBC Act 1999), ‘Vulnerable’ in Victoria (DSE 2007a) and is listed under the FFG Act. The Australian Grayling is generally found in relatively fast flowing waterways with relatively good water quality with substrates of cobbles and boulders (Backhouse *et al.* 2008). The species breeds within the lower reaches of coastal waterways, in which larvae are washed into the estuarine environments and the juveniles return to the adult habitats.

Little is known about this vagrant species, with habitat condition, waterway type and water quality differing between populations. The National Recovery Plan for the Australian Grayling (Backhouse *et al.* 2008) states the threats to this species include barriers to movements, river regulation, poor water quality, siltation, introduced fish, climate change, disease, angling and whitebaiting.

The National Recovery Plan also lists Cardinia Creek as containing an important population and that the Cardinia Creek is a high priority for recovery actions. The



designation of a high priority population is to ensure the long-term survival of this species, those populations at the limits of the species range, and those known to contain large breeding populations or occur in areas with extensive spawning habitat.

### 1.6.5 Swamp Skink *Egernia coventryi*

- *EPBC Act Conservation Status*: Vulnerable
- *FFG Act Conservation Status*: Listed.

Swamp Skink occurs predominantly in Victorian, south and east of the Great Dividing Range, but also extends from south-east South Australia to south-east New South Wales (AVW 2009) (Plate 9). The species is currently listed as threatened under the Flora and Fauna Guarantee Act 1988 (FFG Act) and listed as vulnerable by the DSE (2007c).

It is an omnivorous, medium, robust skink (approximately 100 millimetres in length), with a fourth toe that is noticeably longer than the third, and the presence of separated parietal scales. The species produces live young, usually around January to February, and litter sizes vary from one to eight (Greer 1989).

**Plate 9:** Swamp Skink *Egernia coventryi* (Ecology Partners Pty Ltd 2009b).



The Swamp Skink can be found in a range of habitats, most notably in densely vegetated freshwater swamps and watercourses, wet heaths, sedgelands (often sedge-rich, low lying marshes or drainage lines) or saltmarshes (A. Organ pers obs.). However, the species is not restricted to these vegetation types and it has been recorded in areas where vegetation structure consisted of dense ground cover, up to two metres, with sparse to no overstorey (Clemann 2000; 2006; Ecology Partners Pty Ltd 2009b).

### 1.6.6 Glossy Grass Skink *Pseudemoia rawlinsoni*

- *DSE 2007 Conservation Status:* Near Threatened

The Glossy Grass Skink is dark brown to black above, with a narrow dark brown vertebral stripe from the nape to the base of the tail (Cogger 1996). A narrow white or cream dorso-lateral stripe extends from the temporal region to the base of the tail.

Glossy Grass Skinks can grow up to 62 millimetres length and are known to inhabit areas close waterbodies including dense vegetation coverage (i.e. rushes and grasses).

The Glossy Grass Skink prefers confined humid microhabitats including waterbodies such as swamps and wetlands including dry sclerophyll forests that adjoin wet heathland areas that are exposed to frequent bouts of flooding (Cogger 1996).

The Glossy Grass Skink uses dense vegetation, fallen logs, dead trees or rocky outcrops for shelter, and their distribution extends through the highlands of south-eastern Australia, with peripheral or outlying populations on the Blue Mountains, west of Sydney (NSW), and in the Gisborne region and Otway Ranges in Victoria (Cogger 1996).

### 1.6.7 Southern Toadlet *Pseudophryne semimarmorata*

- *DSE 2007 Conservation Status:* Vulnerable

**Plate 10:** Southern Toadlet *Pseudophryne semimarmorata* (Peter Robertson – Wildlife Profiles Pty Ltd).



The Southern Toadlet is a small frog, with adult body length up to 30 millimetres (Plate 10). The back is warty and varies from brown to dark olive-green with darker flecks (Barker *et al.* 1995; Robinson 2000).

The chest has black and white marbling, while the throat, lower belly and underside of the limbs are tan to orange in colour (Barker *et al.* 1995; Robinson 2000). Males have a granular belly, while the belly of the female smooth (Hero *et al.* 1991; Barker *et al.* 1995; Robinson 2000).

The species occurs throughout southern Australia, predominantly in Victoria and Tasmania. It is a ground-dwelling frog with a preference for walking (Hero *et al.* 1991). It is found in forest, woodland, scrubland, grassland and heathland habitats. Adults shelter under leaf litter, rocks, logs and other debris in damp, boggy areas and breed from March to May (Hero *et al.* 1991; Robinson 2000).

## 2 METHODS

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### 2.1 Terminology

Common and scientific names of vascular plants follow the Flora Information System (FIS 2009) and the Census of Vascular Plants of Victoria (Walsh and Stajsic 2007). Ecological Vegetation Classes (EVCs) within the study area were determined by reference to DSE pre-1750 and extant EVC mapping and their published descriptions (DSE 2009b).

Terrestrial and aquatic vertebrate fauna (mammals, birds, reptiles, amphibians and fish) follow the Atlas of Victoria Wildlife (AVW 2009).

### 2.2 Literature and Database Review

A review of all previous ecological surveys within and adjacent to the study area was undertaken during the preparation of this report (see References).

The FIS (2009) and AVW (2009) biological databases were reviewed. The presence of EVCs within the study area was reviewed using DSE's biodiversity interactive maps (DSE 2010b), while information referring to matters of National Environmental Significance listed under the *Environment Protection Conservation Act 1999* (EPBC Act) were obtained from SEWPaC (2010). Planning Schemes online was also reviewed to ascertain current zoning and overlays (DPCD 2010c).

To determine anecdotal evidence of other fish records, the Fish Victoria records [http://www.fishvictoria.com/pyoursay/reports/cardinia\\_ck\\_berwick\\_sp050821.php](http://www.fishvictoria.com/pyoursay/reports/cardinia_ck_berwick_sp050821.php) were viewed. The Australian New Guinea Fish Aquatic Survey Database was also accessed for relevant fish records within the area (<http://db.angfa.org.au/>).

Additionally, information on significant species habitat, distribution and morphology was obtained from other literature such as FFG Act Action Statements, Recovery Plans, local experts and other relevant literature. Previous reports prepared by Ecology Partners Pty Ltd and other relevant authorities relating to the study area and to significant species were also reviewed.

### 2.3 Field Survey Techniques

#### 2.3.1 Vegetation Assessment

The aim of the flora assessment was to document flora species and vegetation types within the study area. The entire study area was assessed by car and on foot, with all vascular plants recorded, and the overall condition of vegetation noted. Planted trees and shrubs were not recorded unless they were seen to be naturally spreading on site.

Initial boundaries within the Precinct did not include Cardinia Creek and its associated floodplain and additional surveys were conducted on the 14 October and 12 November 2010 to identify any flora values and areas of remnant vegetation within this area.

The significance assessment criteria of taxa and vegetation communities are presented in Appendix 1. A list of flora species observed was compiled (Appendix 2.1) and the location of significant species recorded and mapped. Vegetation mapping was undertaken during the field survey through aerial photograph interpretation and on-ground observations.

Remnant native vegetation in the study area was classified according to the EVC system by referring to DSE's pre-1750 and extant EVC mapping and their published descriptions (DSE 2010b).

Classification of native vegetation to EVC level involved matching officially mapped areas with stands of vegetation observed on the site, and then comparing the observed structural and floristic characteristics with those given in EVC descriptions (e.g. regional reports and EVC Benchmarks). It should be noted that at finer scales EVC mapping becomes less accurate due to the inherently broad environmental and ecological parameters used in the mapping process and as a result, of site-specific factors such as disturbance and modification. Vegetation boundaries are rarely clear or distinct on the ground, as natural vegetation has diffuse edges and different EVCs blend into each other over various scales (referred to as 'ecotonal boundaries').

### **2.3.2 Net Gain Analysis**

A habitat hectare analysis in accordance with DSE's published methodology (DSE 2004), was also undertaken in areas of remnant native vegetation, to quantify the overall potential loss (NRE 2002).

This assessment included measuring the quality of the observed vegetation against the relevant EVC Benchmark. The diameter at breast height (DBH) of trees was also measured to determine the size class of trees compared to the relevant EVC Benchmark (DSE 2004).

#### **2.3.2.1 Tree Assessment**

The Framework recognises that old trees are important environmental assets and that these trees can be found in habitat zones, or as relicts of vegetation that formerly occupied the site (scattered trees).

The Framework includes minimum protection/replacement ratios for trees that are to be removed as part of permitted clearing, based on their DBH.

Different ratios apply to large old trees in ‘habitat zones’ and to scattered old trees where the indigenous understorey cover is less than 25% of the total understorey cover. Small scattered trees (i.e. not old trees) are also considered to be environmental assets, and would also require offsets if they were to be cleared.

### **2.3.2.2 Trees within Habitat Zones**

In relation to habitat zones that contain large old trees, the Framework states:

*For each large old tree removed as part of permitted clearing a certain number of other large old trees have to be protected and a certain number recruited (NRE 2002).*

Net Gain is the overall outcome where native vegetation and habitat gains are greater than the losses and where losses are avoided, where possible.

### **2.3.2.3 Scattered Trees**

In relation to scattered old trees in parcels of land the Framework states:

*For each medium or large old tree removed as part of permitted clearing an appropriate number of new trees must be recruited. The number of new trees that must be recruited will be specified in regional Native Vegetation Plans and may be graded according to conservation significance....However where it better suits their circumstances, landholders may use the ‘protect other trees and ensure supplementary recruitment’ approach to meet this criteria (NRE 2002).*

The Port Phillip and Westernport Native Vegetation Plan (PPWCMA 2006) currently contains offset ratios for losses of scattered trees, which are:

- Protect and recruit options for Very Large, Large and Medium Old Trees; or
- Recruit only options for Very Large, Large, Medium Old Trees and other/small scattered trees.

### **2.3.3 Fauna**

Fauna assessments were conducted throughout the Precinct on 2, 6 and 9 October 2009 to obtain information on terrestrial fauna within the study area. The climatic conditions at the time of the diurnal surveys were mild (approximately 15°C), with light winds and isolated showers (on 6 October only).

Initial boundaries within the Precinct did not include Cardinia Creek floodplain wetlands, and thus additional surveys were conducted on the 14 October and 12 November 2010 to identify any fauna values present within the Cardinia Creek corridor.

Additional nocturnal surveys along Cardinia Creek (i.e. bat surveys - AnaBat©, owl call-playback and arboreal mammal spotlighting) in accordance with the Biodiversity Precinct Planning Kit 2010 were not undertaken for the following reasons:

- The Biodiversity Precinct Structure Planning Kit was not final at the time of the original surveys (i.e. transition period regarding survey methodology and extent etc).
- The abovementioned survey requirements were not discussed with GAA (Matt Palmen and Greg Burcill) and DSE prior to additional targeted surveys works within the Officer Precinct Structure Plan study area.
- Cardinia Creek will function as a regional open space (Parks Victoria) and public open space. Accordingly, no major construction works along Cardinia Creek will apply and such surveys are unlikely to be warranted for the completion of the final Biodiversity Assessment Report.

Binoculars (10 x 42) were used to scan the area for animals, and observers also listened for calls and searched for other signs such as; nests, remains of dead animals, droppings and footprints. Habitat features including ground cover composition and structure, and the presence of hollows and fallen ground debris were also noted. The presence of hollows in isolated trees was recorded, and any other features likely to be important habitat features for fauna.

As fauna species are mobile, a visual assessment of the adjoining areas outside of the study area was undertaken to determine if there was suitable habitat (principally for rare or threatened species) in the immediate area. This helped to determine if threatened species reside within the study area for extended periods of time, or whether the study area contributed to a larger home range of a particular significant species.

An inventory of all fauna species recorded during the survey is provided below (Appendix 3.1.).

## **2.3.4 Targeted Flora and Fauna Surveys**

### **2.3.4.1 Flora**

Initial surveys were undertaken over several days in March and April 2009. The surveys aimed to identify and map the locations of significant flora species within the study area. The exact locations of plants, and the number of plants in each population were recorded by a qualified botanist with a hand-held GPS.

Given that the initial surveys were undertaken at the end of some of the significant species' optimal identification period, a second survey period was undertaken during the optimal time (i.e. spring and early summer) in an effort to detect additional populations

and previously undetected species. A total of seven days were undertaken between early October and mid December 2009.

Additional survey days for threatened flora were undertaken in October and November 2010 along the Cardinia Creek corridor as this area of the Precinct was not initially surveyed.

The majority of time was spent in areas which contained native flora which provided the highest quality habitat for significant flora species. This generally included road reserves, rocky areas, fence lines, waterbodies and woodlands.

When surveying for Matted Flax-lily an estimate of the size, number of tillers, any flowers or fruit present and the health of the plant were made.

Surveys for Green Scentbark trees consisted of searching large areas with numerous trees. Therefore, it was not possible to obtain fertile material (e.g. buds and fruit) from all trees for identification purposes. To account for this, bark was used as the primary characteristic for identification purposes. Trees which had bark typical of Green Scentbark were then assessed in more detail to confirm the identity of the species.

All significant plants and trees recorded during the survey were marked on a field map and using a GPS.

#### **2.3.4.2 Fauna**

The methodology undertaken for targeted surveys by Ecology Partners throughout the Officer Precinct is detailed below. Targeted fauna surveys were undertaken in accordance with the DSE *Scientific Research Permit: 10004532*. All fish surveys were undertaken under the *General (Research) Permit RP958*.

Ecology Australia Pty Ltd and Streamline Research Pty Ltd were commissioned by the GAA to undertake habitat assessments and targeted fauna surveys for Growling Grass Frog, Southern Brown Bandicoot, Dwarf Galaxias and Australian Gralying along eastern side of Cardinia Creek between the Princes Highway and Princes Freeway during March 2010 (Ecology Australia Pty Ltd 2010). For a summary of these results please refer to Section 3.2.2 below and the Ecology Australia CMP (Ecology Australia Pty Ltd 2010).

Please note the following information does not include methodology associated with the Cardinia Creek floodplain wetlands. For this information please refer to the Ecology Australia CMP (Ecology Australia Pty Ltd 2010).



#### 2.3.4.2.1 *Southern Brown Bandicoot*

Previous records of Southern Brown Bandicoot from the local area were obtained and reviewed (AVW 2009). A targeted survey (active searching) was undertaken by experienced zoologists within the study area (excluding Cardinia Creek) to identify the presence of Southern Brown Bandicoot.

Multiple diurnal searches of at least two hours, within potentially suitable habitat, including areas with dense understorey and thick ground cover were undertaken during March and April 2009. Diurnal searches for signs of activity, including tracks, scats, nests and conical foraging holes, were undertaken concurrently with habitat assessments. Potential scats or remains were also identified. Direct detection techniques such as cage trapping or hair sampling surveys were not undertaken within the study area.

#### 2.3.4.2.2 *Growling Grass Frog*

Two personnel experienced in surveying for the Growling Grass Frog conducted two nocturnal surveys within the study area during mild (~24°C mean) conditions on the 18 and 26 of March 2009 (Figure 8a). Although the species is most active between the months of October and December, when adult males are calling, the current surveys were conducted at a time of year when the species is known to be active, but when calling activity is reduced.

Given that the final survey was undertaken towards the end of the active period for the species, several reference sites were used to confirm that this time was suitable. Reference sites included waterbodies immediately adjacent to the Pakenham Bypass, Toomuc Creek and a constructed frog pond outside the study area (Melways p. 215 H11). These reference sites confirmed that current survey conditions were appropriate, and that the species remained active during the warmer weather that persisted throughout April 2010.

Nocturnal surveys comprised quiet listening periods for approximately five minutes at each dam, followed by active searching for at waterbodies for which access was permitted (Figure 8a). Active searching included looking throughout ground level habitat, surface rocks and boulders, at the base of vegetation and beneath hard litter. Surveys were conducted after dusk, on calm, still nights.

A 30 watt, 12 volt hand-held spotlight was used to search for frogs on floating vegetation, areas of emergent vegetation and on the surrounding banks. In addition, surrounding terrestrial habitat within 10 metres of each waterbody was also searched.

To limit infection and the spread of amphibian disease (i.e. chytrid fungus), the collection and handling of all specimens met the standards used by the NSW National Parks and Wildlife Service (NPWS 2001).

#### 2.3.4.2.3 *Dwarf Galaxias*

As areas adjoining Cardinia Creek and the creek itself are proposed to be set aside as open/regional open spaces, no targeted surveys were undertaken within Cardinia Creek or waterbodies adjacent to the creek for this species under this assumption. Based on previous records from within the local area, it is acknowledged as part of this assessment that Dwarf Galaxias have been recorded within the study area in close proximity to Cardinia Creek (McGuckin 2008; Saddler *et al.* 2008; Ecology Australia Pty Ltd 2010).

Targeted surveys for Dwarf Galaxias were undertaken using backpack electrofishing, bait traps and dip netting techniques at three locations within the study area (Figures 5a-5d). Backpack electrofishing was conducted using a LR24 Smith-Root Backpack Electrofisher through all available aquatic habitats. The backpack electrofishing survey was conducted under a safe manner following the Code of Practice Electrofishing (SCFFA 1997) and Ecology Partners Pty Ltd Standard Operating Procedures for Fish Surveys (Ecology Partners Pty Ltd 2008c).

Bait traps were set overnight with a light source within the bait pouch to act as an attractant. Bait traps were retrieved the following morning. Dip netting was conducted through all available microhabitats and collected samples were screened for fish and microinvertebrates.

#### 2.3.4.2.4 *Australian Grayling*

Australian Grayling preferred habitat includes large waterways which are clear and are flowing, generally over rocky substrate (Backhouse *et al.* 2008).

Despite the low likelihood of occurrence for this species within the study area, the survey methods used for Dwarf Galaxias (described above) were appropriate to also survey for Australian Grayling. Cardinia Creek was not surveyed for Australian Grayling in this study.

#### 2.3.4.2.5 *Swamp Skink*

Previous habitat assessments identified several sites which contain potential habitat for Swamp Skink (Ecology Partners Pty Ltd 2008a).

Sites with the highest quality habitat (e.g. areas supporting Swamp Scrub and dense understorey vegetation) for these species were selected and used for targeted surveys. Trapping was undertaken at these sites (Table 2; Figure 5a-5d and 7). Potential habitat was determined based on vegetation and habitat attributes only, and Swamp Skink has not previously been recorded within and in the vicinity of the study area (AVW 2009; Figure 7).

Although, it was considered unlikely that Swamp Skink were present within any of the targeted study areas, trapping was conducted to verify any potential presence at sites where potential habitat was identified (excluding Cardinia Creek). Swamp Skink surveys were undertaken between 18 March and 24 March 2009 (Table 2). Weather conditions were fine and mild (average temperature 25.7°C; minimum temperature 10°C and maximum temperature 34.5°C).

A total of 50 small Elliot traps were used for a period of between 2–5 days at each site and were spaced approximately 10 metres apart (Figure 7) providing over 200 trap nights. Visual searches were also conducted, using active searching techniques and binoculars. A Garmin 76 GPS hand held unit was used to accurately record the site locations.

#### 2.3.4.2.6 *Glossy Grass Skink*

Potentially suitable habitat (albeit low quality) for Glossy Grass Skink occurs within some of the Officer Precinct habitat types (i.e. Plains/Swampy Woodland EVC 651 and Swamp Scrub EVC 53), roadside areas with dense vegetation as well as drainage lines. The targeted survey techniques undertaken to detect this species are the same as those used for Swamp Skink. Additional roadside areas, supporting dense vegetation and drainage lines were also surveyed (Figures 5a-5d and 7). Cardinia Creek was not surveyed during targeted surveys.

#### 2.3.4.2.7 *Southern Toadlet*

Surveys for the Southern Toadlet were conducted during two separate diurnal and nocturnal periods on 26 March 2009 and 2 April 2009, respectively (Figure 8a). Ephemeral drainage lines and depressions were carefully searched using a 30 watt 12 volt hand-held spotlight, while call imitation was undertaken to elicit a response from any adult males residing within the area. Suitable refuge sites such as logs, rocks and other ground debris were opportunistically searched to locate inactive frogs. Cardinia Creek was not surveyed during targeted surveys.

### 2.3.5 **Best or Remaining 50% of Habitat for Threatened Species**

In order to determine the best or remaining 50% of habitat for rare and threatened flora and fauna, species that are considered likely to be present within each EVC were assessed according to the steps outlined in Table 2 in the *Guide for Assessment of Referred Planning Permit Applications* (DSE 2007a).

Threatened flora species considered likely to be present (i.e. species given a likelihood rating of at least 2 in Appendix 2.2) within each EVC, was based on previous records, habitat type present and the requirements of each flora species.

Threatened fauna species considered likely to use the study area for foraging and/or breeding due to the high quality of habitat (i.e. species given likelihood rating of at least 2 in Appendix 3.1 and are listed as endangered, vulnerable or rare).

For significant flora and fauna species not recorded within the study area but recorded in the local area or with potential habitat present in the local area (Appendices 2 and 3), if they were not considered to be a ‘resident’ or to ‘make significant use of the study area’, there was no further consideration given to these flora and fauna species in regards to determining best or remaining 50% habitat (Table 2, DSE 2007a).

## **2.4 Assessment Qualifications and Limitations**

### **2.4.1 Preliminary Flora and Fauna Surveys**

The survey was undertaken during spring which is considered an appropriate season to detect most flora and fauna species, and at a time when the native understorey vegetation is more diverse. However, consistent with most flora and fauna surveys that are undertaken throughout south eastern Australia over a short duration, a small number of migratory, transitory or uncommon fauna species may also have been missed.

Notwithstanding the above, terrestrial flora and fauna data collected during the field assessment, and information obtained from relevant sources (e.g. biological databases, relevant literature and the author’s personal observation over several years of survey across the study area and immediate surrounds) provide an accurate assessment of the ecological values within the study area, and potential impacts and mitigation measures associated with the future development of the precinct.

### **2.4.2 Targeted Flora and Fauna Surveys**

As with any biological survey, there is a chance that the presence of some species or specimens may go undetected. Targeted flora and fauna surveys, such as the present survey, aim to reduce the probability of this occurring.

Uncertainty about the likelihood of occurrence has been reduced as far as possible by a comprehensive desktop assessment of available literature and databases, consultation with experts, review of habitat requirements for the species as well as the assessor’s experience.

Initial field surveys were undertaken in early autumn 2009, which was outside of optimal conditions for a number of flora and fauna species. Furthermore, conditions were limited for a number of species due to the ongoing drought as well as the high temperatures between February and March.

Due to these limitations a second survey was undertaken the following spring and summer to help identify targeted species during more favourable conditions and alleviate some of the limitation that had arisen from the autumn surveys.

Initial surveys were conducted during an extended drought period within Victoria, with its third-driest January–March period on record and areas of serious to severe rainfall deficiencies across southern Victoria over the previous 15 months (Bureau of Meteorology, BOM 2010). This is expected to have reduced the activity levels of Growling Grass Frog in the local area. Further, given that Growling Grass Frog surveys were undertaken in March, at a time when the species is generally finished calling, this may have lowered the likelihood of the frog being detected. This would be a greater impact at potential sites that were dry at the time of the surveys.

The level of survey effort undertaken was designed to be detailed and improve the confidence regarding statements about the presence or absence of significant flora and fauna species within the Precinct. It therefore considered that the information provided in the methods undertaken for this report meet the objectives of the project and provides an accurate account of the distribution of significant species within the study area.

## 3 RESULTS

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### 3.1 Flora Assessments

#### 3.1.1 General Flora Survey

A total of 327 plant taxa (215 indigenous and 112 exotic) were recorded in the study area during the current assessment (Appendix 2.1).

Planted trees and shrubs were not recorded unless they were seen to be naturally spreading on site.

#### 3.1.2 EVC number and Name

The literature review of previous ecological assessments indicates that the study area would have originally supported ten EVCs, including; Grassy Forest (EVC 128), Grassy Woodland (EVC 175), Gully Woodland (EVC 902), Plains Grassland/Plains Grassy Woodland mosaic, Plains Grassy Wetland (EVC 125), Swamp Scrub (EVC 53\_62), Riparian Scrub/Swampy Riparian Woodland complex, Swampy Riparian Woodland (EVC 83), Damp Heathy Woodland (EVC 793) and Swampy Woodland (EVC 937). Where present, remnants of these EVCs within the study area occur as either roadside remnants or larger patches in the north-west and areas adjacent to Station St within the Precinct.

Current EVC mapping (DSE 2010b) indicates that there are currently five EVCs within the study area; Grassy Forest (EVC 128), Grassy Woodland, Plains Grassland/Plains Grassy Woodland mosaic, Swampy Woodland and Riparian Scrub/Swampy Riparian Woodland complex. All of these EVCs were recorded during the site assessment, and Swampy Riparian Woodland has been separated from the complex and South Gippsland Plains Grassland (EVC 132\_62) and Plains Grassy Woodland (EVC 55) have also been separated. Additionally, Gully Woodland, Plains Grassy Wetland (EVC 125) and Swamp Scrub were detected during the current assessment (Figures 2a–2d).

#### 3.1.3 Vegetation Assessment

The majority of the study area has been highly modified by past and current agricultural practices and as a result, much of the area is dominated by exotic pasture grasses. Remnant native vegetation within the study area typically occurs within small isolated patches along roadsides and within rail reserves. However, a few larger patches of remnant vegetation occur, predominantly in the north-west of the Precinct (Figure 2a–2d).

Indigenous species in these patches include Swamp Gum *Eucalyptus ovata*, Narrow-leaved Peppermint *Eucalyptus radiata*, Blackwood *Acacia melanoxylon*, Black Wattle *Acacia mearnsii*, Swamp Paperbark *Melaleuca ericifolia* and Spiny-headed Mat-rush *Lomandra longifolia*.

Drainage lines and creeks throughout the study area are dominated by Bulrushes *Typha* spp. and Common Reed *Phragmites australis*. These remnant patches of vegetation represent only a small proportion of overall vegetation cover in the Precinct.

#### **3.1.3.1 Whiteside Road – north**

Large areas of remnant Grassy Forest occurs on either side of Whiteside Road, and where clearing has taken place for agriculture, derived Grassy Forest remains as a remnant tree canopy with a mixed understorey. The canopy is dominated by Narrow-leaved Peppermint, with an understorey comprising Blackwood, Black Wattle and a mixed understorey of exotic and indigenous grasses, and environmental weeds such as Blackberry *Rubus fruticosus* spp. agg.

#### **3.1.3.2 Gilbert Property**

This area is located west of Station Street and comprises remnants of three EVCs: Plains Grassland, Plains Grassy Wetland and Swamp Scrub.

The Plains Grassland remnant comprises Kangaroo Grass, wallaby-grasses and various rushes, while the occasional tussock-grasses *Poa* spp., Austral Bugle *Ajuga australis*, Cotton Fireweed *Senecio quadridentatus* also occur in this area.

Exotic species include Sweet Vernal Grass *Anthoxanthum odoratum*, Blackberry, Cat's Ear *Hypochoeris radicata*, Onion Weed *Romulea rosea*, Spear Thistle *Cirsium vulgare*, Yorkshire Fog *Holcus lanatus* and Paspalum *Paspalum dilatatum*.

The area of Plains Grassy Wetland has an understorey in moderately good condition, comprising wallaby-grasses *Austrodanthonia* spp., various rushes including Pale Rush *Juncus pallidus* and Austral Rush *Juncus australis*, Spike-sedge *Eleocharis* sp., Common Reed and Sheep's Burr *Acaena echinata*. However, several pasture species are present including Sweet Vernal Grass, Brown-top Bent *Agrostis capillaris*, Hare's-tail Grass *Lagurus ovatus*, Barley Grass *Hordeum* spp., Couch *Cynodon dactylon* and Buck's Horn Plantain *Plantago coronopus*.

Two FFG Act (1988) listed communities are present within the Gilbert Property. These include the Herb-rich Plains Grassy Wetland (West Gippsland) community and the Plains Grassland (South Gippsland) community. These correspond with the two Ecological Vegetation Communities Plains Grassy Wetland (EVC 125) and Plains Grassland (South Gippsland) (EVC 132\_05) respectively (Figures 2a–2d).

#### **3.1.3.3 Leber property**

A large patch of Plains Grassy Woodland and Swampy Woodland occurs east of Station Street at Officer Township (Figures 2a–2d).

This remnant is in moderately good condition, comprising Swamp Gum, Narrow-leaved Peppermint, Cherry Ballart *Exocarpos cupressiformis*, Black Wattle, Spiny-headed Mat-rush, Kidney-weed *Dichondra repens*, Swamp Paperbark, Hedge Wattle *Acacia paradoxa*, Prickly Moses *Acacia verticillata*, Common Cassinia *Cassinia aculeata*, and Thatch Saw-sedge *Gahnia radula*. This area also supports a diversity native grass understorey including wallaby-grass, Kangaroo Grass, tussock-grass, spear-grass *Austrostipa* spp. and Common Wheat-grass.

In sections, this area is also dominated by exotic species such as Blackberry, Sweet Pittosporum *Pittosporum undulatum*, Brown-top Bent, Cocksfoot *Dactylis glomerata*, Radiata Pine *Pinus radiata*, Trefoil *Lotus* spp., English Ivy *Hedera helix*, Flax-leaf Broom *Genista linifolia* and Sweet Vernal Grass.

#### **3.1.3.4 Gippsland Railway Line**

The overstorey is dominated by Narrow-leaf Peppermint and Swamp Gum, and the understorey is dominated by Blackwood and Black Wattle with occasional Cherry Ballart and Swamp Paperbark. The understorey comprises a mix of native grasses such as Weeping Grass *Microlaena stipoides* var. *stipoides*, spear-grasses *Austrostipa* spp. and Slender Wallaby-grass *Austrodanthonia racemosa* var. *racemosa*, exotic grasses, Wild Watsonia *Watsonia* spp. and Blackberry. However, high gradient areas that have escaped slashing have a higher proportion of native species, with Small Grass-tree *Xanthorrhoea minor* ssp. *lutea*, Flax-lilies *Dianella* spp. and Spiny-headed Mat-rush present in these areas.

#### **3.1.3.5 Remnant Swampy Riparian Woodland on private property (north of Rix Road)**

The canopy is dominated by Swamp Gum, Narrow-leaf Peppermint, and occasional emergent Manna Gum *Eucalyptus viminalis*.

The majority of the Swampy Riparian Woodland on private property contains patches of scattered trees with a cleared understorey, although in areas where stock have been excluded there is a mix of exotic and introduced grasses, including Weeping Grass and Slender Wallaby-grass. A small area of Swampy Riparian Woodland occurs in depressions and along drainage lines which are unsuitable for development. These wetter areas retain a modified understorey dominated by Black Wattle and Blackwood.

#### **3.1.3.6 Rix Road**

The canopy of Grassy Woodland along Rix Road reserve is dominated by Narrow-leaf Peppermint with occasional Swamp Gum. The understorey is generally mown exotic grasses, with Spiny-headed Mat-rush growing at the base of some canopy trees and an occasional Black Wattle. There is a large stand of planted Monterey Cypress *Cupressus macrocarpa* on the north side of Rix Road, adjacent to the junction with Brunt Road.



### 3.1.3.7 *Brunt Road*

Grassy Woodland occurs along Brunt Road, with the overstorey dominated by Narrow-leaf Peppermint and Swamp Gum. The midstorey is dominated by Blackwood with occasional Cherry Ballart and Swamp Paperbark. The understorey largely contains exotic pasture grasses.

The artificial wetland at the junction of Brunt Road and the Gippsland Railway Line has been planted with Swamp Paperbark, Leafy Twig-sedge *Cladium procerum* and various rushes, which are regenerating prolifically at the eastern end of the wetland. Prostrate herbs growing within the artificial wetland include Blackberry, and Swamp Crassula *Crassula helmsii*, Slender Knotweed *Persicaria decipiens*.

### 3.1.3.8 *Berwick Grammar School*

The grounds of Berwick Grammar School and vegetation patches recorded within the adjoining road reserves are dominated by Grassy Woodland canopy species such as Green Scentbark, Messmate Stringybark *Eucalyptus obliqua* and Bundy *Eucalyptus gonicalyx*. The understorey vegetation in these areas is dominated by common exotic pasture species.

### 3.1.3.9 *Cardinia Creek Corridor*

Swampy Riparian Woodland occurred along Cardinia Creek with the overstorey dominated by Manna Gums and Swamp Gums. A dense midstorey is present with Swamp Paperbark common throughout. Other common midstorey species present included Blackwoods, Tree Violet *Melicytis denatus* and Prickly Current-bush *Coprosma quadrifida*. Common understorey species found along the creekline included Common Tussock-grass *Poa labillardierei* var. *labillardierei*, Sword Tussock-grass *Poa ensiformis*, Thatch Saw-sedge *Ghania radula* and Variable Sword-sedge *Lepidosperma laterale*.

Some areas along the creekline were dominated by exotic species, with Japanese Honeysuckle *Lonicera japonica* (especially in the northern areas), Blackberry, Wandering Jew *Tradescantia fluminensis*, Sweet Pittosporum *Pittosporum undulatum*, Brown-top Bent, Cocksfoot *Dactylis glomerata* and Madiera Winter-cherry *Solanum pseudocapsicum* all common within areas recorded as Swampy Riparian Woodland along Cardinia Creek.

Areas of Swampy Woodland occurred away from the creekline itself with small ephemeral wetlands also recorded. This matches the description by Oates and Taranto (2001), with Swampy Woodland occurring in low gradient habitat on seasonally waterlogged soils. These ephemeral wetlands were lacking the overstorey component, with a variety of sedges and rushes common.

Species within these ephemeral wetlands include Common Reed *Phragmites australis*, Gold Rush *Juncus flavidus*, Water Ribbons *Triglochin procerum* s.l. Tassel sedge *Carex fascicularis* and Bidgee Widgee.

### 3.1.4 Threatened flora species

#### 3.1.4.1 *National*

Significant flora species which have been recorded within the local area (FIS 2009) (i.e. within a 10 kilometre radius of the study area), or recorded as potentially occurring, or their habitats as potentially occurring, within the local area (SEWPaC 2010) are listed in Appendix 2.2 (Figure 3a–3d; Figure 4).

One nationally significant flora species, the endangered Matted Flax-lily, was recorded within the study area during the current assessment and previous surveys (Biosis Research Pty Ltd 2006; Ecology Partners Pty Ltd 2009a). One other nationally significant species, the endangered Maroon Leak-orchid, has previously been documented within the study area and also has habitat as potentially occurring within a 10 kilometre radius of the study area (SEWPaC Protected Matters Search Tool).

There is a low likelihood that this species persists within the Precinct due to the lack of suitable habitat and the exhaustive search that was undertaken.

#### 3.1.4.2 *State*

Two state significant flora species were recorded during the preliminary flora assessment; Green Scentbark and Veined Spear-grass (Ecology Partners Pty Ltd 2008a, 2008b, 2009a). These species have also been recorded previously within the study area (Biosis Research Pty Ltd 2006; Ecology Australia Pty Ltd 2004). A total of 19 state significant flora species have previously been recorded within the local area (Appendix 2.2) (Figure 4).

Two other state significant species, the vulnerable Purple Diuris and the rare Cobra Greenhood *Pterostylis grandiflora*, have previously been documented in the local area and have habitat as potentially occurring within a 10 kilometre radius of the study area (FIS 2009) (Biosis Research Pty Ltd 2006).

However, based on the intensive searching undertaken as part of targeted surveys for these flora species, during the species' flowering periods, there is a low likelihood that either of these species occur within the study area.

#### 3.1.4.3 *Regional and local*

A total of 149 regionally significant flora species were recorded within the study area during the assessment. All other indigenous species are considered to be of local significance due to the general and widespread depletion of native vegetation in the local area.

### 3.1.4.4 Significant communities

There are no vegetation communities listed as threatened under the EPBC Act within the study area or within 10 kilometres of the study area (SEWPaC Protected Matters Search Tool).

All Ecological Vegetation Communities on site are considered to be endangered under the DSE Bioregional Conservation Status of EVCs, due to the historical and widespread clearing within the Officer district and within the Gippsland Plain bioregion.

Two FFG Act (1988) listed communities are present within the Gilbert Property. These include the Herb-rich Plains Grassy Wetland (West Gippsland) community as well as the Plains Grassland (South Gippsland) community. These correspond with the two Ecological Vegetation Communities, Plains Grassy Wetland (EVC 125) and Plains Grassland (South Gippsland) (EVC 132\_05) respectively (Figures 2a–2d).

### 3.1.5 Best or Remaining 50% for Rare and Threatened Flora Species

Suitable habitat has been identified for threatened flora species within the overall Precinct area. The determination of the best or remaining habitat for threatened fauna species is provided in Table 1.

Several rare and threatened flora species have previously been recorded within the vicinity of the study area, and remnant patches within the study area contain suitable habitat for several species. The habitat assessment was undertaken in accordance with the steps outlined in GARPPA (DSE 2007a), and is summarised below in Table 2.

**Table 1.** Habitat assessment for threatened flora species

Step	Description	Outcome
A	Is the species, or has the species been recorded as resident on site> OR if the species is not 'resident' has it been recorded regularly (e.g. annually) on-site?	Yes – go to B No – go to D
B	Is it possible to discriminate between the importance of different populations of the species? For example, can numbers be reasonably estimated and is there available knowledge on what are typical population sizes?	Yes – go to C No – go to E
C	Does the site contain a population that is above average size or importance for the bioregion?	Yes – Best 50% of habitat No – remaining 50% of habitat
D	Does the habitat on site clearly meet one or more of the habitat requirements of the species? Is it reasonable to expect that the species is present or would make significant use of the site in the medium term (i.e. within the next 10 years)?	Yes to both – go to F No to either – no further consideration required for that species
E	Has some form of habitat modelling been undertaken for the species in the bioregion?	Yes – use this information to determine Best 50% of habitat or Remaining 50% of habitat No – go to F
F	Does the site represent above-average condition and landscape context for the relevant EVC or habitat type in the bioregion?	Yes – best 50% of habitat No – Remaining 50% of habitat

### 3.1.5.1 Habitat assessment for threatened flora species

The habitat assessment for threatened flora species is summarised in Table 3.

**Table 2.** Habitat Assessment for threatened flora species

Species	Conservation Status	Steps (1)	Determination of Best 50% / Remaining 50% (2)	Conservation Significance (3)	Notes
Matted Flax-lily	EN, e	A, B, C	Best 50%	Very High	Scattered records in the southern section of the study area.
Veined Spear Grass	r	A, B, C	Best 50%	High	Large populations in the Leber Block and along roadsides.
Arching Flax-lily	v	A, B, C	Best 50%	Very High	Scattered individuals scattered along Rix and McMullen Roads as well as the railway line.
Green Scentbark	r	A, B, C	Best 50%	High	Located on the northern sections of the study area at higher elevations.

**Notes:** E = Endangered within Australia, L = Listed under the FFG Act, v = Vulnerable within Victoria, r = Rare within Victoria.

(1) From Table 2 in GARPPA (DSE 2007a) specify steps taken in habitat assessment to determine best 50% or remaining 50% of habitat.

(2) Specify 'best' or 'remaining'.

(3) Conservation significance of the habitat zone based on consideration of threatened species.

### 3.1.6 Targeted Flora Surveys

Targeted surveys were undertaken for significant flora species including; Matted Flax-lily, Green Scentbark, Swamp Everlasting, River Swamp Wallaby-grass, Veined Spear-grass, Arching Flax-lily and Maroon Leek-orchid within the study area during 2009/10. The results for each species are discussed below.

### **3.1.6.1 Matted Flax-lily**

A total of 10 additional Matted Flax-lily plants were recorded within study area (Figures 3a–3d). The initial survey (conducted in autumn) located only a single plant, although as outlined above, this survey was not undertaken during the optimal flowering period for Matted Flax-lily and many tillers were small and easily overlooked. As such, it was thought that many individual plants escaped detection. During the additional spring/summer survey nine new individual populations of Matted Flax-lily were located along Rix Road and the railway corridor, with one individual population also found within the Gilbert Property.

Biosis Research Pty Ltd (2006) located 17 individual populations, of which the current surveys located only seven. These populations may have gone undetected due to a lack of visible flowering structures, mowing of vegetation for firebreaks (such as in the paddock adjacent to Rix and Officer-South Road) or they may have experienced severe competition from other species in the years since the previous surveys (Biosis Research Pty Ltd 2004; 2006). Matted Flax-lily has also been recorded on one occasion within the local area (i.e. within a 10 kilometre radius of the study area) (FIS 2009).

All of the records for this species are from between 1999 and 2008. However, previous surveys of the area (Biosis Research Pty Ltd 2006) indicate that there are at least a further nine Matted Flax-lily individuals present within the study area (Figures 3a–3d; Figure 4: Note: some points represent multiple records).

### **3.1.6.2 Green Scentbark**

Forty-three Green Scentbark trees were recorded during the present (Figure 3a–3d; Figure 4: Note: some points represent multiple records). Some specimens recorded during the current survey have been previously recorded by Biosis Research Pty Ltd (2004), although many of these trees are new records.

### **3.1.6.3 Swamp Everlasting**

No Swamp Everlasting specimens were recorded during either targeted survey. Swamp Everlasting has not been previously recorded in the study area (FIS 2009), although it appears on the EPBC Act Protected Matters Search Tool.

Based on the lack of records in the Precinct and local area, the generally modified nature of the study area, and the level of assessment undertaken for this assessment (and previous assessments), it is considered to have a low likelihood of occurrence on the site.

#### **3.1.6.4 River Swamp Wallaby-grass**

No River Swamp Wallaby-grass specimens were recorded during either targeted survey. As with Swamp Everlasting, this species has not previously been recorded in the Precinct or within the vicinity of the site, and it is considered to have a low likelihood of occurrence in the study area.

#### **3.1.6.5 Veined Spear-grass**

The present surveys found several Veined Spear-grass individuals throughout the Officer Precinct (Figures 3a–3d; Figure 4: Note: some points represent multiple records). Most specimens were recorded during the second survey as glumes and awns were at a mature stage for correct identification.

Some specimens recorded during the current survey have been previously recorded by Biosis Research Pty Ltd (2004; 2006) (Figure 3a–3d; Figure 4: Note: some points represent multiple records), although many of these specimens are new records.

#### **3.1.6.6 Arching Flax-lily**

This species has been previously recorded by Biosis Research Pty Ltd (2006), and although the present survey found four of these populations, no new locations for this species were found. This species may have gone undetected due to a potential lack of visible flowering structures, or have experienced severe competition from other species in the years since Biosis Research Pty Ltd (2006) recorded them especially along parts of the rail corridor.

#### **3.1.6.7 Maroon Leek-orchid**

Maroon Leek-orchid was not recorded during either targeted flora survey although five of these plants have previously been recorded in the local area (FIS 2009). There is one record of this species within the precinct along Browns Road, however it was last recorded in 1940 (FIS 2009). It is unlikely that this species will be present within the Precinct due to a lack of suitable habitat. However Maroon Leek-orchids does not flower every year, and may become dormant or effected by drought. Furthermore, it is a small and inconspicuous species and therefore it remains possible, however unlikely, that some individuals are present.

## 3.2 Fauna Assessments

### 3.2.1 General Fauna Survey

Eighty-four fauna species (64 native birds and seven introduced) were recorded in the current survey (Appendix 3.1). In addition, three native mammal species (Common Brushtail Possum *Trichosurus vulpecula*, White-striped Freetail Bat *Tadarida australis*, Black Wallaby *Wallabia bicolor*) and four introduced mammals (Red Fox *Vulpes vulpes*, European Hare *Lepus europeaus*, European Rabbit *Oryctolagus cuniculus* and House Mice *Mus musculus*) were recorded within the study area. There were six native frog species including Southern Bullfrog *Limnodynastes dumerilii*, Striped Marsh Frog *Limnodynastes peronii* and Spotted Marsh Frog *Limnodynastes tasmaniensis* were recorded within the study area (Appendix 3.1). Additional species adapted to modified areas are likely to use the study area.

No national or state significant fauna species were recorded during the preliminary fauna assessment, although the nationally significant Growling Grass Frog has previously been recorded within the south-eastern portion of the study area. Dwarf Galaxias are known to breed within Cardinia Creek and its associated floodplains within or adjacent to the study area. Australian Grayling also occur within Cardinia Creek.

The study area was searched for scats and diggings and there was no evidence of kangaroos or wombats within the study area. There was no obvious evidence of additional foraging activity, or diggings by smaller mammals (i.e. bandicoot, potoroo etc). Southern Brown Bandicoot may occasionally use suitable habitat (i.e. dense contiguous woodland and/or Swamp Scrub vegetation) within the north-western section of the study area.

### 3.2.2 Threatened fauna species

#### 3.2.2.1 National

Fourteen nationally significant fauna species have previously been recorded from the local area (AVW 2009), or habitat for these species is predicted to occur within the study area (EPBC Act Protected Matters Search Tool) (Appendix 3.2).

These species include:

Four terrestrial mammals: Southern Brown Bandicoot *Isoodon obesulus obesulus*, Long-nosed Potoroo *Potorous tridactylus*, Spot-tailed Quoll *Dasyurus maculatus* and Smoky Mouse *Pseudomys fumeus*;

- One bat species: Grey-headed Flying-fox *Pteropus poliocephalus*;

- Four woodland dependent birds: Regent Honeyeater *Xanthomyza phrygia*, Superb Parrot *Polytelis swainsonii*, Helmeted Honeyeater *Lichenostomus melanops cassidix* and Swift Parrot *Lathamus discolor*;
- One wetland dependent birds: Australian Painted Snipe *Rostratula australis*;
- Two fish: Dwarf Galaxias *Galaxiella pusilla* and Australian Grayling *Prototroctes maraena*;
- One frog: Growling Grass Frog *Litoria raniformis*; and,
- One invertebrate: Golden Sun Moth *Synemon plana*.

As nationally significant fauna species including Growling Grass Frog, Southern Brown Bandicoot and Dwarf Galaxias have the potential to occur within the Precinct, targeted surveys were undertaken for these species (Section 3.4). With the exception of Superb Parrot, Swift Parrot, Regent Honeyeater and Helmeted Honeyeater which may fly over the study area on an occasional basis (Appendix 3.2).

There is no suitable breeding habitat for the remaining threatened fauna species listed from the AVW or EPBC Act listed species within the study area (SEWPaC 2010; Appendix 3.2).

### 3.2.2.2 State

No state significant fauna were recorded within the study area during the current assessment. Twenty-three state significant fauna have previously been documented from within 10 kilometres of the study area on the AVW (Appendix 3.2). Previously recorded state significant species include:

- Three nocturnal raptors: Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens* and Sooty Owl *Tyto tenebricosa*;
- Three diurnal raptors: White-bellied Sea-Eagle *Haliaeetus leucogaster*, Grey Goshawk *Accipiter novaehollandiae* and Black Falcon *Falco subniger*;
- Eleven wetland associated birds: Australian Shoveler *Anas rhynchotis*, Blue-billed Duck *Oxyura australis*, Freckled Duck *Stictonetta naevosa*, Hardhead *Aythya australis*, Lewin's Rail *Lewinia pectoralis*, Musk Duck *Biziura lobata*, Baillon's Crake *Porzana pusilla*, Intermediate Egret *Egretta intermedia*, Eastern Great Egret *Ardea modesta*, Caspian Tern *Sterna caspia* and Royal Spoonbill *Platalea regia*;
- Three woodland associated birds: Major Mitchell's Cockatoo *Cacatua leadbeateri*, Hooded Robin *Melanodryas cucullata* and Brown Treecreeper (south-eastern spp.) *Climacteris picumnus victoriae*;



- Two reptiles: Lace Goanna *Varanus varius* and Swamp Skink *Egernia coventryi*; and,
- One frog species: Southern Toadlet *Pseudophryne semimarmorata*.

A number of state significant bird species including; Eastern Great Egret, Hardhead, Baillon's Crake and Royal Spoonbill may occasionally use farm dams, drainage lines and other low lying areas within the study area (Appendix 3.2). Glossy Grass Skink, Swamp Skink and Southern Toadlet may also occur throughout drainage lines and swampy woodland areas containing Swamp Scrub within the study area.

Overall there is no important habitat for any state significant fauna species within the study area. The likelihood of these species occurring in the study area is provided in Appendix 3.2.

### 3.2.2.3 *Regional and local*

No regionally significant fauna species were recorded during the present assessment. Seven regionally significant fauna species have previously been recorded from within 10 kilometres of the study area on the AVW (Appendix 3.2). Previously recorded state significant species include:

- Four wetland associated birds: Latham's Snipe *Gallinago hardwickii*, Whiskered Tern *Chlidonias hybridus*, Pied Cormorant *Phalacrocorax varius*, Nankeen Night Heron *Nycticorax caledonicus*;
- Two woodland associated birds: Brown Quail *Coturnix ypsilophora*, Spotted-Quail Thrush *Cinlosoma punctatum*; and,
- One diurnal raptor: Spotted Harrier *Circus assimilis*.

Latham's Snipe were recorded during recent surveys along the Cardinia Creek corridor within freshwater wetlands (AT, pers. obs.). Spotted Harrier may forage over open grassland, crops and windbreaks throughout the study area. Spotted Quail-thrush may enter preferred habitat in the north-western section of the study area on the occasional basis. The likely use of the study area by these species is provided in Appendix 3.2. There is no significant or limiting habitat for any species of regional conservation significance within the study area.

All other native fauna (primarily grassland dependent birds) are of local significance, as they are not listed as rare or threatened on a national, state and/or regional level.

### 3.2.3 Best or Remaining 50% for Rare and Threatened Fauna Species

Suitable habitat has been identified for threatened flora species within the overall Precinct area. The determination of the best or remaining habitat for threatened fauna species is provided in Table 2.

**Table 3.** Habitat assessment for threatened fauna species

Species	Conservation status EPBC Act, DSE, FFG Act	Steps	Determination of Best 50% / Remaining 50%	Conservation significance	Notes
Growling Grass Frog	Vu, En, L	A yes, B no, E no, F no	Remaining 50%	Not Applicable	Known habitat within south-eastern corner of study area within pre-existing waterbodies
Dwarf Galaxias	Vu, Vu, L	A yes, B no, E no, F no	Remaining 50%	Very High	Cardinia Creek and associated floodplain known habitat
Southern Brown Bandicoot	En, NT, L	A no, D Yes, F no	Remaining 50%	High – Very High	North-west woodland/forest patches and Cardinia Creek considered potential habitat
Swamp Skink	-- , Vu, L	A no, D Yes, F no	Remaining 50%	High – Very High	A number of habitat zones considered to be potential habitat for this species within the study area
Southern Toadlet	-- , Vu, --	A no, D yes, F no	Remaining 50%	High – Very High	A number of habitat zones considered to be potential habitat for this species within the study area

### 3.2.4 Fauna habitats

The study area supports six broad habitat types: the Cardinia Creek corridor, exotic grasslands, drainage lines/depressions, created wetlands, remnant native woodland and scattered remnant trees. The value of each of these habitats for fauna ranges from low for exotic grassland, to moderate for remnant native woodland. A description of each habitat type and the species likely to occur within them is given below.

#### 3.2.4.1 *Cardinia Creek*

*Description:* Cardinia Creek currently acts as an important movement corridor for a range of native fauna species within the local area. The combination of Cardinia Creek in conjunction with remnant patches of vegetation and large hollow-bearing trees provides breeding, foraging and dispersal habitat for a range of locally abundant mammals, birds, reptiles and fish species throughout the broader landscape.

Tree hollows also provide a valuable roosting, nesting and foraging resource for a suite of locally abundant mammal, bird and bat species including; possums, parrots, cockatoos, owls and micro-bats. Remnant trees also provide nesting sites and vantage points for raptors and suitable foraging habitat for a range of insectivorous and nectar-feeding birds.

*Fauna:* A total of 40 bird species (37 native and three introduced) were recorded during the current assessment including the native Bell Miner *Manorina melanophrys*, Sacred Kingfisher *Todiramphus sanctus*, Shining Bronze Cuckoo *Chrysococcyx lucidus*. This diversity bird species indicates the suitability of habitat along the creek corridor. Three frog species (Common Froglet, Spotted Marsh Frog and Striped Marsh Frog) and two skinks (Garden Skink and Tussock Skink) were also recorded along Cardinia Creek.

Introduced species such as Common Myna *Acridotheres tristis* and Common Starling *Sturnus vulgaris* are common in this type of habitat, as are introduced mammals such as European Rabbit and Red Fox.

#### 3.2.4.2 *Exotic grassland*

*Description:* Introduced modified grassland is the dominant fauna habitat throughout the study area south of Gippsland Railway. This habitat occurs where remnant native vegetation has been cleared. Introduced grassland supports relatively few fauna species, none of which are dependent on such habitat. Given the extent of the modification of grassland habitat within the study area, and the number of introduced species, the value of this habitat for fauna within the study area is generally low.

*Fauna:* A number of species common to modified, grassy or open habitats were recorded during the current assessment including the native Australian Magpie *Gymnorhina tibicen*, Little Raven *Corvus mellori*, and Welcome Swallow *Hirundo neoxena*.

Introduced species such as Common Myna *Acridotheres tristis* and Common Starling *Sturnus vulgaris* are common in this type of habitat, as are introduced mammals such as European Rabbit and Red Fox.

Numerous frog species (including Growling Grass Frog) may forage or reside within grassy areas surrounding suitable habitat, although frog species are not dependent on this habitat for breeding purposes.

#### **3.2.4.3 Drainage lines/depressions**

*Description:* There are numerous drainage lines/depressions throughout the study area which may provide habitat for a range of fauna species, including mammals, birds (principally waterbirds), reptiles and frogs.

These are considered to be of high to moderate habitat value as vegetation is modified between remnant swampy woodlands and modified exotic vegetation (namely as a result of past land use i.e. agricultural practices or cattle grazing). The highest quality habitat for fauna is located throughout the VicUrban property, Station Road, Gum Scrub Creek, adjacent to the Officer Train Station and the Princess Highway (Figure 2a–2d). This is primarily due to the presence of remnant woodland flora species such as Swamp Paperbark and wattle trees which provide valuable cover for a range of fauna species.

*Fauna:* In areas of higher quality habitat (as above), Dwarf Galaxias, Southern Toadlet, Swamp Skink and Glossy Grass Skink may use densely vegetated drainage lines as potential breeding or foraging habitat during suitable conditions (i.e. Dwarf Galaxias during large flood events) (Ecology Partners Pty Ltd 2009a).

The presence of Growling Grass Frog and suitable habitat for the species in the study area suggests that Growling Grass Frog may be present in the drainage lines or utilise them as corridors.

Additionally, at times of high rainfall the drainage lines within the study area could further provide breeding, foraging and refuge habitat for a suite of other native fauna, including waterbirds and a diversity of invertebrate species, as well other common frog species heard during the present assessment (i.e. Common Froglet *Crinia signifera* and Striped-Marsh Frog *Limnodynastes peronii*).

#### **3.2.4.4 Pre-existing Waterbodies (Farm Dams)**

*Description:* There are numerous waterbodies within the study area of which the majority have been surveyed previous to this assessment (Ecology Partners Pty 2006a; 2009a).

Waterbodies support varying levels of aquatic and semi-aquatic emergent, floating and fringing vegetation (sedges and reeds) in which some may act as high habitat for the nationally-listed Growling Grass Frog (Ecology Partners Pty 2006a; 2009a).

*Fauna:* The study area may also provide suitable foraging habitat for a variety of state significant bird species including; Hardhead, Royal Spoonbill, Eastern Great Egret and Baillon's Crake.

Waterbodies are likely to provide suitable habitat for the regionally significant Latham's Snipe however, they are unlikely to form important or limiting habitat for any state or regionally listed species. Wetlands within the study area also provide habitat for locally abundant waterbirds such as Pacific Black Duck *Anas superciliosa*, Australian Wood Duck *Chenonetta jubata*. See Section 3.4.2 for a detailed discussing on the likelihood of Growling Grass Frogs using pre-existing waterbodies within the study area.

#### **3.2.4.5 Remnant native woodland/forest**

*Description:* Remnant native woodland and forest habitats dominated by eucalypts, acacia and tea-tree are present within the study area. The largest patch of this habitat type exists towards the north-west corner of the Precinct and along Cardinia Creek with less connected patches common along linear vegetation strips such as roads, railways and drainage lines, and as windbreaks between adjoining properties. Such vegetation strips are frequently used as wildlife corridors, providing habitat and facilitating the movement of species throughout the landscape.

*Fauna:* Although the majority of these trees do not support hollows, they may provide an important source of food for nectar-feeding woodland birds such as lorikeets, honeyeaters and wattlebirds.

Such areas also provide shelter and dispersal habitat for a suite of native fauna, particularly in their role as wildlife corridors. They also provide nesting sites and vantage points for raptors and other open country birds (e.g. Australian Magpie, Little Raven and Brown Goshawk *Accipiter fasciatus*).

Areas of overstorey within the study area that are dominated by eucalypt species may also provide food resources, breeding habitat and cover for common native mammals such as Common Ringtail Possum, Common Brushtail Possum, and insectivorous micro-bats.

The understorey in dense woodland areas is also likely to provide a foraging resource for native mammals, reptiles and frogs, particularly areas that have an extensive cover of ground debris (e.g. fallen leaves, sticks and branches). See Section 4.3 for a detailed discussing on the likelihood of Southern Brown Bandicoot, Swamp Skink, Glossy Grass Skink and Southern Toadlet using remnant native woodland habitat within the study area.

#### **3.2.4.6 Scattered remnant trees**

*Description:* Isolated remnant trees provide moderate habitat value for fauna. Many mature trees are scattered throughout the study area, several of which support varying sized hollows. The native understorey vegetation has been totally removed and replaced by exotic grasses and weeds.

*Fauna:* Few fauna species are likely to use this habitat, primarily woodland birds and birds adapted to cleared landscapes. Tree hollows provide a valuable roosting, nesting and foraging resource for a suite of locally abundant bird and bat species including; parrots, cockatoos, owls and micro-bats. Remnant trees also provide nesting sites and vantage points for raptors and suitable foraging habitat for a range of insectivorous and nectar-feeding birds.

### **3.2.5 Targeted Fauna Surveys**

Targeted surveys were undertaken to ascertain the likelihood of individual or extant populations of threatened fauna species occurring within the study area. The following section discusses the results from targeted surveys for; Southern Brown Bandicoot, Growling Grass Frog, Dwarf Galaxias, Australian Grayling, Swamp Skink, Glossy Grass Skink and Southern Toadlet.

Ecology Australia did not record Southern Brown Bandicoot along the eastern side of Cardinia Creek during recent targeted surveys (Ecology Australia Pty Ltd 2010). Growling Grass Frog was not recorded within additional waterbodies to the east of Cardinia Creek during targeted surveys (Figure 8b).

Dwarf Galaxias are known to occur throughout the Cardinia Creek floodplains wetlands and sandpits and were recorded at one location during recent targeted surveys (Ecology Australia Pty Ltd 2010; Figure 9).

No targeted surveys were conducted for Australian Grayling within this part of the Officer Precinct, although the species has previously been recorded at the Thompson Road fishway, two kilometres south of the study area (NIWA and Streamline Research 2004).

Please note the following information does not include the results from the Cardinia Creek floodplain wetlands. For a more detailed summary of this information, please refer to the Ecology Australia CMP (Ecology Australia Pty Ltd 2010).

#### **3.2.5.1 Southern Brown Bandicoot**

There is a single record of Southern Brown Bandicoot on the Atlas for Victorian Wildlife within a 10 kilometer radius of the study area dating back to 1919 (AVW 2009; Figure 9). This record is from the Upper Beaconsfield region, approximately five kilometres north-west of the precinct.

Within a 15 kilometre radius of Officer there are 37 records in areas south of the Study Area including: Cranbourne Botanic Gardens, Cardinia and Dalmore East (AVW 2009; Figure 9).

However, there are DSE verified unpublished records of Southern Brown Bandicoot in close proximity to the study area, approximately 3.5 kilometres south of the Pakenham Bypass. There are also several records further north, towards Belgrave South and Lysterfield (i.e. Lysterfield Park) (Figure 9). Further information on records can be obtained from the Sub Regional Strategy for the Southern Brown Bandicoot and the Strategic Management Plan for the Koo Wee Rup swamp area (Ecology Australia Pty Ltd 2008)

Active searching for Southern Brown Bandicoot was undertaken within suitable habitat for the species. This included large remnant woodland patches (Grassy Forest) towards the north-west corner of the Precinct (Figure 6), and areas containing Plains Grassy Woodland and Swampy Woodland near the Officer Train station. An optimal time to survey for this species is considered to be during winter when they are actively foraging for food sources such as truffles. Foraging actively may therefore be observed from visual signs such as conical diggings (Menkhorst and Knight 2004). As the timing of the surveys occurred during March and April the timing of the survey may have reduced the likelihood of detecting this species (if present) within suitable habitat.

As recent records have been identified close to the study area, there is a possibility that this species may persist within the Precinct.

There is habitat connectivity to potentially suitable habitat within the north-west sections of Precinct and north of the study area. This habitat is suitable for Southern Brown Bandicoot as it contains lowland or Grassy Forest vegetation.

While no active signs of Southern Brown Bandicoot (ie conical diggings) were recorded during active searching, this species may enter the north-west corner of the study area occasionally. Cardinia Creek has been identified as supporting suitable habitat and form an important dispersal corridor for the species and small patches of less suitable habitat throughout the north-west section of the study area within private property (Figure 6).

Further information can be obtained from the Sub-Regional Strategy for the Southern Brown Bandicoot under Melbourne's Strategic Assessment.

#### **3.2.5.2 *Growling Grass Frog***

The Growling Grass Frog was not recorded during the current targeted surveys. Of the twenty-one dams identified from aerial photographs and daytime walkover assessments, two were completely dry (15A and 17A).

However, these waterbodies may provide suitable breeding habitat during favourable conditions (i.e. increased rainfall) as they contain varying levels of emergent vegetation along the banks (Figure 8b; Appendix 4). An additional two waterbodies were considered unsuitable due to degraded surrounding habitat (i.e. cattle grazing) and water conditions (18A and 19A; Figure 8b; Appendix 4). The remaining water bodies provide suitable habitat for the species as seen in Figure 8a (Appendix 4). Of the remaining twenty-one dams, none were identified as containing Growling Grass Frog (Figure 8a; Appendix 4).

Poor habitat quality was also observed to be common throughout all the additional dams surveyed to the south of the Precinct and adjacent to Rix Road (Figure 8b; Appendix 4).

A population of Growling Grass Frogs is known from the south-east corner of the study area, within waterbodies previously surveyed by Ecology Partners Pty Ltd (2006a) (Figure 8b). Results from that survey indicated that several dams in the south-eastern corner of the study area supported Growling Grass Frogs (Figure 8b; Appendix 4).

The study also demonstrated that successful recruitment occurred at site 1a and that the species has also been recorded in surrounding waterbodies (1b, 1c, 1e and 1f) (Figure 8b). This demonstrated that frogs were moving between sites during the species' active period, including juvenile dispersal from site 1b to other waterbodies including Site 1c (Ecology Partners Pty Ltd 2006a).

The close proximity of permanent drainage channels and streams throughout Pakenham suggests that Gum Scrub Creek may act as an important dispersal corridor for the species in the study area (Ecology Partners Pty Ltd 2006). The south-east corner of the study area and the Gum Scrub Creek riparian corridor is therefore considered to be a high conservation priority area for Growling Grass Frog (Figure 8b). It may also be reasonable to conclude that the population in the south-east of the study area is part of the far north-west corner of a metapopulation that extends throughout Pakenham, Nar Nar Goon and Bayles, south of the Princes Highway (Ecology Partners Pty Ltd 2006b).

While the species has not been detected in the vicinity of Cardinia Creek in the past (i.e. during recent targeted surveys of the species from 2003 onwards), there is potentially suitable habitat (albeit moderate quality) for the species in ephemeral waterbodies adjacent to the creek and other areas (i.e. throughout paddocks) located to the east of the creek (Figure 8b).

'Suitable habitat' refers to all waterbodies (i.e. ponds, dams, wetlands) and watercourses (i.e. creeks and drainage lines) that have varying levels of emergent, submerged, fringing and surrounding vegetation, have high water quality, no or low numbers of predatory fish species, and are located in proximity to other waterbodies or watercourses of similar quality (Figure 8b). Targeted surveys were carried within all waterbodies considered to be suitable habitat for Growling Grass Frog.



Ecology Partners recommends that buffer distances and management requirements for waterbodies classified as suitable habitat follow the recommendations outlined in the Sub-regional Growling Grass Frog *Litoria raniformis* Conservation Strategy under Melbourne's Strategic Assessment.

There are 96 records of the species documented from the local area (AVW 2009; Figure 9). While the number of records for Growling Grass Frog records will be higher due to recent extensive monitoring of the local Growling Grass Frog population as part of the Pakenham Bypass Project 2006b; 2007; 2008; 2009c) (Figure 9).

The results from recent monitoring undertaken throughout this region have revealed that the species site occupancy is lower than previous surveys (Organ, A. pers. obs.) (Table 3; Appendix 4). The presence of the species has not yet been determined in the western portion of the study area or north of the Princes Highway, even after active searching over numerous years (AO, pers. obs.).

Ecology Partners Pty Ltd have also completed several detailed surveys within the study area and surrounds, including a detailed mark-recapture study (Hamer and Organ 2006a; 2006b, 2006c).

From these investigations it appears that frogs may move from drains to farm dams to breed when habitat (e.g. water levels, vegetation) and climatic conditions (e.g. prolonged rain) become more favourable.

It appears the frogs may also move from farm dams to the drains when conditions become unfavourable. This has been documented at a number of other sites occupied by the species such as at the Western Treatment Plant where frogs are known to move between treatment lagoons and drainage channels depending on conditions (Organ 2003a, 2003b, Organ 2005d). During previous surveys by Ecology Partners Pty Ltd (2006a) habitat conditions in selected dams were more favourable for Growling Grass Frogs (i.e. containing suitable habitat/refuge in addition to good water quality) (Table 3). This may explain the variation in the number of Growling Grass Frogs observed during the present survey.

The timing of the survey may also contribute to an explanation of why no Growling Grass Frogs were detected in the current survey. Other factors which may account for lower numbers recorded during the current surveys may be attributed to a natural fluctuation in the population, the prevailing drought, lower quality habitat, and the presence of Plague Minnow *Gambusia holbrooki* and other predatory fish within the waterbodies surveyed.

It is reasonable to conclude that based on detailed survey of the species and its habitats over several years that the population in the study area is part of the far north-west corner of a meta-population, which extends throughout Pakenham, Nar Nar Goon and Bayles, south of the Princes Highway.

### **3.2.5.3 Dwarf Galaxias**

There are two historic records from 1983 of Dwarf Galaxias occurring within Cardinia Creek (AVW 2009). There are known populations within Cardinia Creek Retarding Basin to the north (McGuckin 2007; 2008; Saddler *et al.* 2008; Figure 9). Interestingly, two verified and 11 unverified records from DSE and previous reports have indicated that Dwarf Galaxias are likely to use sections of Cardinia Creek including wetlands, waterbodies, drainage lines and flood plains within or adjacent to the study area (McGuckin 2008; Figure 6; Figure 9).

There are existing records from within Cardinia Creek and the waterbodies and anabranches on the floodplain of Cardinia Creek (McGuckin 2008; 2010).

McGuckin (2008) identifies the flood plain of Cardinia Creek as suitable habitat for the species. There is a low likelihood that this species exists in other temporary waterbodies (i.e. creeks and drainage lines) within the study area due to the recent drought and the patchiness of the population. McGuckin (2007) concluded that the apparent absence of Dwarf Galaxias on the Cardinia Creek Floodplain in 2007 was likely due to low stream flows and poor recruitment of the species in Cardinia Creek in the past few years of drought. However, the species has been recorded again on the floodplain in 2010 (Ecology Australia Pty Ltd 2010).

Dwarf Galaxias were not recorded during the current targeted surveys along Station Street and drainage lines throughout VicUrban property to the west (Figures 5a-5d). Gum Scrub Creek and other potential waterbodies (i.e. flood plains adjacent to Cardinia Creek) were also dry at the time of targeted surveys; as a result these waterbodies were not surveyed for this species.

It is likely that southern sections of Cardinia Creek adjoining the study area act as a dispersal route for this species and are considered important habitat for the conservation of the species locally. It is further expected that individuals would disperse from these breeding sites to nearby waterbodies during favourable conditions (i.e. a flood event) (CA, pers. obs.) and will continue to breed in these wetlands (DSE, pers. comm.).

### **3.2.5.4 Australian Grayling**

There were no Australian Grayling detected within the Precinct the current survey. There is a previous record of Australian Grayling along Cardinia Creek, south of the Precinct (AVW; Figure 9). There is a low likelihood that this species occurs within the Precinct due to the lack of suitable habitat (i.e. poor water quality, lack of flow).

### 3.2.5.5 Swamp Skink

Swamp Skink was not recorded during the current survey and no historic records of the species occur within the vicinity of the Precinct although there are no known surveys for this species in the vicinity of the Precinct (DSE, pers.comm.).

A selection of baits were used in Elliott Traps to survey for this species during the present surveys (i.e. consistent with Clemann *et al.* 1998).

At low populations, Swamp Skink can often be difficult to trap in Elliott Traps (Clemann 2000). Active searching for this species was undertaken principally along creek lines within the Precinct, although this species can also be difficult to detect during active searching due to its cryptic nature.

In addition, it is likely that vegetation structure, rather than the species composition of plants, is the most important determinant of habitat suitability for Swamp Skinks (Robertson 2007). Consequently, the species may occupy areas containing high weed invasion within and adjacent to suitable habitat (Robertson 2007).

**Table 4.** Summary of Swamp Skink survey results at trap sites

Targeted Survey Area	Sites	Survey Dates	Temperature (degrees centigrade)		Precipitation in previous 24 hours	Swamp Skink	Other species
			Maximum	Minimum			
Drainage Line South (Princess Hwy)	West Section - 10 Elliott Traps	18/3/2009	29	14	Yes (0.2mm)	0	8 House Mouse
		19/3/2009	33	15	No	0	
		20/3/2009	23	16	No	0	
		21/3/2009	35	15	No	0	
		22/3/2009	26	20	No	0	
Drainage Line South Princess Hwy–VicUrban	Central Section (Running North-West – South-East) – 20 Elliott Traps	18/3/2009–22/3/2009	Weather Conditions As Above			None	4 House Mouse
Station Street Drainage Line	South Section – 5 Elliott Traps	23/3/2009 &	20	15	No	0	3 House Mouse
		24/3/2009	21	14	Yes (1.6mm)	0	
Station Street Drainage Line	North Section – 5 Elliott Traps	23/3/2009 & 24/3/2009	Weather Conditions As Above			0	2 House Mouse

Notwithstanding the above, Swamp Skink was not detected in the highest quality habitat for the species, including sections of the Princess Highway, a large area west of Station Road and throughout Gum Scrub Creek (Table 4; Figure 5; Figure 7).

### 3.2.5.6 Glossy Grass Skink

Glossy Grass Skink was not recorded during the current survey, and has not been recorded within the vicinity of the study area (Figure 9). Habitat for Glossy Grass Skink within the Precinct is considered to be low quality, but the species was targeted opportunistically while surveying for Swamp Skink (Figures 5a-5d; Figure 7).

Glossy Grass Skink is considered to have a low likelihood of occurrence in damp wetland areas throughout the Precinct, and is unlikely to occur elsewhere in the Precinct given the highly modified nature of habitats and lack of suitable habitat. This species can also be difficult to detect during active searching due to its cryptic nature.

Potentially suitable habitat (albeit of low quality) for the Glossy Grass Skink was identified and actively searched along Starling Road, Tivendale Road, Bayview Road, Rix Road and along the Trainline (in addition to areas surveyed for Swamp Skink) within the Precinct (Figure 6). Results from this assessment indicated no visual or incidental evidence that this species occurs within the Precinct.

### **3.2.5.7 *Southern Toadlet***

There have been 82 AVW (2009) records within a 10 kilometre radius of the Precinct (Figure 9). However, Southern Toadlet was not detected within the study area during the current survey.

Southern Toadlet is active between March and May. While it is more likely to call after a rainfall event, very little rainfall (<2mm) was experienced in and around Melbourne prior to the assessment dates. This reduced the likelihood of recording the species at this time, although additional surveys were carried out during April after rainfall events within preferred habitats (Figure 8a).

Southern Toadlet was not heard or observed during the recent targeted surveys across potentially suitable habitats within the Precinct. With the exception of the remnant vegetation north of the Officer Train Station, and to the north-western section of the Precinct, there is a low likelihood that this species occurs within the remainder of the Precinct.

Ecology Partners Pty Ltd (2010a) recently surveyed potential habitat for this species within Cardinia Creek (south of the Pakenham Bypass) as part of the Biodiversity Assessment for Area 5, 'Officer Employment Area, during April 2010. While there were no Southern Toadlet heard calling, patches of remnant vegetation may provide suitable breeding or foraging habitat for an extant population of this species throughout Cardinia Creek.

## 4 RELEVANT POLICY AND LEGISLATION

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This section identifies biodiversity policy and legislation relevant to the current assessment and principally addresses:

### 4.1 Commonwealth Legislation

#### 4.1.1 Environment Protection and Biodiversity Conservation (EPBC) Act 1999

The EPBC Act establishes a Commonwealth process for assessment of proposed actions that are likely to have a significant impact on matters of National Environmental Significance (NES), or on Commonwealth land. An action (i.e. project, development, undertaking, activity, or series of activities), unless otherwise exempt, requires approval from the Commonwealth Environment Minister if they are likely to have an impact on any matters of NES. A referral under the EPBC Act is required if a proposed action is likely to have a ‘significant impact’ on any of the following seven NES significance:

1. World Heritage properties;
2. National Heritage places;
3. Ramsar wetlands of international significance;
4. Threatened species and ecological communities;
5. Migratory and marine species;
6. Commonwealth marine area;
7. Nuclear actions (including uranium mining); and,
8. The Great Barrier Reef.

The study area is not located within or near a World Heritage property or National Heritage property, therefore these matter of NES are not considered further.

##### 4.1.1.1 *Ramsar wetlands of international significance*

The SEWPac Protected Matters Search Tool (SEWPac 2010) identified one wetland of international significance—Edithvale-Seaford Wetlands—as occurring within the same catchment as the study area and one wetland of international significance—Western Port Bay—as occurring within 10 kilometres of the study area.

The Edithvale-Seaford Wetlands are unlikely to be impacted by any development within the study area due to their distance from Officer (>30 kilometres) and lack of connection to Officer via waterways.

Any proposed developments within the study area should ensure that no sediments or toxic pollutants enter the creek system and ultimately Western Port Bay.

Best practise sedimentation and pollution control measures (to EPA standard) should be carried out and enforced within the study area to ensure this internationally significant wetland system is not adversely affected by upstream development.

#### ***4.1.1.2 Listed flora and fauna species, and ecological communities***

An action requires approval from the Commonwealth Environment Minister if it will, or if it is likely to, have a significant impact on an endangered or critically endangered species, or on an ‘important population’ or critical habitat of a listed vulnerable species.

*Flora:* Populations of Matted Flax-lily, listed as endangered under the EPBC Act, were recorded during the current surveys, in addition to the species being previously recorded within the study area (Biosis Research Pty Ltd 2004; FIS 2009).

*Fauna:* Growling Grass Frog, Dwarf Galaxias and Australian Grayling (Cardinia Creek) are known to occur within the Precinct

Grey-headed Flying-fox, Regent Honeyeater, Superb Parrot and Swift Parrot may fly over, or periodically reside within the study area on rare occasions. There is no suitable habitat for any other nationally significant species within the study area (Appendix 3.2).

*Communities:* There are no endangered communities located within the study area, nor are there any occurring within the local area (i.e. within a 10 kilometre radius of the study area). However it must be noted that the Plains Grassy Wetland (EVC 125) located within the Gilbert Property is the surrogate vegetation class for the EPBC Act nominated Temperate Lowland Plains Grassy Wetland community and a decision on this is pending.

#### ***4.1.1.3 Listed migratory and marine species***

A small number of common migratory and marine species were recorded during the present survey (Appendix 3.1). While a number migratory and marine species may occupy habitats within the study area on occasions, the study area does not provide important habitat for an ecologically significant proportion of any of these species.

#### ***4.1.1.4 Commonwealth marine area and nuclear actions***

The study area is not within a marine area, nor is the proposed works related to nuclear actions.

#### **4.1.1.5 Implications for the proposed development**

An agreement under the Strategic Assessment provision of the EPBC Act (Section 146(1) Agreement, Part 10 Strategic Assessment (EPBC Act)) was made between the Commonwealth of Australia and the State of Victoria on 16th June 2009.

The Strategic Assessment provides an opportunity to align State and Commonwealth requirements and approval standards for issues of common interest.

## **4.2 State Legislation**

- *Flora and Fauna Guarantee (FFG) Act 1988 (Victoria)*
- *Planning and Environment Act 1987 (Victoria)*
- *Catchment and Land Protection (CALP) Act 1994 (Victoria)*
- *Victoria's Biodiversity Strategy 1997*
- *Port Phillip and Westernport Native Vegetation Plan (2006)*
- *Victoria's Native Vegetation Management Framework (Net Gain Policy)*

### **4.2.1 Flora and Fauna Guarantee Act 1988**

The primary legislation for the protection of flora and fauna in Victoria is the FFG Act. The Act builds on broader national and international policy in the conservation of biodiversity.

The broad objectives of the FFG Act are to; 1) ensure native flora and fauna survive, flourish and maintain in situ evolutionary potential, 2) manage threatening processes, 3) encourage the conserving of flora and fauna through cooperative community endeavours, and 4) establish a regulatory structure for the conservation of flora and fauna in Victoria.

The Act contains protection procedures such as the listing of threatened species and/or communities of flora and fauna, and the preparation of action statements to protect the long-term viability of these values.

#### **4.2.1.1 Flora**

Four FFG Act listed flora species have previously been recorded in the study area and an additional three are predicted to occur in the local area based on their habitat requirements (Appendix 2.2).

Twelve flora species, Black Wattle, Narrow-leaf Wattle *Acacia mucronata* subsp. *longifolia*, Hop Wattle *Acacia stricta*, Prickly Moses, Common Maidenhair *Adiantum aethiopicum*, Common Correa *Correa reflexa*, Rough Tree-fern *Cyathea australis*, Common Heath *Epacris impressa*, Slender Onion-orchid *Microtis parviflora*, Grass Triggerplant *Stylidium graminifolium* s.l. and the Blue-star Sun-orchid *Thelymitra homsii*, listed as protected under the FFG Act were identified within the study area during the current survey.

Additionally, four species listed as threatened under schedule 2 of the FFG Act have previously been recorded within the local area—Clover Glycine, Maroon Leek-orchid, Grey Billy-buttons and Purple Diuris.

It is unlikely that Clover Glycine and Grey Billy-buttons occur within the study area due to the highly modified nature of the vegetation present.

Only one FFG Act-listed species listed as threatened, the Matted Flax-lily, was recorded during the current targeted flora surveys.

#### **4.2.1.2 Fauna**

Three fauna species (Growling Grass Frog, Dwarf Galaxias and Australia Grayling) listed under the FFG Act are known to occur within the Precinct. There have been a small number of fauna species listed under the FFG Act which have previously been recorded within the local area (AVW 2009) (Appendix 3.2).

No FFG Act listed fauna were recorded within the study area during the assessment. Twenty-four FFG Act-listed fauna species have previously been recorded from within the local area (i.e. in a 10 kilometre radial of the study area) (Appendix 3.2) or habitats of these species are predicted to occur within the study area (EPBC Act Protected Matters Search Tool) (Appendix 3.2).

Given the presence and overall condition of habitat that is available, a small number of FFG Act listed species may use habitats within the study area on occasions (Appendix 3.2; Section 3).

#### **4.2.1.3 Ecological Communities**

Two FFG Act (1988) listed communities are present within the Gilbert Property. These include the Herb-rich Plains Grassy Wetland (West Gippsland) community as well as the Plains Grassland (South Gippsland) community.

These correspond with the two Ecological Vegetation Communities, Plains Grassy Wetland (EVC 125) and Plains Grassland (South Gippsland) (EVC 132-05) respectively.



#### 4.2.1.4 Threatening processes

Threatening processes listed under the FFG Act applicable to future development within the study area include:

- Alteration to the natural flow regimes of rivers and streams (through soil disturbance or increased run-off into waterways within study area);
- Habitat fragmentation as a threatening process for fauna in Victoria (through roadside and waterway vegetation removal and/or disturbance);
- Increase in sediment input into Victorian rivers and streams due to human activities (through construction works and increased run-off in or around waterways);
- The potential input of toxic substances into Victorian rivers and streams (through construction works in or around waterways);
- Invasion of native vegetation by Blackberry (through increased soil disturbance and potential human dispersal of seed);
- Invasion of native vegetation by “environmental weeds” (through increased soil disturbance and potential dispersal of weed material through increased human trampling and construction machinery);
- Loss of coarse woody debris from Victorian native forests and woodlands (through firewood collection by nearby residents);
- Loss of hollow-bearing trees from Victorian native forests (through increased mortality due to drought conditions, and subsequent felling by landowners);
- Predation of native wildlife by the House Cat, *Felis catus* (through increased presence of cats due to residential development);
- Predation of native wildlife by the introduced Red Fox *Vulpes vulpes*;
- Reduction in biomass and biodiversity of native vegetation through grazing by the Rabbit;
- Removal of wood debris from Victorian streams (through waterways disturbance);
- Spread of *Pittosporum undulatum* in areas outside its natural distribution;
- Use of *Phytophthora*-infected gravel in construction of roads, bridges and reservoirs (through construction works); and,

- Wetland loss and degradation as a result of change in water regime, dredging, draining, filling and grazing (through alterations and filling in of dams and low-lying areas within study area).

#### **4.2.1.5 Implications for the proposed development**

One flora species and two ecological communities listed as ‘threatened’ under the FFG Act were recorded within the study area. Also several flora and fauna species listed as ‘protected’ under the FFG Act have been previously recorded, and as such, any potential threatening processes listed under the FFG Act (see above) will also need to be considered during the planning and development phases.

#### **4.2.2 Planning and Environment Act 1987**

Clause 52.16 applies to land where a native vegetation precinct plan, corresponding to that land, is incorporated into this scheme. Where an NVPP applies, a permit is required to remove, destroy or lop native vegetation, except where it is in accordance with that NVPP and Clause 52.16.

#### **4.2.3 Catchment and Land Protection (CALP) Act 1994**

The CALP Act contains provisions relating to catchment planning, land management, noxious weeds and pest animals.

This Act provides a legislative framework for the management of private and public land and sets out the responsibilities of land managers, stating that they must take all reasonable steps to:

- Avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner;
- Protect water resources;
- Conserve soil;
- Eradicate regionally prohibited weeds;
- Prevent the growth and spread of regionally controlled weeds; and,
- Prevent the spread of, and as far as possible eradicate, established pest animals.

Essentially the Act establishes a framework for the integrated management and protection of catchments, and provides a framework for the integrated and coordinated management, which aims to ensure that the quality of land and water resources and their associated plant and animal life are maintained and enhanced.

#### ***4.2.3.1 Implications for the proposed development***

Any infestation of noxious weeds which may become established after the development should be appropriately controlled in areas of native vegetation to minimise their spread and overall impact on ecological values.

There are currently nine declared noxious weeds and four Weeds of National Significance (WON) present within the study area (Appendix 2.1). Current legislation under the CALP Act requires that these species must be controlled or eradicated. In addition, increased levels of sediment should not enter any drainage lines or creeks as a result of construction works.

#### **4.2.4 Victoria's Biodiversity Strategy**

The Victorian Government endorses this strategy titled 'Victoria's Biodiversity – Directions in Management' (NRE 1997) and represents a benchmark for biodiversity conservation and management throughout the state.

The Biodiversity Strategy encourages Victorians to better understand and appreciate flora and fauna and ecosystems throughout the state, and to take an active part in conservation and management to ensure biodiversity is managed in an ecologically sound and sustainable manner.

#### **4.2.5 Port Phillip and Westernport Native Vegetation Plan 2006**

The Port Phillip and Westernport Native Vegetation Plan (PPWCMA 2006) is a guide for local government in assessing planning applications for vegetation removal and determining permit conditions (Net Gain requirements) to ensure that ecological values across the region are not compromised.

The Plan provides information on biodiversity values across the Region and gives guidance to local municipalities on how clearing applications should be assessed. The document also outlines actions to ensure there is a more strategic and coordinated approach to address ongoing degradation in quantity and quality of native vegetation throughout Victoria.

The recommendations above, made in the *Native Vegetation Precinct Plan*, should be taken into consideration in the planning phase of any proposed development within the study area.

## Implications for the proposed development

The planning for the proposed Officer Precinct should address the key recommendations outlined under the Port Phillip and Westernport Native Vegetation Plan (PPWCMA 2006).

Vegetation within the study area can be evaluated using the guidelines for conservation significance assessment and application of the Net Gain approach to regional outcomes and local responses (PPWCMA 2006). Management actions pertinent to the proposed development would need to be consistent with the management priorities provided in the Port Phillip and Westernport Native Vegetation Plan, and these actions would need to be articulated in a detailed Environmental Management Plan.

### 4.2.6 Victoria's Native Vegetation Framework

Since 1989, most proposals to clear native vegetation have required a planning permit from the local Council (Responsible Authority), under the native vegetation provisions of Clause 52.17 of the Victoria Planning Provisions ('VPPs').

In 2002, the Victorian Government released *Victoria's Native Vegetation Management – A Framework for Action* (NRE 2002) ('the Framework'), which establishes a "strategic direction for the protection, enhancement and revegetation of native vegetation across the State".

Amendment (VC19) to Victoria's Planning Provisions introduced the Framework in July 2003 as an incorporated document for all Victorian Planning Schemes. Clauses 11 and 15.09 in the State Planning Policy Framework provide the framework for considering native vegetation issues in the planning system.

These clauses require planning and responsible authorities to have regard to the Framework, which establishes the strategic direction for the protection, enhancement and revegetation of native vegetation across Victoria.

#### 4.2.6.1 Net Gain

The Framework states that the primary goal is to achieve:

"A reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain" (NRE 2002).

Net Gain is the overall outcome where native vegetation and habitat gains are greater than the losses and where losses are avoided, where possible.

#### **4.2.6.2 Applying Net Gain – The Three Step Approach**

When Net Gain is considered for potential impacts on native vegetation within all planning schemes, the Framework has defined a three-step approach for applying Net Gain to protection and clearance decisions. The three-step approach is:

1. To avoid adverse impacts, particularly through vegetation clearance.
2. If impacts cannot be avoided, to minimise impacts through appropriate consideration in planning processes and expert input to project design or management.
3. Identify appropriate offset options.

The three-step approach to Net Gain is the first consideration for all planning permit applications and planning scheme amendments, with emphasis placed on the first two steps of avoidance and minimisation. Only after these two steps have been taken should offsets (actions undertaken to achieve commensurate gains in vegetation loss) be considered (NRE 2002).

#### **4.2.6.3 Measurement of Net Gain outcomes**

The Framework introduces a combined quality-quantity measuring system called the ‘Habitat Hectare’, which can assist with applying Net Gain outcomes for native vegetation (DSE 2004, Parkes *et al.* 2003). Generally this system can ‘measure’ the native vegetation and be used to calculate potential losses and gains over a specified area and period of time, of both vegetation patches (where the understorey has a greater than 25% benchmark cover of indigenous species) and trees (in patches or parcels).

Once the overall losses are known, then offset objectives can be calculated according to Table 6 of the Framework (NRE 2002) and considering the regional Native Vegetation Plans. Offsets for any permitted vegetation loss can be achieved by improvements in the quality or extent of native vegetation in a selected ‘offset area’.

#### **4.2.6.4 Implications for the proposed development**

Indigenous vegetation patches and scattered trees that fit the Net Gain criteria have been identified within the study area. A formal habitat hectare assessment has been undertaken as part of the development of the Native Vegetation Precinct Plan for the Officer Precinct Structure Plan (Ecology Partners Pty Ltd 2010b).

## 4.3 Local Government

### 4.3.1 Cardinia Shire Council Planning Scheme

Under the Cardinia Planning Scheme, the study area north of the railway line is predominantly mapped as an Urban Growth Zone (UGZ1). There is Low Density Residential Zone (LDRZ) to the west of Brunt Road in the southwestern corner of the study area. There is a Public Conservation and Resource Zone adjacent to Cardinia Creek included by the southern boundary of the study area. The Gippsland Railway line is zoned as Public Use Zone 4 – Transport (PUZ4) and the Princes Highway is classified as a Road Zone – Category 1 (RDZ1).

The remainder of the study area comprises; Business Zones (B1Z, B4Z), Public Use Zones (PUZ1, PUZ2); Public Park and Recreation Zones (PPRZ) and Industrial Zones (IN1Z) (DPCP 2010c).

Additionally, there are two overlays pertaining to native vegetation within the study area. A Vegetation Protection Overlay (VPO) covers the Low Density Residential Zone. Under Schedule 1 to the VPO, the vegetation projection objective for this area is:

- To protect and conserve existing vegetation as an important element of the character of low density residential areas.

An Environmental Significance Overlay applies to the railway reserve bisecting the study area, the open space at 24 Brunt Road, a large area in the south-east corner of the Low Density Residential Zone, and at the junction of the Pakenham Bypass with the Cardinia Creek corridor. Under Schedule 3 to the ESO, the environmental objectives for these areas are:

- To ensure that the habitat values of the site are not diminished by the incremental removal of vegetation or inappropriate development; and,
- To ensure that any new development is sensitively designed and sited to reinforce the existing environmental characteristics of the area.

#### 4.3.1.1 *Implications for the proposed development*

Clause 52.16 applies to land where a native vegetation precinct plan, corresponding to that land, is incorporated into this scheme. Where an NVPP applies, a permit is required to remove, destroy or lop native vegetation, except where it is in accordance with that NVPP and Clause 52.16.

## 5 KEY BIODIVERSITY ISSUES AND IMPLICATIONS IDENTIFIED FROM THE ASSESSMENT

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The significance assessment criteria of flora and fauna species and vegetation communities are presented in Appendix 1.

Roadsides and waterways within the study area containing indigenous vegetation are considered to be of regional conservation significance due to: 1) the presence of at least 150 regionally significant flora species within the Gippsland Plain bioregion, 2) the presence of nine EVCs that are endangered within the Gippsland Plain bioregion, and 3) the presence of continuous vegetated corridors along roadsides and waterways which provide habitat for flora and fauna species, and that facilitate the movement of fauna across the landscape.

Several patches of native vegetation within the study area are considered to be of state significance due to the presence of significant flora species such as Veined Spear-grass, Green Scentbark and Arching Flax-lily, as well as the two FFG listed communities located within the Gilbert Property.

Some parts of the study area are of national conservation significance due to the presence of flora species (i.e. Matted Flax-lily) and fauna species (i.e. Growling Grass Frog and Dwarf Galaxias). Key areas of national conservation significance for fauna include waterbodies which are known to be, or likely to be suitable for breeding and recruitment by Growling Grass Frog, and also creeks and drainage lines which are likely to be used for dispersal.

The conservation significance of these parts of the study area has been assigned for the following reasons:

- Presence of one nationally significant flora species, the endangered Matted Flax-lily;
- Known habitat and occurrence of the nationally significant Growling Grass Frog (nationally significant population), Dwarf Galaxias and Australian Grayling (Cardinia Creek);
- Presence of ten EVCs of moderate quality that are endangered within the Gippsland Plain bioregion;
- Presence of at least 150 flora species considered regionally significant within the Gippsland Plain bioregion, together with other locally significant indigenous flora species;
- Presence of continuous vegetated corridors along roadsides which provide vital habitat for flora and fauna species, and a means of dispersal across the broader area; and,

- Potentially suitable habitat for several national, state and regionally significant fauna species, primarily Southern Toadlet, Swamp Skink and Latham's Snipe (regional), and several significant waterbirds which are likely to use farm dams within the study area. Other species that may be present within the study area (albeit low likelihood) that have not been recorded within a 10 kilometre radius of the study area include Glossy Grass Skink.

## 5.1 Potential impacts

Any loss of ecological values should be viewed in the overall context of ongoing loss, fragmentation, and deterioration in the quality of remnant vegetation throughout the local area and within the wider Gippsland Plain bioregion. Development within the study area is likely to have several impacts on the indigenous flora and fauna species, and habitats, including:

- Loss and/or disturbance to multiple EVCs listed as endangered within the bioregion;
- Decreases in population sizes of national and state significant flora species located throughout the Precinct including the EPBC Act listed Matted Flax-lily;
- Decreases in population sizes of local flora species, including 150 flora species considered significant to the region as well as flora species considered significant to the local area;
- Loss and/or disturbance to remnant scattered trees and planted native vegetation. This may include hollow-bearing trees and coarse woody debris which are used by a suite of woodland fauna species;
- Disturbance and/or modification to the ecological function and habitat of existing waterways and drainage lines within the study area. Sedimentation and pollution of waterways may further affect; Cardinia Creek, Gum Scrub Creek and Western Port Bay;
- Loss of waterbodies (i.e. farm dams) and potential foraging habitat for state significant fauna including Southern Toadlet, Eastern Great Egret, Hardhead, Blue-billed Duck and Australasian Shoveler and regionally significant fauna such as Latham's Snipe;
- Potential removal and isolation of suitable habitat for the nationally threatened Growling Grass Frog and Dwarf Galaxias (i.e. farm dams or drainage lines);
- Increased soil disturbance and compaction which may have a negative impact on remnant native trees (roots) within the study area; and,
- Ongoing fragmentation and incremental loss of remnant native vegetation, which will lead to the ongoing degradation of surrounding areas supporting remnant native vegetation and fauna habitats.



Indirect effects are also possible if construction activities are not appropriately managed, and these include:

- An increase to domestic dog and cat numbers resulting in an increase in the level of predation and noise disturbance which may impact local fauna populations;
- Increases in the area of hard surfacing resulting in increased runoff, nutrient levels and sediment movement, particularly during the construction;
- Inappropriate landscape plantings along roadsides, in areas of open space, and as part of residential developments, which could increase the spread of weeds in the study area and beyond. Also potential for further spread of soil pathogens from on-site activities and subsequent degradation of remaining native vegetation;
- Disturbance to wildlife from increased human activity, and increased noise during construction;
- Uncontrolled human access to the wetland areas within the study area, which may result in the disturbance to vegetation from trampling and introduction of weeds;
- Increased mortality to fauna during construction and road works through roadkill (i.e. increased traffic); and,
- Trapping of ground dwelling fauna in trenches during construction; this may lead to the death of fauna.

## **5.2 Opportunities to reduce potential impacts**

There are numerous opportunities to avoid and minimise potential impacts within the study area as part of this development. The following sections outline the mitigation measures that are recommended as part of this development.

### **5.2.1 Biodiversity Assets**

A number of measures will assist with the ongoing management and conservation of biodiversity assets within the study area during the development. In particular, the following should be considered to guide development within the Precinct:

- Avoid areas that support known records or potential habitat for significant flora and fauna species. Avoid areas of ecological value when locating and designing proposed development areas; particularly wildlife corridors. These areas contain the highest concentrations of indigenous vegetation in the study area and provide habitat and connectivity for flora and fauna.

- Gum Scrub Creek and Cardinia Creek should be enhanced during or post-construction to provide connective habitat throughout the landscape for locally abundant and threatened flora and fauna species.
- Where avoidance of conservation significant species is unavoidable, measures should be implemented to salvage or collect material from these species (i.e. seeds) and used to propagate further plants to ensure that these plants persist either in situ within the study area.
- Retained habitat which contains known or potential habitat for threatened flora and fauna species should be clearly sign posted and fenced appropriately. This will ensure ecological values are maintained into the future in response to increased resident activity (i.e. conservation reserves or parks).
- Avoiding significant vegetation communities especially those that provide habitat for significant species is recommended (e.g. Plains Grassland, Plains Grassy Wetland and Plains Grassy Woodland). As large patches of vegetation are likely to be removed, retaining suitable habitat where possible for locally abundant or threatened flora and fauna species is recommended.
- Areas to be protected and conserved within the study area in the long-term should be fenced appropriately to allow regeneration and to deter trampling. Areas that are particularly devoid of vegetation should be improved through revegetation and weed control works using appropriately sourced local indigenous seed stock and a reputable bushland management team.
- Fencing off areas of ecological value (riparian zone of drainage lines and wetlands) to discourage trampling and disturbance during proposed construction phase (i.e. to discourage workers, construction machinery, material stockpiles and access routes) is recommended.

### 5.2.2 Minimising Impacts

There are a number of recommended mitigation measures which can minimise the potential impacts during the development.

- Ensure contractors are aware of areas of ecological value within the study area and penalties should be applied if native vegetation no-go zones are damaged.
- A personnel and equipment hygiene policy should be developed for implementation during construction to minimise the spread of weeds and pathogens. This may include a Bio-security Management Plan to ensure harmful materials and chemicals are stored and applied appropriately during construction stages.

- Accidental introduction of pathogens such as Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*, could have a deleterious impact on local frog populations. Appropriate bio-security measures should be implemented adjacent to all pre-existing waterbodies or waterways within the study area.
- Eradicate and control weeds appropriately to ensure contractors and machinery are not transferring weed seed or material into the site. This should be in accordance with a Weed and Pest Animal Management Plan.
- Where possible, avoid native vegetation through construction and micro-siting techniques. Trees should be lopped or trimmed rather than removed. Soil disturbance and sedimentation within wetlands should be avoided or kept to a minimum, to avoid, or minimise impacts to fauna habitats.
- The removal of cattle may enable regeneration of indigenous vegetation in areas reserved for open space, parkland, or areas which will be managed solely for conservation.
- Areas adjacent to stormwater drainage lines should not store potential pollutants or have major soil disturbance (if possible).
- Machinery moved around the site should be restricted to access tracks, where possible. If this is not possible, constructing temporary access tracks comprised of gravel on geo-fabric or mats or other low footprint load distributing structures should be undertaken.
- Vehicle parking areas and equipment and material stockpile sites should be clearly identified and sited outside of areas with ecological values.
- Soil stockpiles and machinery should not be located on native vegetation remnants and fauna habitat.

### 5.2.3 Timing

- The timing of construction within known or potential Growling Grass Frog habitat should be undertaken during the species inactive period (April-July).
- Disturbance to frogs particularly over the breeding season may lead to a reduction in breeding success, recruitment and survivorship. Construction should, where possible, be timed to reduce impacts to this and other threatened fauna (i.e. outside of the breeding period).
- Avoid construction activity in late winter and spring to avoid potential high rainfall events and breeding periods of most fish species (including Dwarf Galaxias).

- All major drainage works should be undertaken during spring or summer to reduce the likelihood of pollutants or sediment run-off after large rain events.
- Any weed management should be undertaken during an appropriate time of year to ensure the most affective treatment of weeds throughout the study area is achieved.
- It is recommended that fauna escape features and refuges (including ramps and damp sandbags) are placed and maintained in any open trenches and that open trenches are inspected in the morning and evening during construction for trapped fauna.
- If hollow-bearing trees cannot be avoided, and must be removed, pre-clearance surveys prior to felling are recommended.
- Fauna should be cleared from the development area immediately prior to construction/disturbance by undertaking pre-clearance and salvage surveys during construction within suitable habitat.

### **5.3 Opportunities to protect and enhance regional biodiversity values**

As part of this development, there are a number of opportunities to enhance local and regional biodiversity values within the study area.

- All EVCs within the study area are listed as endangered within the bioregion and as such should be enhanced where possible to conserve biodiversity assets for flora and fauna.
- The loss and disturbance to remnant scattered trees and planted native vegetation should be replaced by planting or offsetting vegetation within the study area. This will provide important refuge and habitat structure for locally abundant and threatened flora and fauna in an otherwise patchy landscape.
- The ecological functioning and habitat of existing waterways and drainage lines should be restored and enhanced within the study area to permit dispersal for flora and fauna species throughout the local area. This may involve undertaken revegetation along waterways and drainage lines to improve riparian condition and in stream habitat.
- It is recommended that future landholders plant and revegetate their properties with plants indigenous to the area and applicable to the correct EVC for the site.
- It is recommended that terrestrial habitat features such as rocks and logs are replaced following construction. Potential habitat will not be disposed of or burnt if possible. Any excess material should be placed within conservation reserves or parks to create additional habitat for fauna species.

- The north-western portion of the Precinct which contains potential breeding and foraging habitat for significant species including Southern Brown Bandicoot, Swamp Skink and Glossy Grass Skink should be retained and enhanced where possible to expand suitable habitat for these species within the study area. Habitat creation or enhancement may also apply to Swampy Woodland and Swamp Scrub located along; Station Road, Rix Road, Tivendale Road, Starling Road, opposite the Officer Train Station and Princess Highway.
- Any loss of suitable habitat for state significant fauna including Southern Toadlet, Eastern Great Egret, Hardhead, Blue-billed Duck and Australasian Shoveler, and regionally significant fauna such as Latham's Snipe, should be replaced or enhanced where possible. This may include the creation or enhancement of waterbodies or potential habitat (i.e. Swampy Woodland for Southern Toadlet) which has been altered as part of the development.
- The implementation of a Pest Weed and Animal Management Plan creates opportunities to reduce the future spread and impacts caused by exotic flora and fauna (i.e. domestic pets, foxes and rabbits) species. This may include curfews for domestic animals, in addition to proactive baiting programs throughout the study area, to minimise potential predation pressures on native fauna.
- Any land which is not developed should be re-vegetated to develop habitat connectivity throughout the landscape.

## 6 CONCLUSION

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### 6.1 Preliminary Flora and Fauna Surveys

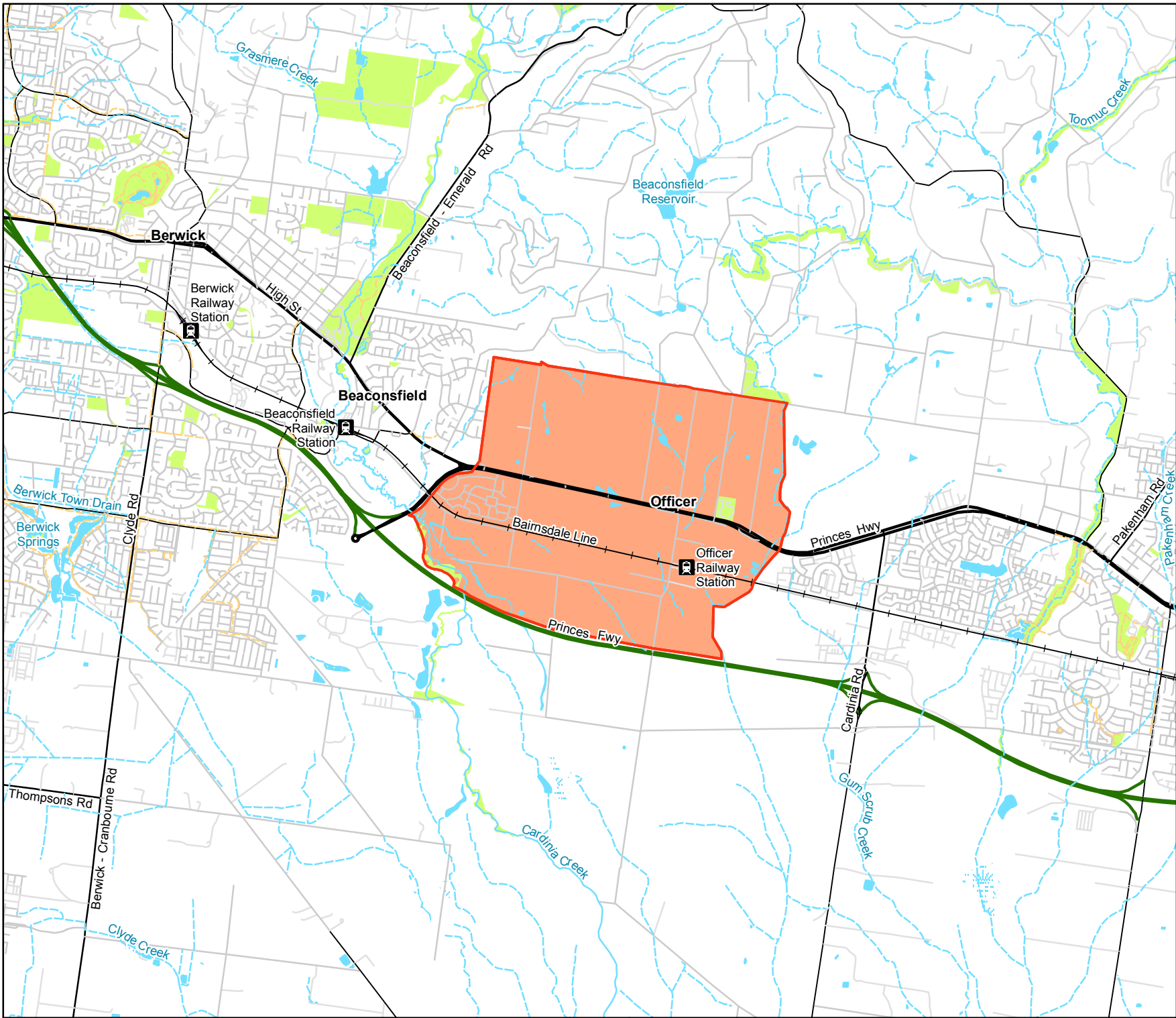
The majority of the study area is highly modified and dominated by introduced flora species, particularly pasture grasses. However, remnant indigenous vegetation still occurs throughout the Precinct in areas such as the Cardinia Creek corridor, the Gilbert and Leber properties, the north west corner as well as numerous roadside reserves and railway reserves.

### 6.2 Targeted Flora and Fauna Surveys

Targeted surveys located 11 Matted Flax-lily plants, along with 43 Green Scentbark trees and several populations of Veined Spear-grass within the Precinct. Four Arching Flax-lily plants that had already previously recorded were also located (Biosis Research Pty Ltd 2006). Surveys were also undertaken for three other flora species (River Swamp Wallaby-grass, Swamp Everlasting and Maroon Leek-orchid) although despite extensive surveys none of these species were detected. The cryptic nature of these species, a prolonged period of drought, lack of suitable habitat and the high level of survey intensity suggests that either these species are absent, or large populations of these species are absent from the Precinct.

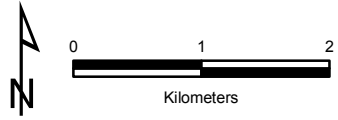
## **FIGURES**

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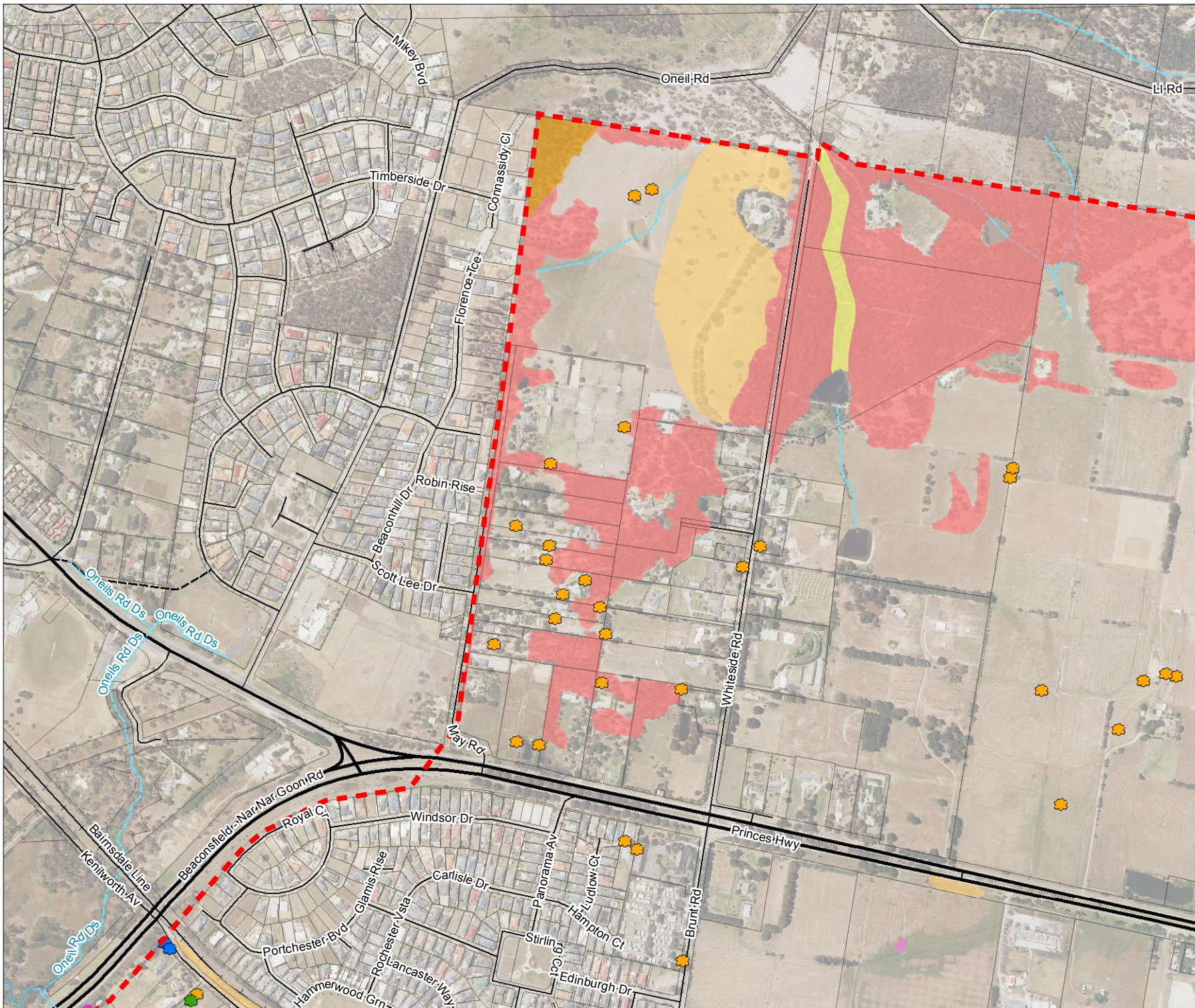


 Study Area

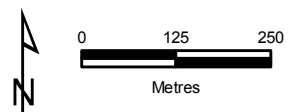
**Figure 1**  
 Location Map  
 of the Study Area  
 Officer Structure Plan, Officer



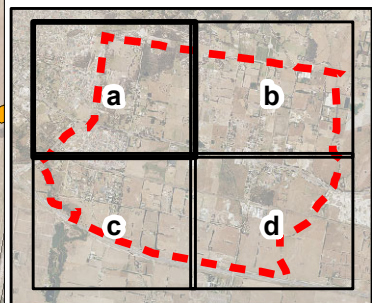


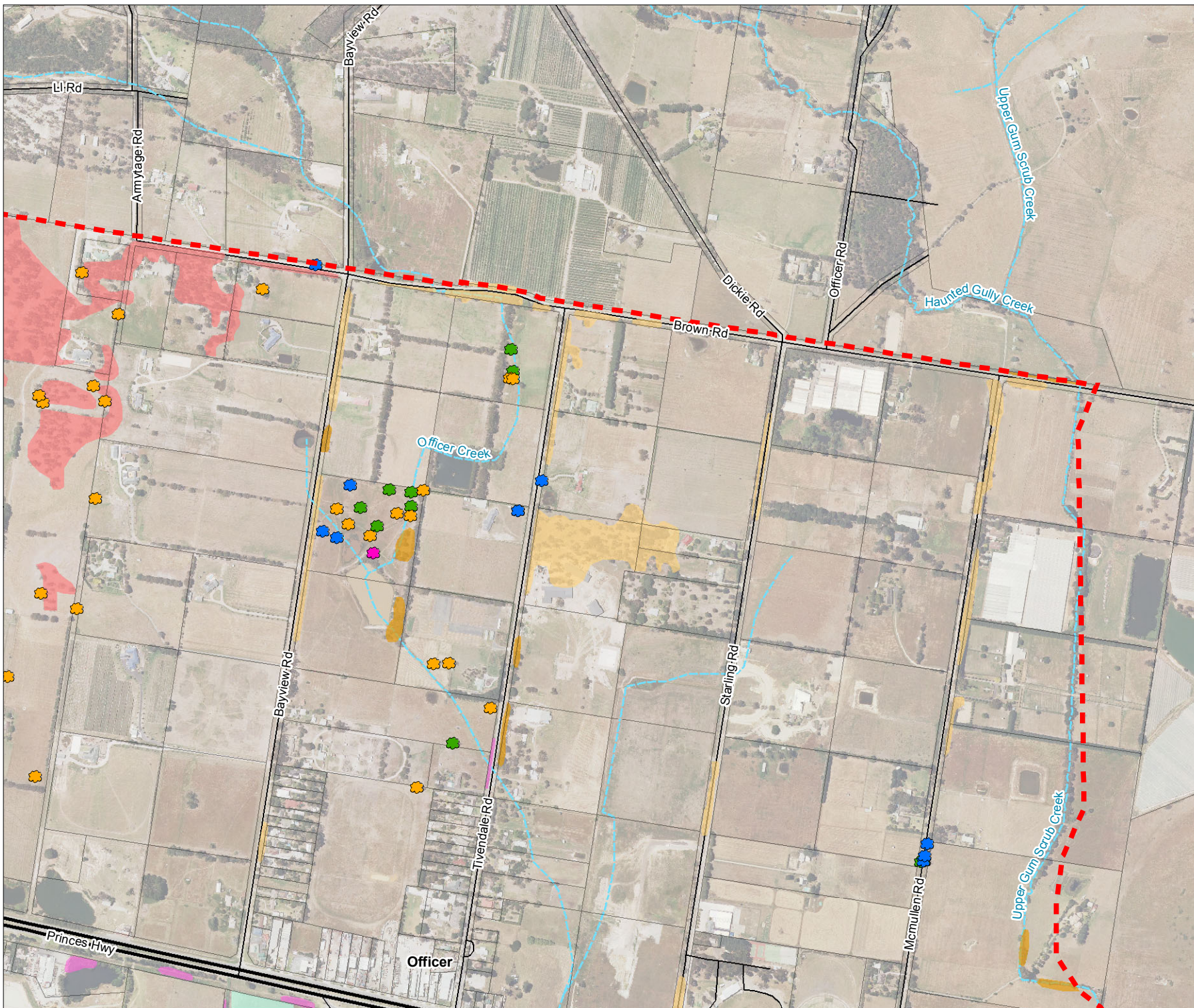


-  Study Area
- Trees (size)**
-  Very Large Old Tree
-  Large Old Tree
-  Medium Old Tree
-  Small Tree
- Vegetation (EVC) Patches**
-  Grassy Forest
-  Grassy Woodland
-  Gully Woodland
-  Plains Grassland
-  Plains Grassy Wetland
-  Plains Grassy Woodland
-  Swamp Scrub
-  Swampy Riparian Woodland
-  Swampy Woodland

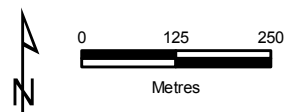


**Figure 2a**  
 Ecological Features  
 within the Study Area  
*Officer Structure Plan, Officer*

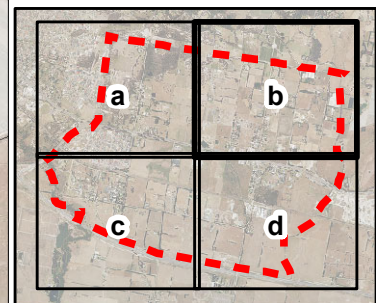


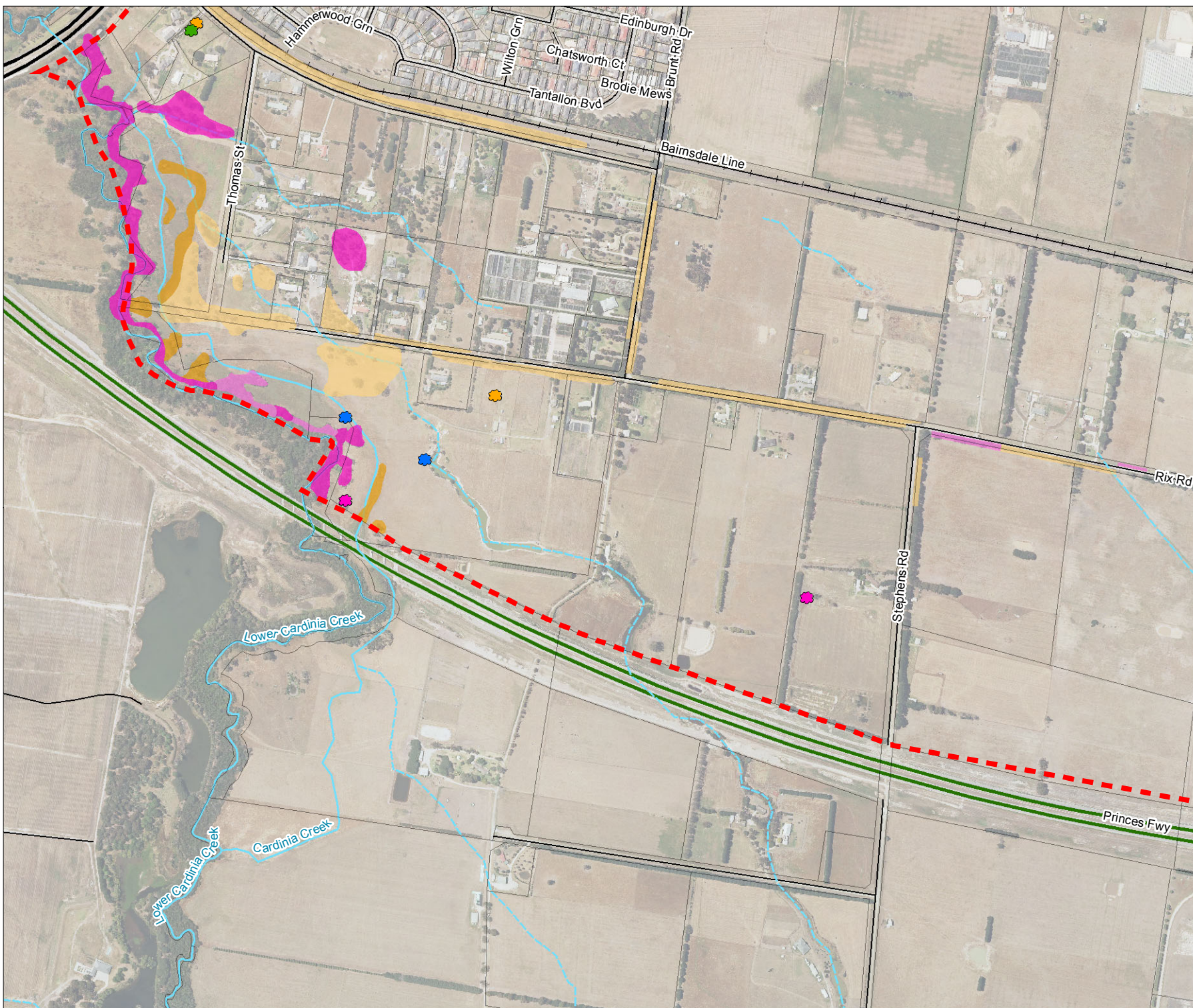


- Study Area
- Trees (size)**
- Very Large Old Tree
- Large Old Tree
- Medium Old Tree
- Small Tree
- Vegetation (EVC) Patches**
- Grassy Forest
- Grassy Woodland
- Gully Woodland
- Plains Grassland
- Plains Grassy Wetland
- Plains Grassy Woodland
- Swamp Scrub
- Swampy Riparian Woodland
- Swampy Woodland

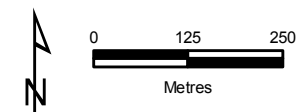


**Figure 2b**  
 Ecological Features  
 within the Study Area  
*Officer Structure Plan, Officer*

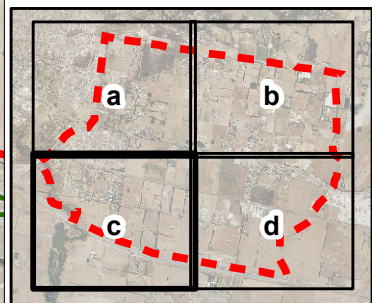


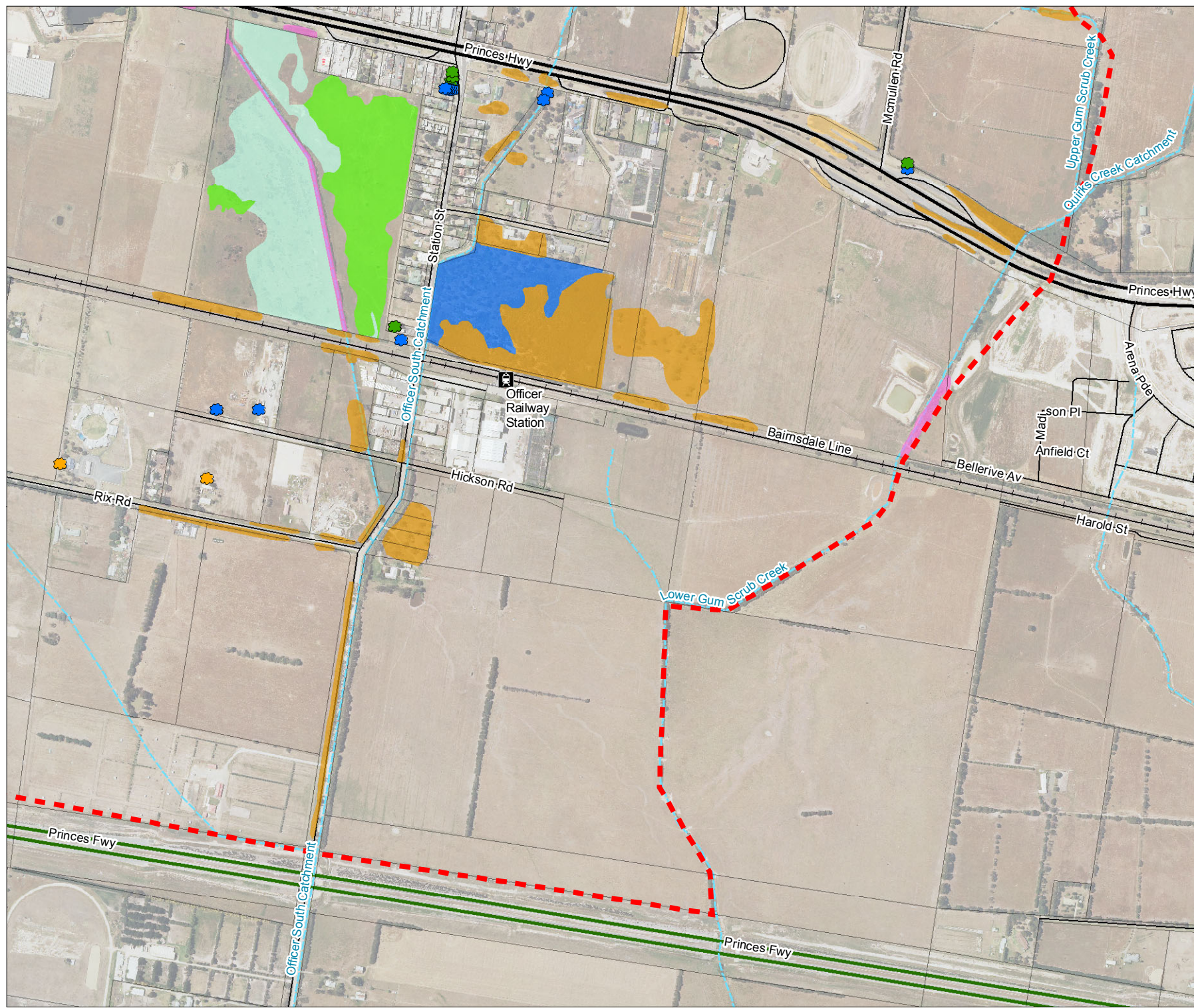


- - - Study Area
- Trees (size)**
- Very Large Old Tree
- Large Old Tree
- Medium Old Tree
- Small Tree
- Vegetation (EVC) Patches**
- Grassy Forest
- Grassy Woodland
- Gully Woodland
- Plains Grassland
- Plains Grassy Wetland
- Plains Grassy Woodland
- Swamp Scrub
- Swampy Riparian Woodland
- Swampy Woodland

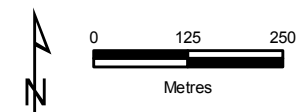


**Figure 2c**  
 Ecological Features  
 within the Study Area  
*Officer Structure Plan, Officer*

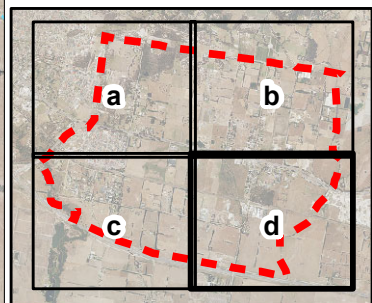




- Study Area
- Trees (size)**
- Very Large Old Tree
- Large Old Tree
- Medium Old Tree
- Small Tree
- Vegetation (EVC) Patches**
- Grassy Forest
- Grassy Woodland
- Gully Woodland
- Plains Grassland
- Plains Grassy Wetland
- Plains Grassy Woodland
- Swamp Scrub
- Swampy Riparian Woodland
- Swampy Woodland

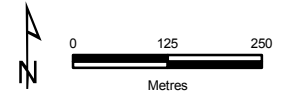


**Figure 2d**  
 Ecological Features  
 within the Study Area  
*Officer Structure Plan, Officer*

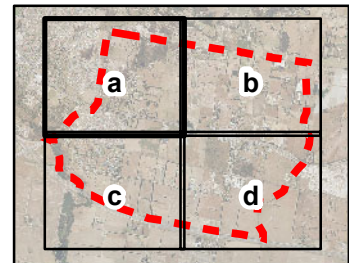




- Study Area
- Vegetation Patches
- Targeted Survey Results (2008/09)**
- + Arching Flax-lily
- ▲ Green Scent-bark
- Matted Flax-lily
- Veined Spear-grass
- Previous Survey Results (2004/06)**
- ◆ Arching Flax-lily
- Great Swamp Gum
- ▼ Green Scent-bark
- ▲ Maroon Leek-orchid
- Matted Flax-lily
- + Purple Diuris
- Veined Spear-grass
- FIS Records**
- Matted Flax-lily
- Purple Diuris
- Veined Spear-grass

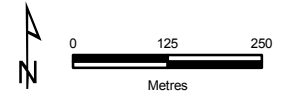


**Figure 3a**  
 Targeted Flora Survey Results  
 Officer Structure Plan, Officer

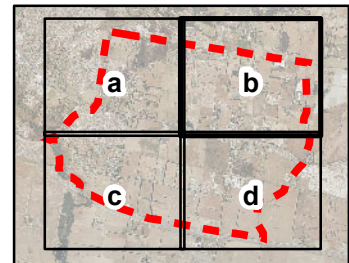


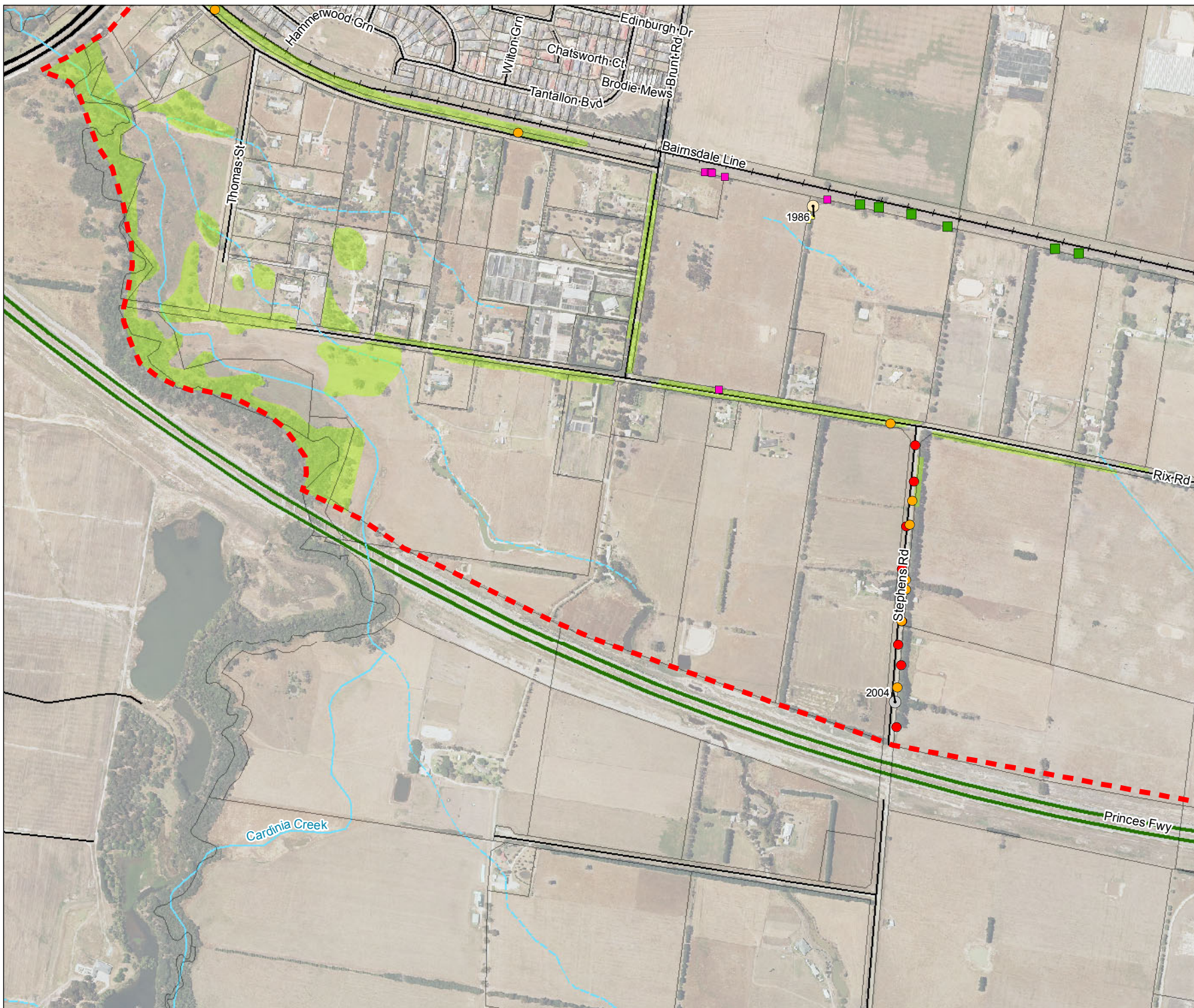


- - - Study Area
- Vegetation Patches
- Targeted Survey Results (2008/09)**
- + Arching Flax-lily
- ▲ Green Scent-bark
- Matted Flax-lily
- Veined Spear-grass
- Previous Survey Results (2004/06)**
- ◆ Arching Flax-lily
- Great Swamp Gum
- ▼ Green Scent-bark
- ▲ Maroon Leek-orchid
- Matted Flax-lily
- + Purple Diuris
- Veined Spear-grass
- FIS Records**
- Matted Flax-lily
- Purple Diuris
- Veined Spear-grass

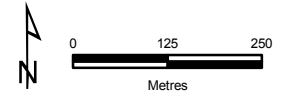


**Figure 3b**  
Targeted Flora Survey Results  
*Officer Structure Plan, Officer*

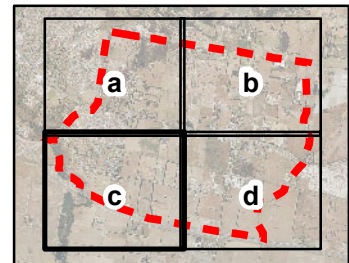


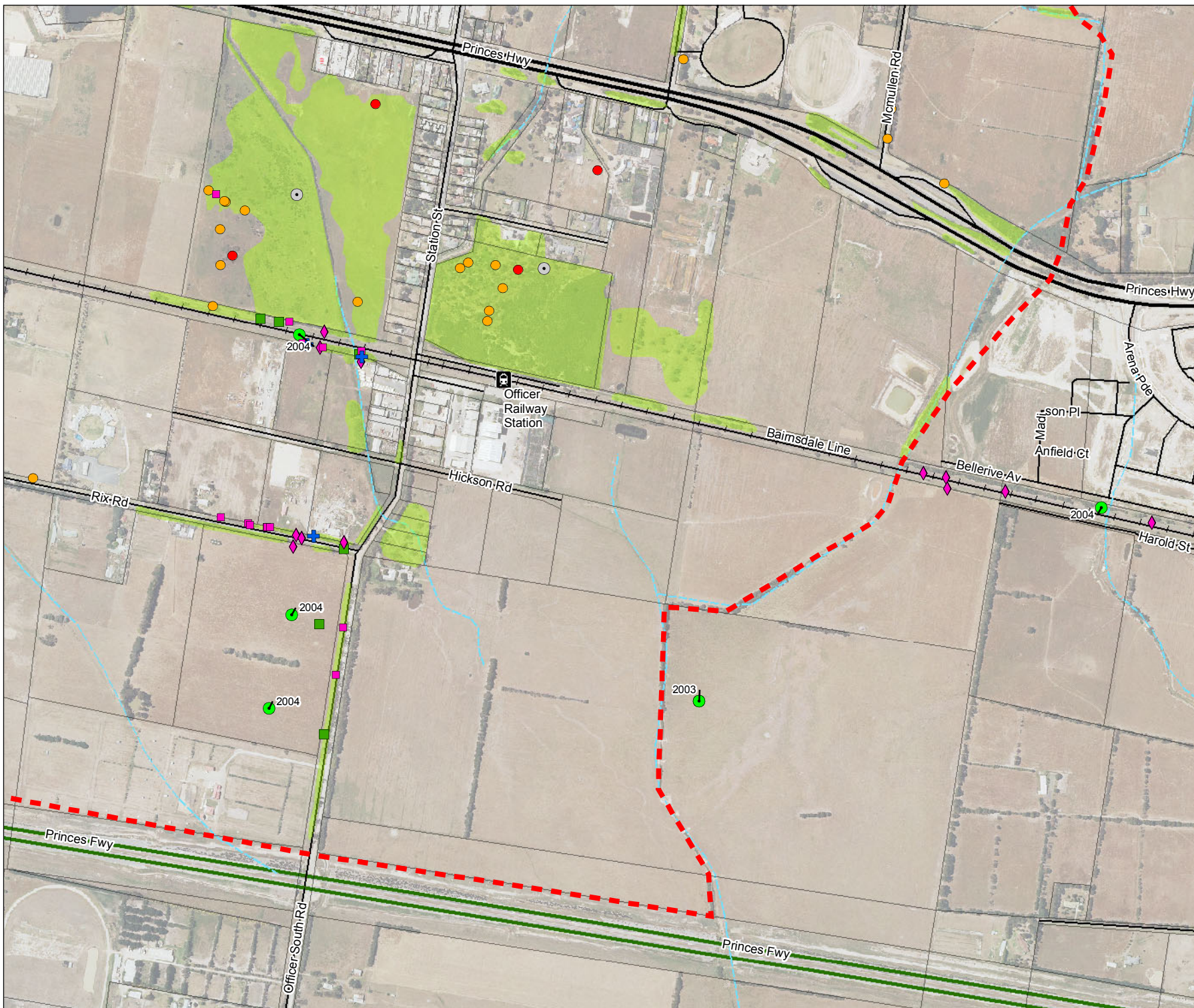


- - - Study Area
- Vegetation Patches
- Targeted Survey Results (2008/09)**
- + Arching Flax-lily
- ▲ Green Scent-bark
- Matted Flax-lily
- Veined Spear-grass
- Previous Survey Results (2004/06)**
- ◆ Arching Flax-lily
- Great Swamp Gum
- ▼ Green Scent-bark
- ▲ Maroon Leek-orchid
- Matted Flax-lily
- + Purple Diuris
- Veined Spear-grass
- FIS Records**
- Matted Flax-lily
- Purple Diuris
- Veined Spear-grass

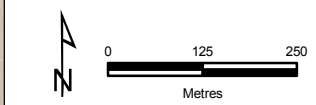


**Figure 3c**  
 Targeted Flora Survey Results  
*Officer Structure Plan, Officer*

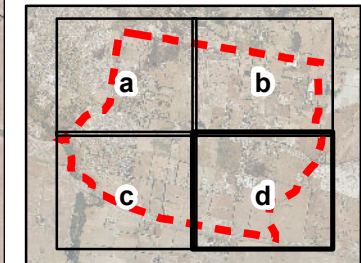




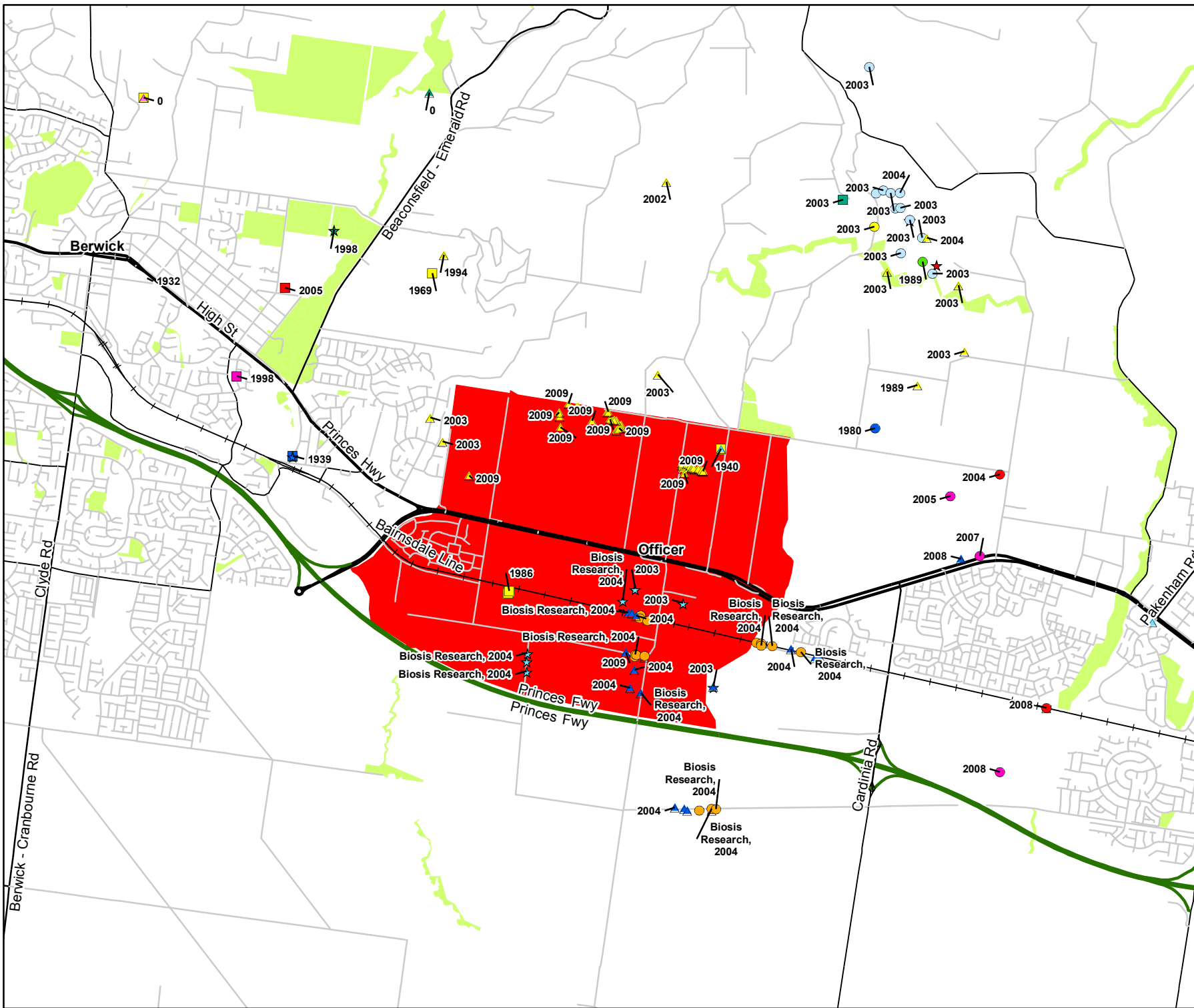
- Study Area
- Vegetation Patches
- Targeted Survey Results (2008/09)**
- + Arching Flax-lily
- ▲ Green Scent-bark
- Matted Flax-lily
- Veined Spear-grass
- Previous Survey Results (2004/06)**
- ◆ Arching Flax-lily
- Great Swamp Gum
- ▼ Green Scent-bark
- ▲ Maroon Leek-orchid
- Matted Flax-lily
- + Purple Diuris
- Veined Spear-grass
- FIS Records**
- Matted Flax-lily
- Purple Diuris
- Veined Spear-grass



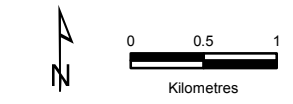
**Figure 3d**  
 Targeted Flora Survey Results  
 Officer Structure Plan, Officer







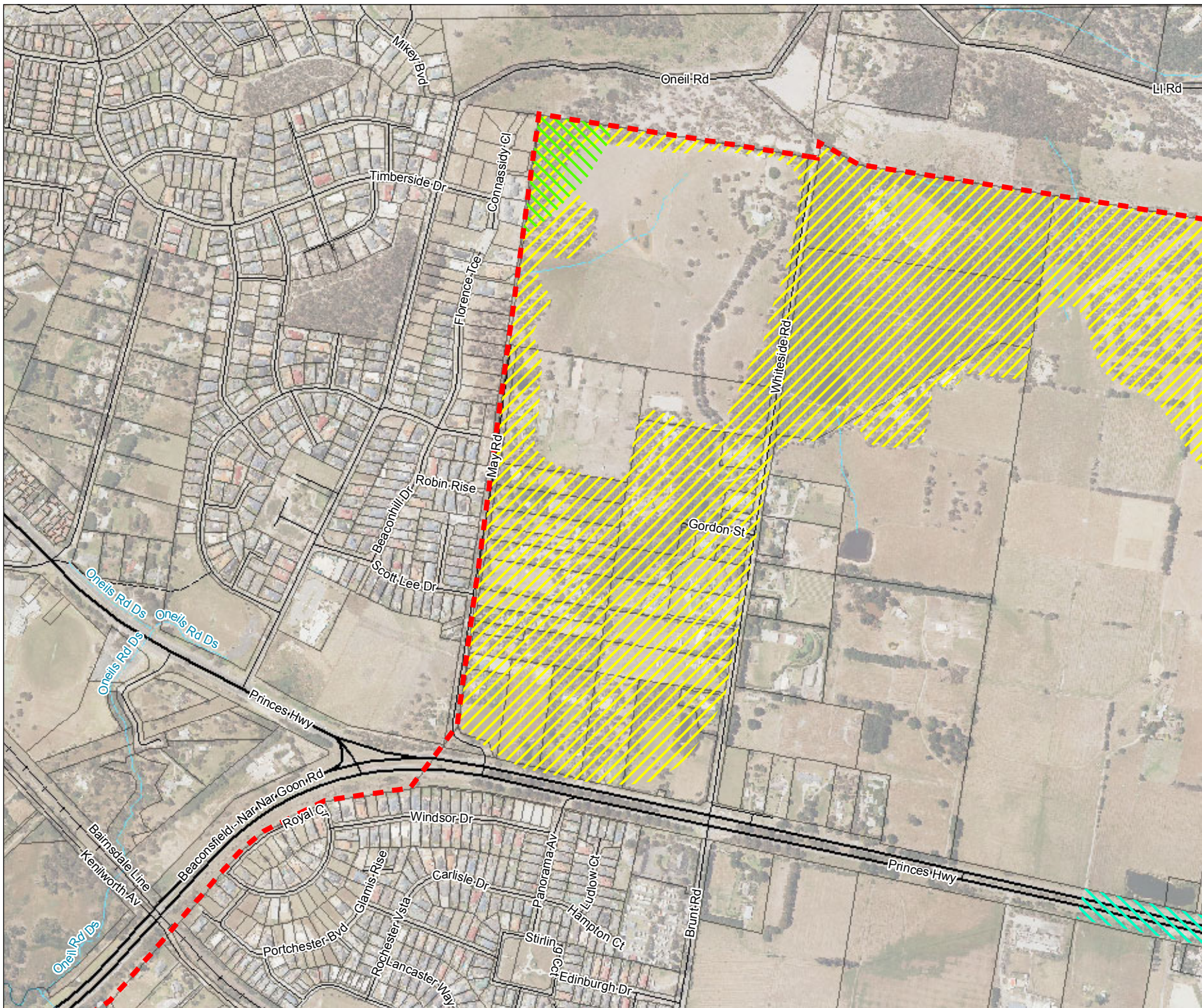
- Austral Crane's-bill (State)
- Clover Glycine (State)
- Cobra Greenhood (State)
- Dandenong Range CinnamonWattle (State)
- Forest Sedge (State)
- Giant Honey-myrtle (State)
- Green Leek-orchid (State)
- Green Scentbark (State)
- Lizard Orchid (State)
- Maroon Leek-orchid (National)
- Matted Flax-lily (State)
- Notched Leonema (State)
- Perfoliate Pondweed (State)
- Purple Diuris (State)
- Red-tip Greenhood (State)
- Rough Daisy-bush (State)
- Sharp Greenhood (State)
- Slender Bitter-cress (State)
- ★ Slender Tick-trefoil (State)
- ★ Southern Blue-gum (State)
- ★ Spurred Helmet-orchid (State)
- ★ Veined Spear-grass (State)
- ★ Wine-lipped Spider-orchid (State)
- Study Area



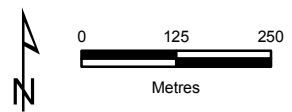
**Figure 4**  
**Significant flora records,**  
**Officer Structure Plan,**  
**Officer**

Note:  
 Where multiple records occur  
 in the same location only the  
 most recent is shown.

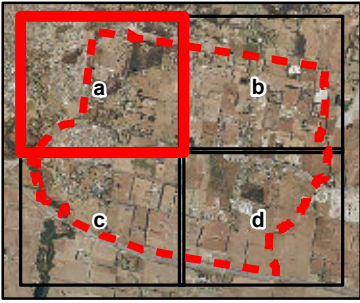


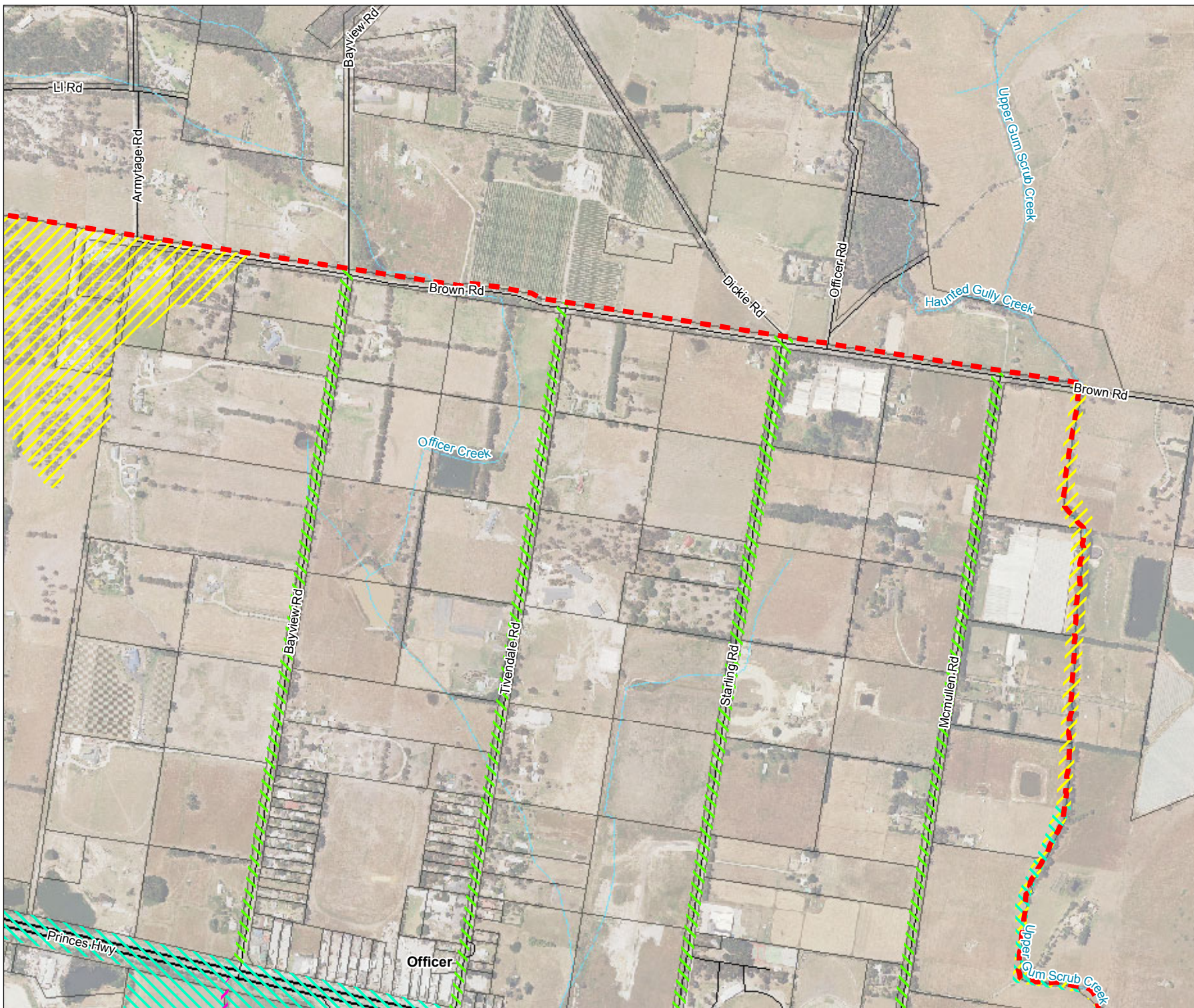


-  Study Area
-  Glossy Grass Skink
-  Dwarf Galaxias/Australian Grayling (Electrofisher)
-  Swamp Skink & Glossy Grass Skink
-  Southern Brown Bandicoot

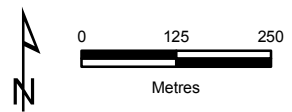


**Figure 5a**  
Threatened Fauna  
Survey Areas  
Officer Structure Plan, Officer

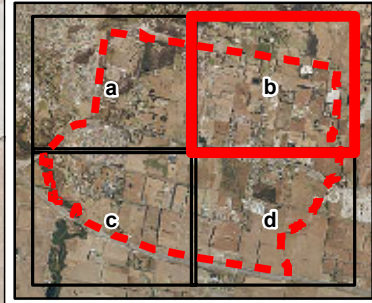


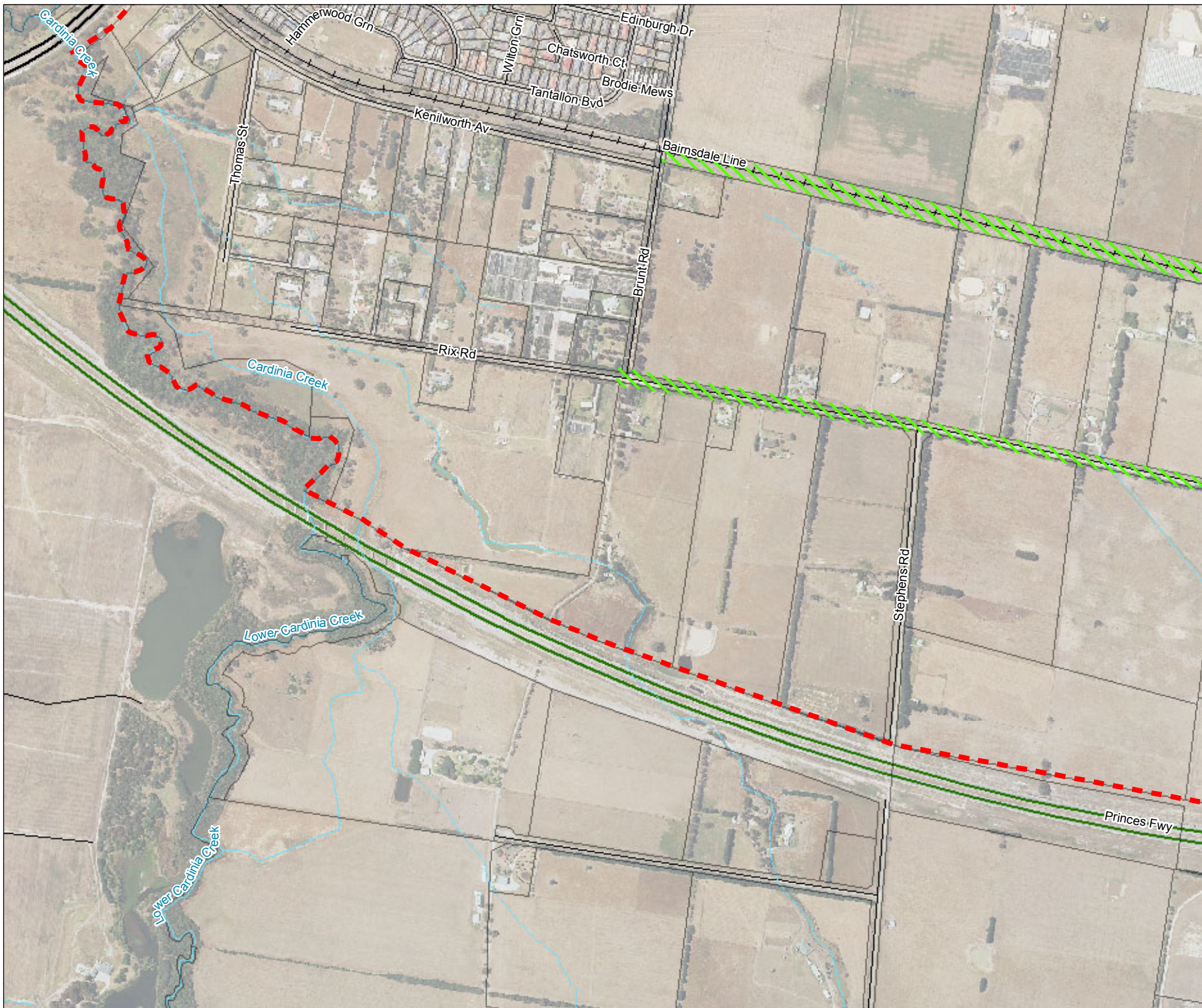


- Study Area
- Glossy Grass Skink
- Dwarf Galaxias/Australian Grayling (Electrofisher)
- Swamp Skink & Glossy Grass Skink
- Southern Brown Bandicoot

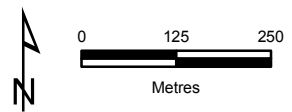


**Figure 5b**  
Threatened Fauna  
Survey Areas  
Officer Structure Plan, Officer

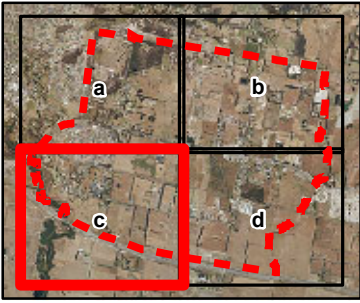


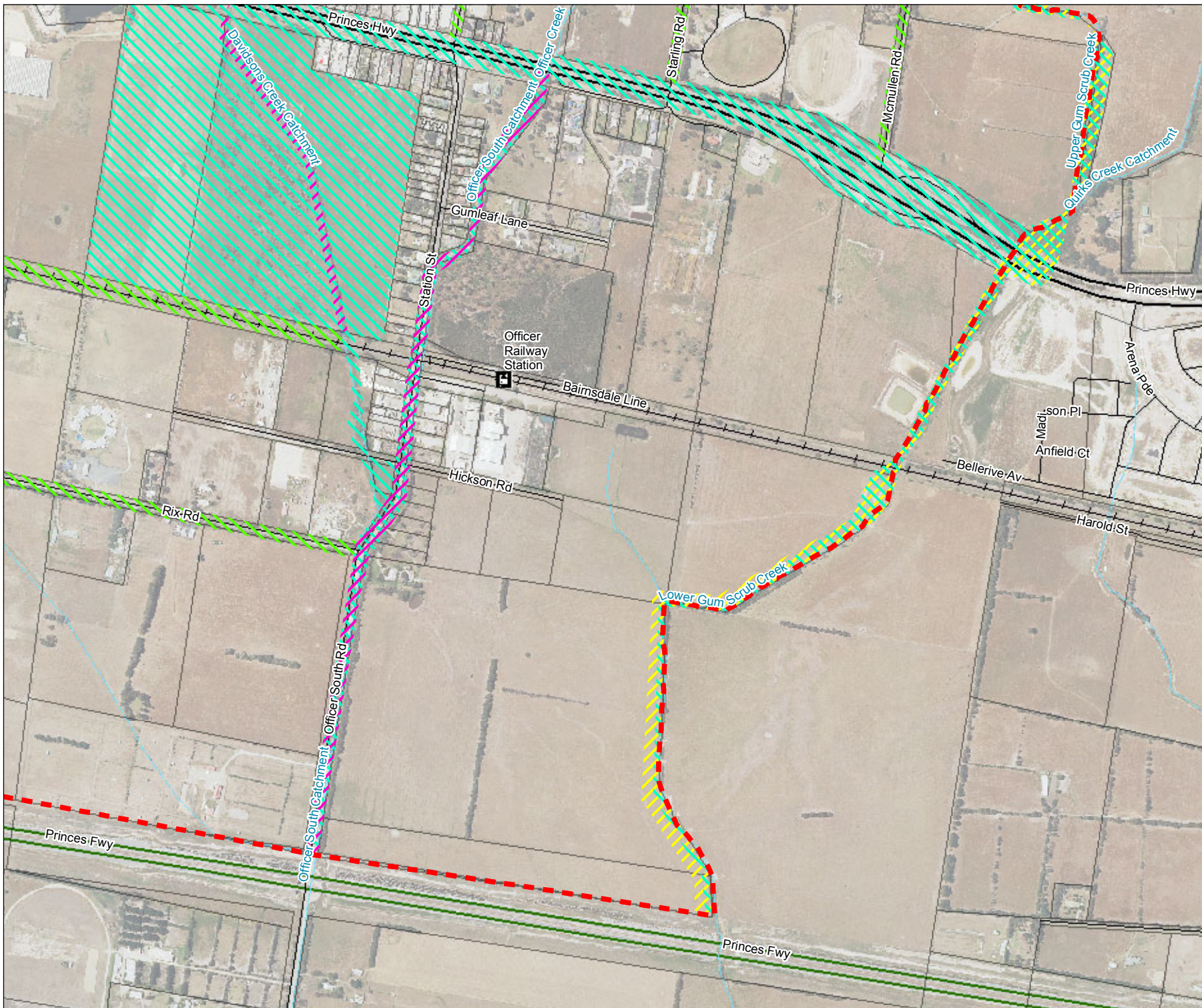


-  Study Area
-  Glossy Grass Skink
-  Dwarf Galaxias/Australian Grayling (Electrofisher)
-  Swamp Skink & Glossy Grass Skink
-  Southern Brown Bandicoot

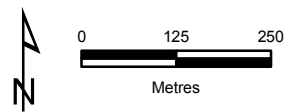


**Figure 5c**  
Threatened Fauna  
Survey Areas  
Officer Structure Plan, Officer

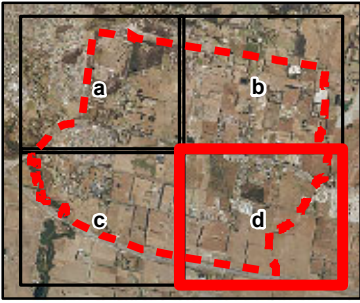


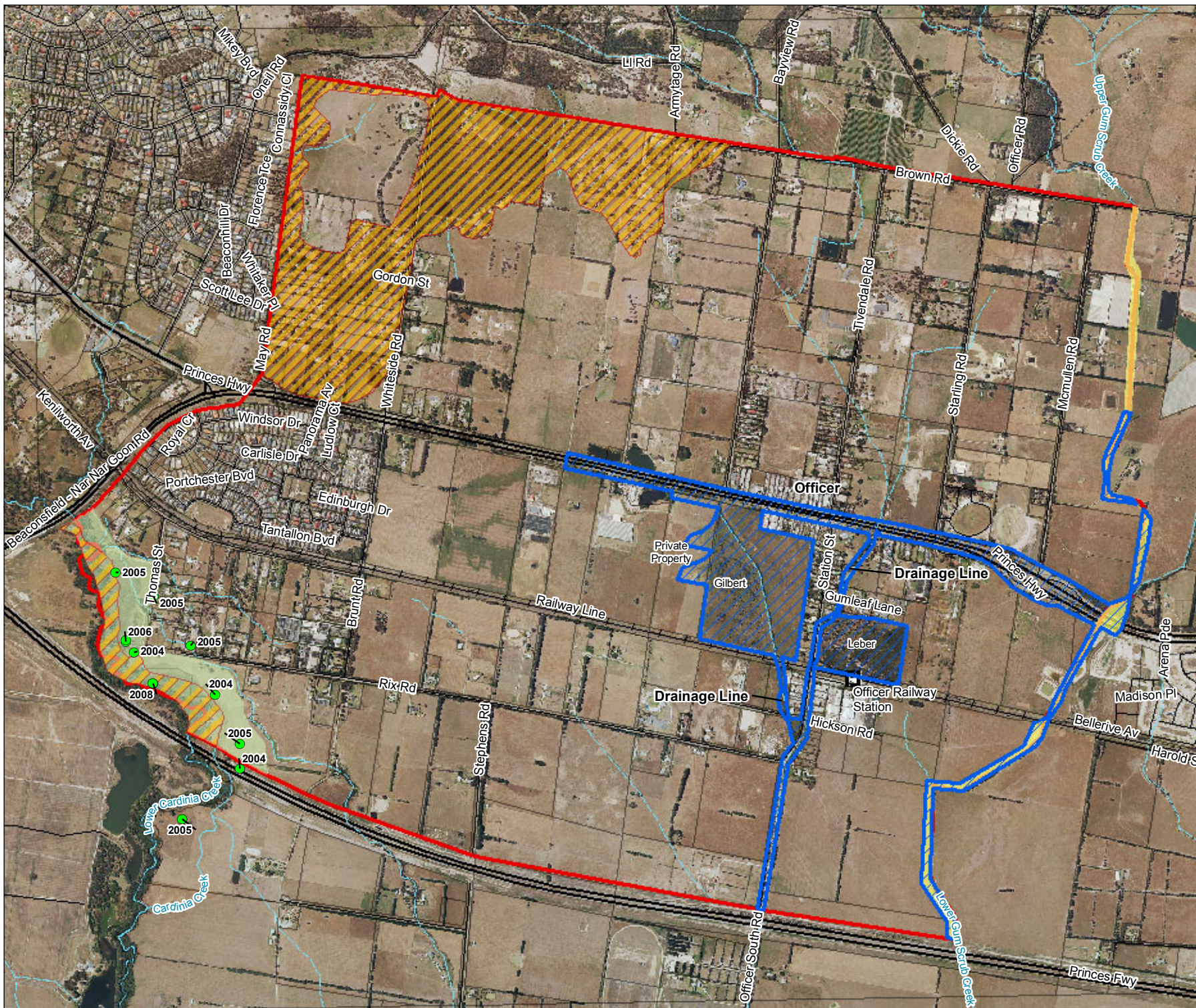


-  Study Area
-  Glossy Grass Skink
-  Dwarf Galaxias/Australian Grayling (Electrofisher)
-  Swamp Skink & Glossy Grass Skink
-  Southern Brown Bandicoot

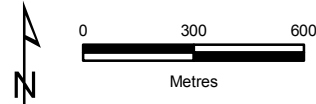


**Figure 5d**  
Threatened Fauna  
Survey Areas  
Officer Structure Plan, Officer





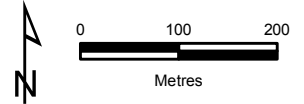
- Dwarf Galaxias Records
- Dwarf Galaxias Known Habitat
- Suitable Habitat (Low Likelihood)
- Southern Brown Bandicoot
- Potential Habitat (Moderate likelihood)
- Swamp Skink, Glossy Grass Skink, Southern Toadlet
- Southern Brown Bandicoot Dispersal corridor (as outlined by the draft Sub Regional Strategy)
- Study Area



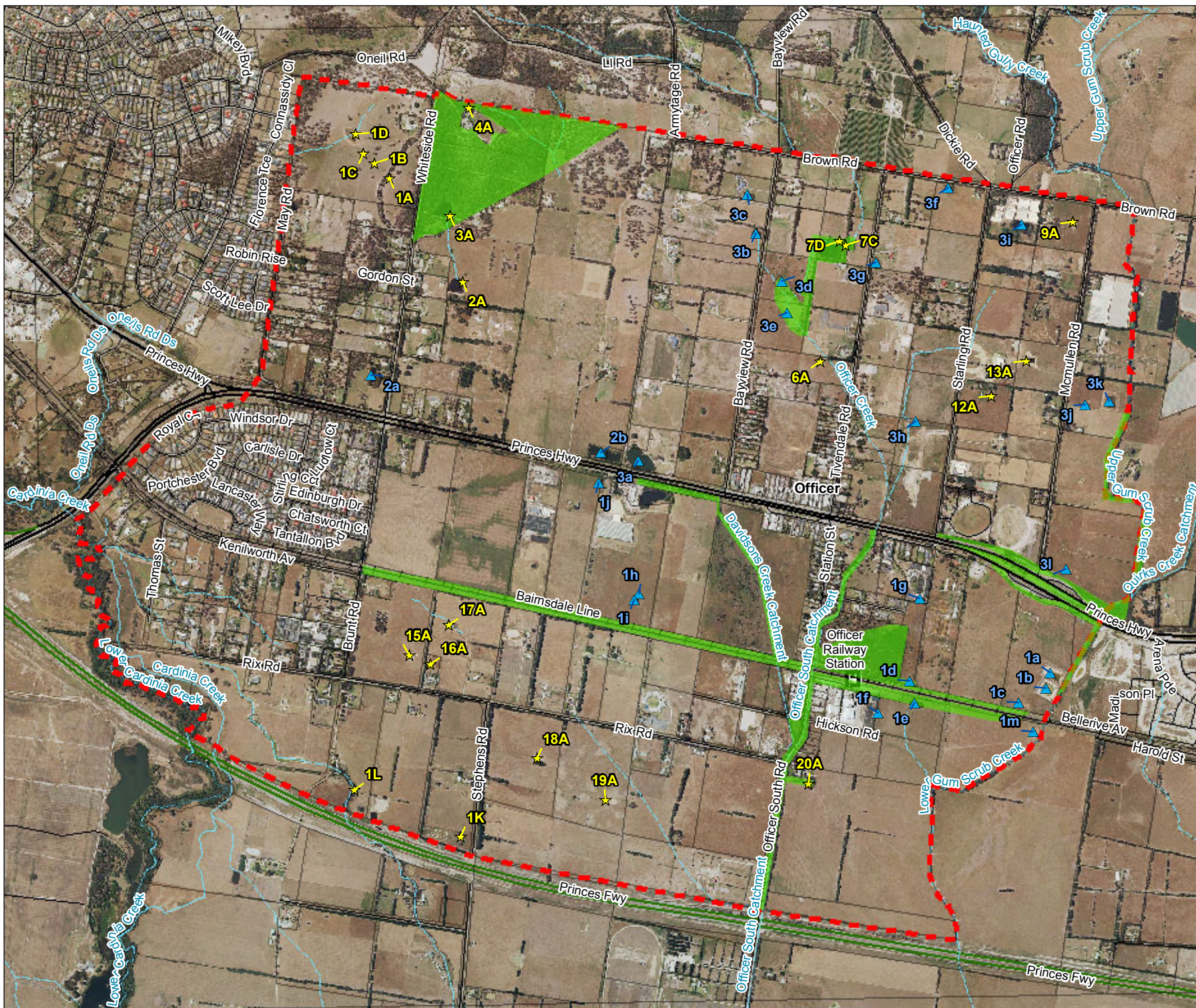
**Figure 6**  
 Significant Habitat Areas within the Study Area  
 Officer Precinct Structure Plan, Officer



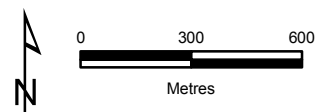
- ▲ Elliott Traps
- Active Search Area for Swamp Skink & Glossy Grass Skink
- Study Area



**Figure 7**  
 Targeted Survey Sites and Active Search Area for Swamp Skink and Glossy Grass Skink  
 Officer Structure Plan, Officer

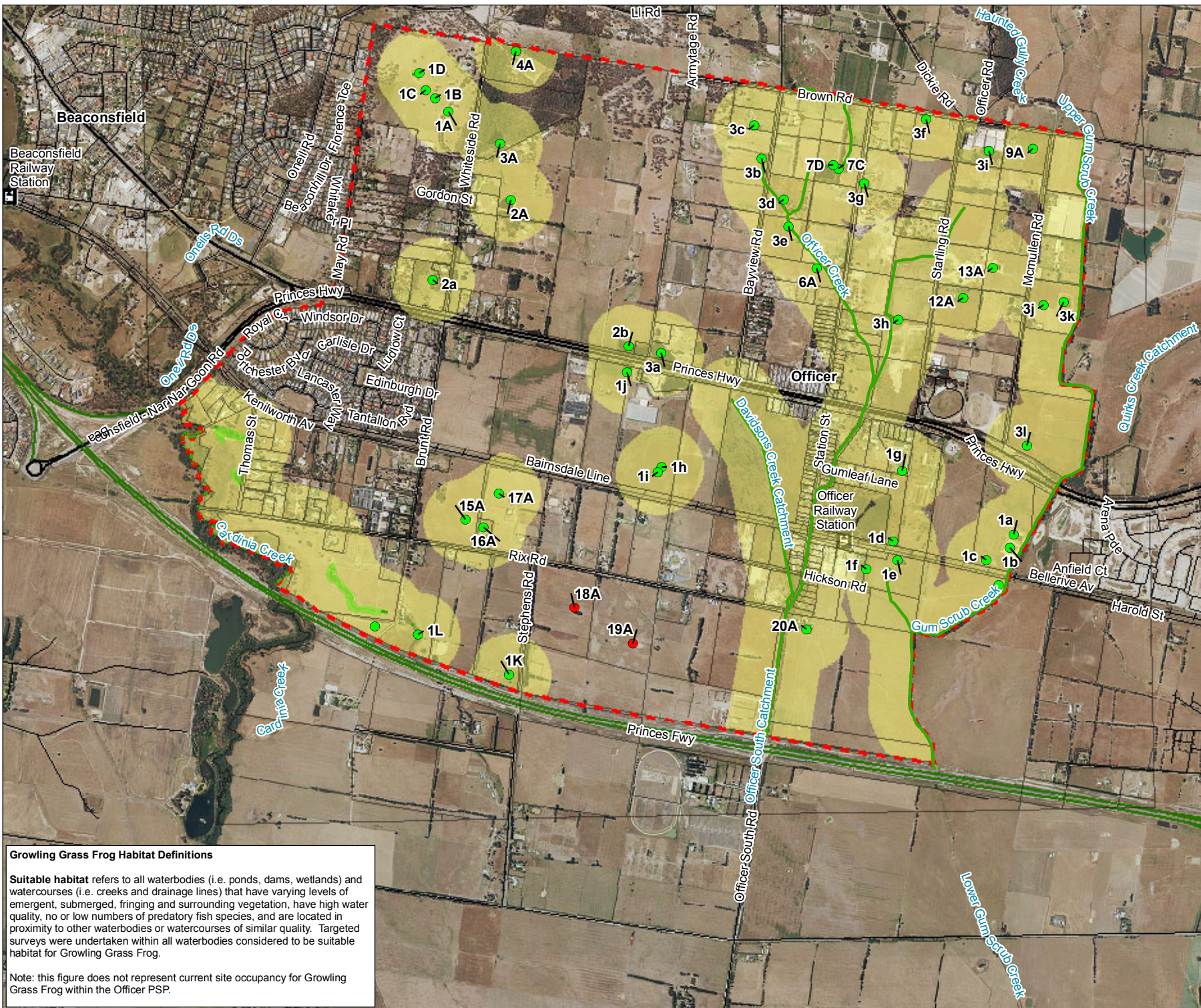


- ★ Current GGF Survey Sites 2008/9
- ▲ Previous GGF Survey Sites 2006 (Ecology Partners Pty Ltd)
- Potential/Surveyed Southern Toadlet Habitat
- ⋯ Study Area



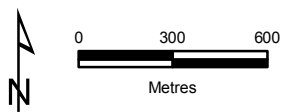
**Figure 8a**  
 Southern Toadlet and Growing Grass Frog Survey Sites  
 Officer Structure Plan, Officer





**Suitable GGF Terrestrial Habitat**

- Suitable Waterbodies
- 200m around Surveyed Waterbodies/  
Suitable Habitat
- Suitable Waterbodies
- Unsuitable Waterbodies
- Suitable Habitat  
(Drainage Lines and Waterways)

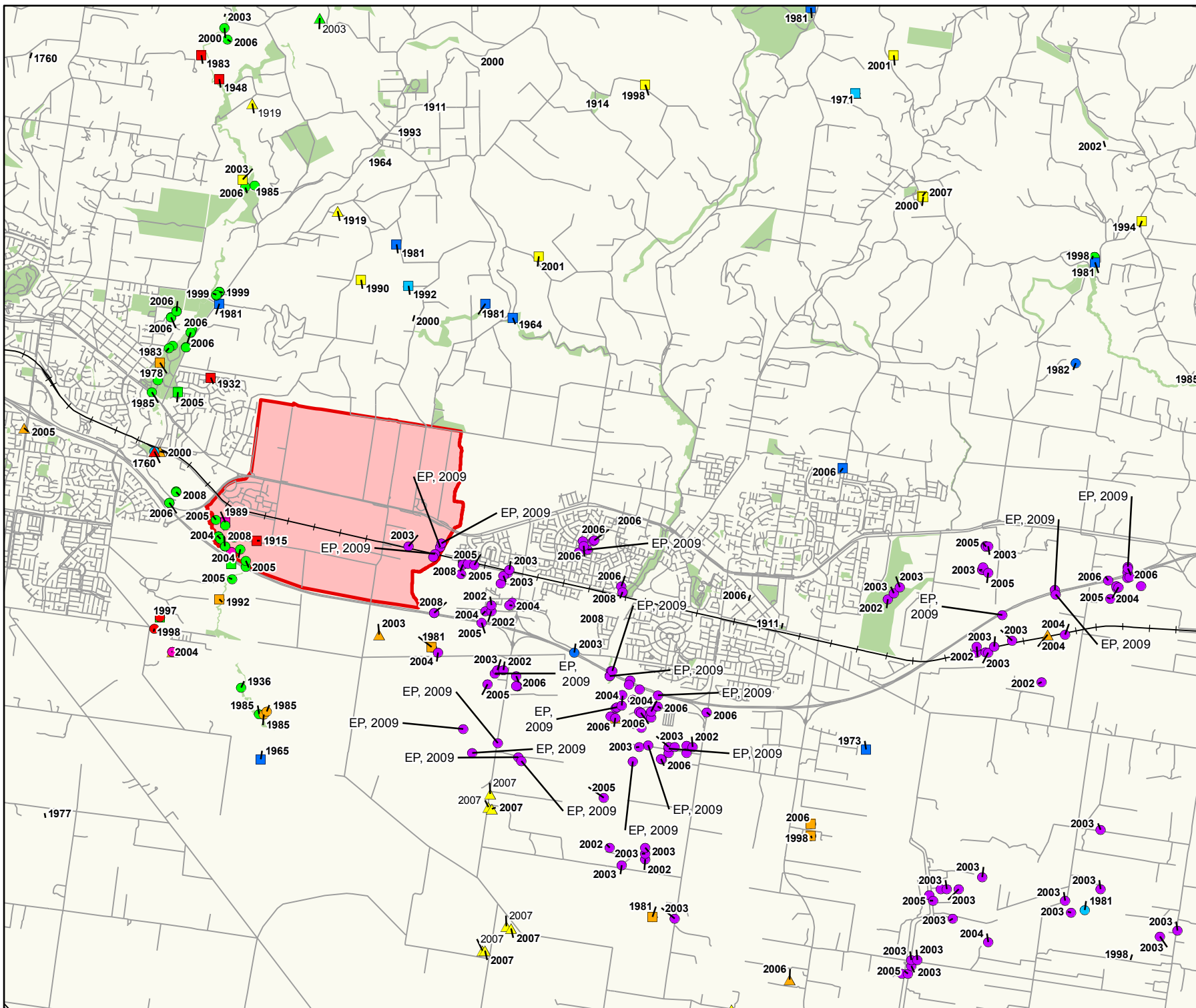


**Figure 8b**  
Suitable Habitat for Growing Grass Frog within the Officer Precinct Structure Plan

**Growing Grass Frog Habitat Definitions**

**Suitable habitat** refers to all waterbodies (i.e. ponds, dams, wetlands) and watercourses (i.e. creeks and drainage lines) that have varying levels of emergent, submerged, fringing and surrounding vegetation, have high water quality, no or low numbers of predatory fish species, and are located in proximity to other waterbodies or watercourses of similar quality. Targeted surveys were undertaken within all waterbodies considered to be suitable habitat for Growing Grass Frog.

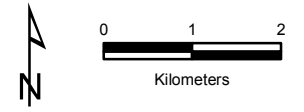
Note: this figure does not represent current site occupancy for Growing Grass Frog within the Officer PSP.



**Threatened Fauna Records (VBA)**

- Australasian Shoveler
- Australian Grayling
- Bailion's Crake
- Dwarf Galaxias
- Eastern Great Egret
- Grey-headed Flying-fox
- Growling Grass Frog
- Hardhead
- Helmeted Honeyeater
- Musk Duck
- Powerful Owl
- Royal Spoonbill
- Sooty Owl
- Southern Toadlet
- Superb Parrot
- Swift Parrot
- ▲ Southern Brown Bandicoot
- ▲ White-bellied Sea-Eagle
- ▲ Latham's Snipe
- Study Area

*Note: Where multiple records occur in the same location only the most recent is shown.*



**Figure 9**  
 Significant Fauna Records  
 Officer Structure Plan, Officer



## **APPENDICES**

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## Appendix 1 – Significance Assessment

Criteria used by Ecology Partners Pty Ltd to define conservation significance, vegetation condition and habitat quality is provided below.

### A1.1. Rare or Threatened Categories for Listed Victorian Taxa

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

Rare or Threatened Categories
<b>CONSERVATION STATUS IN AUSTRALIA</b> (Based on the EPBC Act 1999, Briggs and Leigh 1996)
<b>EX</b> - Extinct: Extinct is when there is no reasonable doubt that the last individual of the species has died.
<b>CR</b> - Critically Endangered: A species is critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
<b>EN</b> - 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.
<b>VU</b> - 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.
<b>R*</b> - Rare: A species is rare but overall is not currently considered critically endangered, endangered or vulnerable.
<b>K*</b> - Poorly Known: A species is suspected, but not definitely known, to belong to any of the categories extinct, critically endangered, endangered, vulnerable or rare.
<b>CONSERVATION STATUS IN VICTORIA</b> (Based on DSE 2005b, DSE 2007c, FIS 2009)
<b>x</b> - 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.
<b>e</b> - Endangered in Victoria: at risk of disappearing from the wild state if present land use and other causal factors continue to operate.
<b>v</b> - 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.
<b>r</b> - 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.
<b>k</b> - 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.

## A1.2. Defining Ecological Significance

Table A1.2. Defining Ecological Significance.

Criteria for defining Ecological Significance	
<b>NATIONAL SIGNIFICANCE</b>	
<b>Flora</b>	National conservation status is based on the EPBC Act list of taxa considered Threatened in Australia (i.e. Extinct, Critically Endangered, Endangered, Vulnerable).
	Flora listed as Rare in Australia in <i>Rare or Threatened Australian Plants</i> (Briggs and Leigh 1996).
<b>Fauna</b>	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 the Department of the Environment, Water, Heritage and the Arts: threatened marsupials and monotremes (Maxwell et al. 1996), rodents (Lee 1995), bats (Duncan <i>et al.</i> 1999), birds (Garnett and Crowley 2000), reptiles (Cogger <i>et al.</i> 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).
	Species that have not been included on the EPBC Act but listed as significance according to the <i>IUCN 2009 Red List of Threatened Species</i> (IUCN 2009).
<b>Communities</b>	Vegetation communities considered Critically Endangered, Endangered or Vulnerable under the EPBC Act and considering vegetation condition.
<b>STATE SIGNIFICANCE</b>	
<b>Flora</b>	Threatened taxa listed under the provisions of the FFG Act.
	Flora listed as Extinct, Endangered, Vulnerable or Rare in Victoria in the DSE Flora Information System (most recent version).
	Flora listed in the State Government's <i>Advisory List of Rare or Threatened Plants in Victoria, 2005</i> (DSE 2005b).
	Flora listed as Poorly Known in Australia in <i>Rare or Threatened Australian Plants</i> (Briggs and Leigh 1996).
<b>Fauna</b>	Threatened taxon listed under Schedule 2 of the FFG Act.
	Fauna listed as Extinct, Critically Endangered, Endangered and Vulnerable on the State Government's <i>Advisory List of Threatened Vertebrate Fauna in Victoria – 2007</i> (DSE 2007c).

<b>Criteria for defining Ecological Significance</b>	
	Listed as Lower Risk (Near Threatened, Conservation Dependent or Least concern) or Data Deficient under National Action Plans for terrestrial species prepared for the Department of the Environment, Water, Heritage and the Arts: threatened marsupials and monotremes (Maxwell <i>et al.</i> 1996), rodents (Lee 1995), bats (Duncan <i>et al.</i> 1999), birds (Garnett and Crowley 2000), reptiles (Cogger <i>et al.</i> 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).
<b>Communities</b>	Ecological communities listed as Threatened under the FFG Act.
	Ecological Vegetation Class listed as Threatened (i.e. Endangered, Vulnerable) or Rare in a Native Vegetation Plan for a particular bioregion ( <a href="http://www.dse.vic.gov.au">www.dse.vic.gov.au</a> ) and considering vegetation condition.
<b>REGIONAL SIGNIFICANCE</b>	
<b>Flora</b>	Flora considered Rare in any regional native vegetation plan for a particular bioregion.
	Flora considered Rare by the author for a particular bioregion.
<b>Fauna</b>	Fauna with a disjunct distribution, or a small number of documented recorded or naturally rare in the particular bioregion in which the study area occurs in.
	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 <i>Advisory List of Threatened Vertebrate Fauna in Victoria – 2007</i> (DSE 2007c).
<b>Communities</b>	Ecological Vegetation Class listed as Depleted or Least Concern in a Native Vegetation Plan for a particular bioregion ( <a href="http://www.dse.vic.gov.au">www.dse.vic.gov.au</a> ) and considering vegetation condition.
	Ecological Vegetation Class considered Rare by the author for a particular bioregion.
<b>LOCAL SIGNIFICANCE</b>	
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.	

### A1.3 Defining Site Significance

The following geographical areas apply to the overall level of significance with respect to the current survey.

- National:** Australia
- State:** Victoria
- Regional:** Gippsland Plain bioregion
- Local:** Within 10 kilometres surrounding the study area

Table A1.3. Defining Site Significance.

Criteria for defining Site Significance
<b>NATIONAL SIGNIFICANCE</b>
<p><b>A site is of National significance if:</b></p> <ul style="list-style-type: none"> <li>- 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 Department of the Environment, Water, Heritage and the Arts.</li> <li>- 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.</li> <li>- It is known to support, or has a high probability of supporting taxon listed as 'Vulnerable' under National Action Plans.</li> <li>- 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.</li> <li>- 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.</li> <li>- 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).</li> </ul>
<b>STATE SIGNIFICANCE</b>
<p><b>A site is of State significance if:</b></p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- 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 2005b, 2007), or species listed as 'Data Deficient' or 'Insufficiently Known' under National Action Plans.</li> <li>- It contains an area, or part thereof designated as 'critical habitat' under the FFG Act.</li> <li>- It supports, or likely to support a high proportion of any Victorian flora and fauna taxa.</li> <li>- It contains high quality, intact vegetation/habitat supporting a high species richness and diversity in a particular bioregion.</li> <li>- 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.</li> </ul>

Criteria for defining Site Significance
<b>REGIONAL SIGNIFICANCE</b>
<p><b>A site is of Regional significance if:</b></p> <ul style="list-style-type: none"> <li>- It regularly supports, or has a high probability of regularly supporting regionally significant fauna as defined in Table 1.2.</li> <li>- 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.</li> <li>- It supports a fauna population with a disjunct distribution, or a particular taxon that has an unusual ecological or biogeographical occurrence.</li> <li>- 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.</li> </ul>
<b>LOCAL SIGNIFICANCE</b>
<p><b>Most sites are considered to be of at least local significance for conservation purposes and, in general, a site of local significance can be defined as:</b></p> <ul style="list-style-type: none"> <li>- An area which supports indigenous flora species and/or a remnant Ecological Vegetation Class, and habitats used by locally significant fauna species.</li> <li>- 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.</li> </ul>

## A1.4. Defining Vegetation Condition

Table A1.4. Defining Vegetation Condition.

Criteria for defining Vegetation Condition
<p><b>Good condition</b> - 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><b>Moderate condition</b> - 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><b>Poor condition</b> - Vegetation dominated by introduced species, but supports low levels of indigenous species present, in the canopy, shrub layer or ground cover.</p>



## A1.5. Defining Habitat Quality

Several factors are taken into account when determining the value of habitat. Habitat quality varies on both spatial and temporal scales, with the habitat value varying depending upon a particular fauna species.

**Table A1.5.** Defining Habitat Quality.

<b>Criteria for defining Habitat Quality</b>
<b>HIGH QUALITY</b>
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 2007c.
<b>MODERATE QUALITY</b>
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 2007c.
<b>LOW QUALITY</b>
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.

**Criteria for defining Habitat Quality**

Unlikely to provide habitat for rare or threatened species listed under the EPBC Act, FFG Act, or considered rare or threatened according to DSE 2007c.

## Appendix 2.1 – Flora survey results

Table A2.1. Flora recorded during the present survey (5 June 2008)

Species in **bold** are considered regionally significant in the Gippsland Plain boregion (FIS 2009).

# Taxa which, since European settlement, occurs outside its original geographic range

\* Declared noxious weed within the Port Phillip and Westernport catchment (DPI 2008)

WONS = Weed of National Significance (National Weeds Strategy)

Scientific Name	Common Name
<b>INDIGENOUS SPECIES</b>	
<i>Acacia dealbata</i>	Silver Wattle
<i>Acacia mearnsii</i>	Black Wattle
<i>Acacia melanoxylon</i>	Blackwood
<i>Acacia mucronata</i> subsp. <i>longifolia</i>	Narrow-leaf Wattle
<i>Acacia paradoxa</i>	Hedge Wattle
<b><i>Acacia stricta</i></b>	<b>Hop Wattle</b>
<i>Acacia verticillata</i>	Prickly Moses
<b><i>Acaena echinata</i></b>	<b>Sheep's Burr</b>
<i>Acaena novae-zelandiae</i>	Bidgee-widgee
<b><i>Acrotriche prostrata</i></b>	<b>Trailing Ground-berry</b>
<b><i>Adiantum aethiopicum</i></b>	<b>Common Maidenhair</b>
<b><i>Ajuga australis</i></b>	<b>Austral Bugle</b>
<b><i>Alisma plantago-aquatica</i></b>	<b>Water Plantain</b>
<b><i>Allocasuarina littoralis</i></b>	<b>Black Sheoak</b>
<i>Allocasuarina paludosa</i>	Scrub Sheoak
<b><i>Allocasuarina verticillata</i></b>	<b>Drooping Sheoak</b>
<b><i>Alternanthera denticulata</i> s.l.</b>	<b>Lesser Joyweed</b>
<b><i>Amphibromus archeri</i></b>	<b>Pointed Swamp Wallaby-grass</b>
<b><i>Amphibromus nervosus</i></b>	<b>Common Swamp Wallaby-grass</b>
<i>Amyema pendula</i>	Drooping Mistletoe
<b><i>Asperula conferta</i></b>	<b>Common Woodruff</b>
<i>Arthropodium strictum</i>	Chocolate Lily
<b><i>Austrodanthonia caespitosa</i></b>	<b>Common Wallaby-grass</b>
<b><i>Austrodanthonia laevis</i></b>	<b>Smooth Wallaby-grass</b>
<b><i>Austrodanthonia pilosa</i></b>	<b>Velvet Wallaby-grass</b>
<i>Austrodanthonia racemosa</i> var. <i>racemosa</i>	Slender Wallaby-grass
<i>Austrodanthonia setacea</i>	Bristly Wallaby-grass
<b><i>Austrostipa rudis</i></b>	<b>Veined Spear-grass</b>
<b><i>Austrostipa</i> spp.</b>	<b>Spear Grass</b>

Scientific Name	Common Name
<b><i>Azolla filiculoides</i></b>	<b>Pacific Azolla</b>
<b><i>Baumea articulata</i></b>	<b>Jointed Twig-sedge</b>
<i>Billardiera scandens</i>	Common Apple-berry
<i>Bossiaea prostrata</i>	Creeping Bossiaea
<b><i>Bromus</i> spp.</b>	<b>Brome</b>
<b><i>Brunonia australis</i></b>	<b>Blue Pincushion</b>
<b><i>Bulbine bulbosa</i></b>	<b>Bulbine Lily</b>
<i>Burchardia umbellata</i>	Milkmaids
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Sweet Bursaria
<b><i>Caesia parviflora</i></b>	<b>Pale Grass-lily</b>
<b><i>Carex appressa</i></b>	<b>Tall Sedge</b>
<i>Carex breviculmis</i>	Common Grass-sedge
<i>Carex fascicularis</i>	Tassel Sedge
<b><i>Carex inversa</i></b>	<b>Knob Sedge</b>
<b><i>Cassinia aculeata</i></b>	<b>Common Cassinia</b>
<i>Cassinia arcuata</i>	Drooping Cassinia
<b><i>Cassytha melantha</i></b>	<b>Coarse Dodder-laurel</b>
<b><i>Centella cordifolia</i></b>	<b>Centella</b>
<b><i>Centrolepis strigosa</i> subsp. <i>strigosa</i></b>	<b>Hairy Centrolepis</b>
<b><i>Chenopodium pumilio</i></b>	<b>Clammy Goosefoot</b>
<b><i>Chiloglottis valida</i></b>	<b>Common Bird-orchid</b>
<b><i>Cladium procerum</i></b>	<b>Leafy Twig-sedge</b>
<i>Clematis microphylla</i>	Small-leaved Clematis
<i>Coprosma quadrifida</i>	Prickly Currant-bush
<i>Correa reflexa</i>	Common Correa
<b><i>Crassula helmsii</i></b>	<b>Swamp Crassula</b>
<b><i>Cyathea australis</i></b>	<b>Rough Tree-fern</b>
<b><i>Daviesia latifolia</i></b>	<b>Hop Bitter-pea</b>
<b><i>Daviesia leptophylla</i></b>	<b>Narrow-leaf Bitter-pea</b>
<b><i>Dianella admixta</i></b>	<b>Black-anther Flax-lily</b>
<b><i>Dianella amoena</i></b>	<b>Matted Flax-lily</b>
<b><i>Dianella longifolia</i> s.l.</b>	<b>Pale Flax-lily</b>
<i>Dichondra repens</i>	Kidney-weed
<i>Dillwynia cinerascens</i>	Grey Parrot-pea
<b><i>Doodia caudata</i></b>	<b>Small Rasp-fern</b>
<i>Drosera peltata</i> subsp. <i>auriculata</i>	Tall Sundew
<b><i>Drosera peltata</i> subsp. <i>peltata</i></b>	<b>Pale Sundew</b>
<b><i>Drosera pygmaea</i></b>	<b>Tiny Sundew</b>

Scientific Name	Common Name
<i>Drosera whittakeri</i>	Scented Sundew
<b><i>Eleocharis acuta</i></b>	<b>Common Spike-sedge</b>
<b><i>Eleocharis sphacelata</i></b>	<b>Tall Spike-sedge</b>
<i>Elymus scaber</i>	Common Wheat-grass
<i>Epacris impressa</i>	Common Heath
<b><i>Epilobium billardierianum</i></b>	<b>Variable Willow Herb</b>
<b><i>Epilobium hirtigerum</i></b>	<b>Hairy Willow-herb</b>
<b><i>Eragrostis brownii</i></b>	<b>Common Love-grass</b>
<b><i>Eryngium vesiculosum</i></b>	<b>Prickfoot</b>
<b><i>Eucalyptus camaldulensis</i></b>	<b>River Red-gum</b>
<b><i>Eucalyptus dives</i></b>	<b>Broadleaf Peppermint</b>
<b><i>Eucalyptus fulgens</i></b>	<b>Green Scentbark</b>
<b><i>Eucalyptus goniocalyx</i> s.l.</b>	<b>Bundy</b>
<b><i>Eucalyptus melliodora</i></b>	<b>Yellow Box</b>
<i>Eucalyptus ovata</i>	Swamp Gum
<i>Eucalyptus radiata</i>	Narrow-leaf Peppermint
<i>Eucalyptus viminalis</i>	Manna Gum
<b><i>Euchiton collinus</i> s.l.</b>	<b>Creeping Cudweed</b>
<b><i>Euchiton involucratus</i> s.s.</b>	<b>Star Cudweed</b>
<i>Euphorbia</i> spp.	Spurge
<i>Exocarpos cupressiformis</i>	Cherry Ballart
<b><i>Exocarpos strictus</i></b>	<b>Pale-fruit Ballart</b>
<i>Gahnia radula</i>	Thatch Saw-sedge
<b><i>Geranium homeanum</i></b>	<b>Northern Crane's-bill</b>
<i>Geranium</i> spp.	Crane's Bill
<b><i>Glyceria australis</i></b>	<b>Australian Sweet-grass</b>
<b><i>Glycine clandestina</i></b>	<b>Twining Glycine</b>
<i>Gonocarpus tetragynus</i>	Common Raspwort
<b><i>Goodenia humilis</i></b>	<b>Swamp Goodenia</b>
<b><i>Goodenia lanata</i></b>	<b>Trailing Goodenia</b>
<i>Goodenia ovata</i>	Hop Goodenia
<b><i>Gratiola peruviana</i></b>	<b>Austral Brooklime</b>
<b><i>Hakea nodosa</i></b>	<b>Yellow Hakea</b>
<b><i>Haloragis heterophylla</i></b>	<b>Varied Raspwort</b>
<b><i>Hardenbergia violacea</i></b>	<b>Purple Coral-pea</b>
<b><i>Hemarthria uncinata</i></b>	<b>Mat Grass</b>
<b><i>Hovea heterophylla</i></b>	<b>Common Hovea</b>
<i>Hydrocotyle hirta</i>	Hairy Pennywort

Scientific Name	Common Name
<i>Hydrocotyle</i> spp.	Pennywort
<i>Hypericum gramineum</i>	Small St John's Wort
<b><i>Hypoxis hygrometrica</i> var. <i>hygrometrica</i></b>	<b>Golden Weather-glass</b>
<b><i>Imperata cylindrica</i></b>	<b>Blady Grass</b>
<b><i>Indigofera australis</i></b>	<b>Austral Indigo</b>
<b><i>Isolepis cernua</i> var. <i>cernua</i></b>	<b>Nodding Club-sedge</b>
<b><i>Isolepis cernua</i> var. <i>platycarpa</i></b>	<b>Broad-fruit Club-sedge</b>
<b><i>Isolepis fluitans</i></b>	<b>Floating Club-sedge</b>
<b><i>Isolepis hookeriana</i></b>	<b>Grassy Club-sedge</b>
<b><i>Isolepis inundata</i></b>	<b>Swamp Club-sedge</b>
<b><i>Joycea pallida</i></b>	<b>Silvertop Wallaby-grass</b>
<b><i>Juncus amabilis</i></b>	<b>Hollow Rush</b>
<b><i>Juncus bufonius</i></b>	<b>Toad Rush</b>
<b><i>Juncus flavidus</i></b>	<b>Gold Rush</b>
<b><i>Juncus gregiflorus</i></b>	<b>Green Rush</b>
<b><i>Juncus holoschoenus</i></b>	<b>Joint-leaf Rush</b>
<b><i>Juncus pallidus</i></b>	<b>Pale Rush</b>
<b><i>Juncus planifolius</i></b>	<b>Broad-leaf Rush</b>
<b><i>Juncus procerus</i></b>	<b>Tall Rush</b>
<b><i>Juncus sarophorus</i></b>	<b>Broom Rush</b>
<b><i>Juncus subsecundus</i></b>	<b>Finger Rush</b>
<b><i>Kennedia prostrata</i></b>	<b>Running Postman</b>
<i>Kunzea ericoides</i> spp. agg.	Burgan
<b><i>Lachnagrostis aemula</i> s.s.</b>	<b>Leafy Blown-grass</b>
<b><i>Lachnagrostis filiformis</i></b>	<b>Common Blown-grass</b>
<b><i>Lagenophora gracilis</i></b>	<b>Slender Bottle-daisy</b>
<b><i>Lemna disperma</i></b>	<b>Common Duckweed</b>
<b><i>Lepidosperma elatius</i></b>	<b>Tall Sword-sedge</b>
<b><i>Lepidosperma laterale</i> var. <i>laterale</i></b>	<b>Variable Sword-sedge</b>
<b><i>Lepidosperma laterale</i> var. <i>majus</i></b>	<b>Variable Sword-sedge</b>
<b><i>Lepidosperma longitudinale</i></b>	<b>Pithy Sword-sedge</b>
<b><i>Leptorhynchos tenuifolius</i></b>	<b>Wiry Buttons</b>
<i>Leptospermum continentale</i>	Prickly Tea-tree
<b><i>Leptospermum lanigerum</i></b>	<b>Woolly Tea-tree</b>
<b><i>Lobelia anceps</i></b>	<b>Angled Lobelia</b>
<i>Lomandra filiformis</i>	Wattle Mat-rush
<b><i>Lomandra filiformis</i> subsp. <i>filiformis</i></b>	<b>Wattle Mat-rush</b>
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush

Scientific Name	Common Name
<b><i>Lythrum hyssopifolia</i></b>	<b>Small Loosestrife</b>
<i>Melaleuca ericifolia</i>	Swamp Paperbark
<b><i>Melicytus dentatus</i></b>	<b>Tree Violet</b>
<i>Microlaena stipoides</i>	Weeping Grass
<b><i>Microtis parviflora</i></b>	<b>Slender Onion-orchid</b>
<b><i>Notodanthonia semiannularis</i></b>	<b>Wetland Wallaby-grass</b>
<b><i>Opercularia ovata</i></b>	<b>Broad-leaf Stinkweed</b>
<i>Opercularia varia</i>	Variable Stinkweed
<b><i>Ottelia ovalifolia</i> subsp. <i>ovalifolia</i></b>	<b>Swamp Lily</b>
<i>Oxalis exilis</i>	Shady Wood-sorrel
<b><i>Oxalis perennans</i></b>	<b>Grassland Wood-sorrel</b>
<i>Ozothamnus ferrugineus</i>	Tree Everlasting
<b><i>Pandorea pandorana</i></b>	<b>Wonga Vine</b>
<b><i>Patersonia occidentalis</i></b>	<b>Long Purple-flag</b>
<b><i>Pentapogon quadrifidus</i></b>	<b>Five-awned Spear-grass</b>
<b><i>Persicaria decipiens</i></b>	<b>Slender Knotweed</b>
<b><i>Persicaria hydropiper</i></b>	<b>Water Pepper</b>
<b><i>Persicaria lapathifolia</i></b>	<b>Pale Knotweed</b>
<b><i>Phragmites australis</i></b>	<b>Common Reed</b>
<i>Pimelea humilis</i>	Common Rice-flower
<i>Platylobium obtusangulum</i>	Common Flat-pea
<b><i>Poa clelandii</i></b>	<b>Noah's Ark</b>
<i>Poa ensiformis</i>	Sword Tussock-grass
<i>Poa labillardierei</i>	Common Tussock-grass
<i>Poa morrisii</i>	Soft Tussock-grass
<b><i>Poa rodwayi</i></b>	<b>Velvet Tussock-grass</b>
<b><i>Poa sieberiana</i></b>	<b>Grey Tussock-grass</b>
<b><i>Poa tenera</i></b>	<b>Slender Tussock-grass</b>
<i>Poranthera microphylla</i>	Small Poranthera
<b><i>Portulaca oleracea</i></b>	<b>Common Purslane</b>
<i>Potamogeton ochreateus</i>	Blunt Pondweed
<b><i>Potamogeton pectinatus</i></b>	<b>Fennel Pondweed</b>
<b><i>Potamogeton tricarinatus</i> s.l.</b>	<b>Floating Pondweed</b>
<b><i>Pseudognaphalium luteoalbum</i></b>	<b>Jersey Cudweed</b>
<i>Pteridium esculentum</i>	Austral Bracken
<b><i>Pterostylis melagramma</i></b>	<b>Tall Greenhood</b>
<b><i>Pultenaea gunnii</i></b>	<b>Golden Bush-pea</b>
<b><i>Ranunculus amphitrichus</i></b>	<b>Small River Buttercup</b>

Scientific Name	Common Name
<i>Ranunculus glabrifolius</i>	Shining Buttercup
<i>Ranunculus inundatus</i>	River Buttercup
<i>Ranunculus lappaceus</i>	Australian Buttercup
<i>Rubus parvifolius</i>	Small-leaf Bramble
<i>Schoenoplectus tabernaemontani</i>	River Club-sedge
<i>Schoenus apogon</i>	Common Bog-sedge
<i>Schoenus tesquorum</i>	Soft Bog-sedge
<i>Selaginella gracillima</i>	Tiny Selaginella
<i>Senecio glomeratus</i>	Annual Fireweed
<i>Senecio hispidulus</i> s.l.	Rough Fireweed
<i>Senecio minimus</i>	Shrubby Fireweed
<i>Senecio quadridentatus</i>	Cotton Fireweed
<i>Senecio tenuiflorus</i> s.l.	Slender Fireweed
<i>Solanum</i> spp.	Kangaroo Apple
<i>Solanum vescum</i>	Gunyang
<i>Solenogyne dominii</i>	Smooth Solenogyne
<i>Stackhousia monogyne</i>	Creamy Stackhousia
<i>Spergularia marina</i> s.s.	Lesser Sea-spurry
<i>Stylidium graminifolium</i> s.l.	Grass Triggerplant
<i>Thelymitra holmesii</i>	Blue-star Sun-orchid
<i>Thelymitra</i> spp.	Sun Orchid
<i>Themeda triandra</i>	Kangaroo Grass
<i>Tricoryne elatior</i>	Yellow Rush-lily
<i>Triglochin procera</i> s.s.	Common Water-ribbons
<i>Triglochin striata</i>	Streaked Arrowgrass
<i>Typha domingensis</i>	Narrow-leaf Cumbungi
<i>Typha orientalis</i>	Broad-leaf Cumbungi
<i>Veronica gracilis</i>	Slender Speedwell
<i>Veronica plebeia</i>	Trailing Speedwell
<i>Villarsia reniformis</i>	Running Marsh-flower
<i>Viola hederacea</i>	Ivy-leaf Violet
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell
<i>Wahlenbergia multicaulis</i>	Branching Bluebell
<i>Xanthorrhoea minor</i> subsp. <i>lutea</i>	Small Grass-tree
<b>INTRODUCED SPECIES</b>	
# <i>Acacia floribunda</i>	White Sallow-wattle
<i>Acacia longifolia</i> subsp. <i>Longifolia</i>	Sallow Wattle
<i>Acetosella vulgaris</i>	Sheep Sorrel



Scientific Name	Common Name
<i>Agapanthus praecox</i> subsp. <i>orientalis</i>	Agapanthus
<i>Agrostis capillaris</i>	Brown-top Bent
<i>Aira elegantissima</i>	Delicate Hair-grass
<i>Allium triquetrum</i>	Angled Onion
<i>Alopecurus geniculatus</i>	Marsh Fox-tail
<i>Anagallis arvensis</i>	Pimpernel
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Arctotheca calendula</i>	Cape Weed
<i>Arum</i> spp.	Arum
* <i>Asparagus asparagoides</i> (WONS)	Bridal Creeper
<i>Aster subulatus</i>	Aster-weed
<i>Avena fatua</i>	Wild Oat
<i>Brassica rapa</i>	White Turnip
<i>Briza maxima</i>	Large Quaking-grass
<i>Briza minor</i>	Lesser Quaking-grass
<i>Bromus catharticus</i>	Prairie Grass
<i>Bromus hordeaceus</i> subsp. <i>hordeaceus</i>	Soft Brome
<i>Centaureum erythraea</i>	Common Centaury
<i>Centaureum tenuiflorum</i>	Slender Centaury
<i>Chamaecytisus palmensis</i>	Tree Lucerne
<i>Chenopodium album</i>	Fat Hen
<i>Chenopodium murale</i>	Sowbane
* <i>Cirsium vulgare</i>	Spear Thistle
<i>Cotoneaster</i> spp.	Cotoneaster
<i>Conyza bonariensis</i>	Flaxleaf Fleabane
<i>Coprosma repens</i>	Mirror Bush
<i>Cortaderia selloana</i>	Pampas Grass
<i>Cotula coronopifolia</i>	Water Buttons
* <i>Crataegus monogyna</i> subsp. <i>monogyna</i>	Hawthorn
<i>Cupressus macrocarpa</i>	Monterey Cypress
<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch
<i>Cyperus eragrostis</i>	Drain Flat-sedge
<i>Dactylis glomerata</i>	Cocksfoot
<i>Daucus carota</i>	Carrot
<i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass
<i>Ehrharta longiflora</i>	Annual Veldt-grass
<i>Erica lusitanica</i>	Spanish Heath
<i>Erigeron karvinskianus</i>	Seaside Daisy

Scientific Name	Common Name
<i>Euphorbia peplus</i>	Petty Spurge
<i>Festuca arundinacea</i>	Tall Fescue
<i>Festuca rubra</i>	Red Fescue
<i>Fumaria capreolata</i>	Ramping Fumitory
* <i>Foeniculum vulgare</i>	Fennel
<i>Galium aparine</i>	Cleavers
* <i>Genista monspessulana</i>	Montpellier Broom
<i>Geranium dissectum</i>	Cut-leaf Cranesbill
<i>Gladiolus</i> spp.	Gladiolus
<i>Hedera helix</i>	English Ivy
<i>Helminthotheca echioides</i>	Ox-tongue
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Hordeum leporinum</i>	Barley-grass
<i>Hypochoeris radicata</i>	Flatweed
<i>Juncus articulatus</i>	Jointed Rush
<i>Juncus capitatus</i>	Capitate Rush
<i>Lactuca serriola</i>	Prickly Lettuce
<i>Leontodon taraxacoides</i> subsp. <i>taraxacoides</i>	Hairy Hawkbit
<i>Lepidium africanum</i>	Common Peppercross
<i>Lonicera japonica</i>	Japanese Honeysuckle
<i>Lotus angustissimus</i>	Slender Bird's-foot Trefoil
<i>Lycium ferocissimum</i>	African Box-thorn
<i>Malva nicaeensis</i>	Mallow of Nice
<i>Modiola caroliniana</i>	Red-flower Mallow
<i>Oxalis corniculata</i> s.s.	Creeping Wood-sorrel
* <i>Oxalis pes-caprae</i>	Soursob
<i>Paspalum dilatatum</i>	Paspalum
<i>Paspalum distichum</i>	Water Couch
<i>Passiflora tarminiana</i>	Banana Passion-fruit
<i>Pennisetum clandestinum</i>	Kikuyu
<i>Phalaris aquatica</i>	Toowoomba Canary-grass
<i>Phalaris minor</i>	Lesser Canary-grass
<i>Pinus radiata</i>	Radiata Pine
# <i>Pittosporum undulatum</i>	Sweet Pittosporum
<i>Plantago coronopus</i>	Buck's-horn Plantain
<i>Plantago lanceolata</i>	Ribwort
<i>Plantago major</i>	Greater Plantain
<i>Poa annua</i>	Annual Meadow-grass

Scientific Name	Common Name
<i>Polygonum arenastrum</i>	Wireweed
<i>Prunella vulgaris</i>	Self-heal
<i>Prunus spp</i>	Prunus
<i>Ranunculus muricatus</i>	Sharp Buttercup
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Romulea rosea</i>	Onion Grass
* <i>Rosa rubiginosa</i> (WONS)	Sweet Briar
* <i>Rubus fruticosus</i> spp. agg. (WONS)	Blackberry
<i>Rumex crispus</i>	Curled Dock
<i>Rumex pulcher subsp. pulcher</i>	Fiddle Dock
<i>Rumex conglomeratus</i>	Clustered Dock
<i>Salix babylonica</i> s.l.	Weeping Willow
<i>Senecio jacobaea</i>	Ragwort
<i>Silybum marianum</i>	Variegated Thistle
<i>Solanum nigrum</i>	Black Nightshade
<i>Solanum pseudocapsicum</i>	Madiera Winter-cherry
<i>Sonchus oleraceus</i>	Common Sow-thistle
<i>Sporobolus africanus</i>	Rat-tail Grass
<i>Taraxacum officinale</i> spp. agg.	Garden Dandelion
<i>Tradescantia fluminensis</i>	Wandering Jew
<i>Tragopogon porrifolius</i>	Salsify
<i>Trifolium campestre</i> var. <i>campestre</i> Hop Clover	White Clover
<i>Trifolium dubium</i>	Suckling Clover
<i>Trifolium fragiferum</i> var. <i>fragiferum</i>	Strawberry Clover
<i>Trifolium glomeratum</i>	Cluster Clover
<i>Trifolium repens</i> var. <i>repens</i>	White Clover
<i>Trifolium subterraneum</i>	Subterranean Clover
* <i>Ulex europaeus</i> (WONS)	Gorse
<i>Urtica urens</i>	Small Nettle
<i>Vicia sativa</i>	Common Vetch
<i>Vulpia bromoides</i>	Squirrel-tail Fescue
* <i>Watsonia</i> spp.	Watsonia
<i>Zantedeschia aethiopica</i>	White Arum-lily

## Appendix 2.2 – Flora results

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

Sources used to determine species status:

EPBC	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
DSE	Advisory List of Threatened Flora in Victoria (DSE 2005b)
FFG	Flora and Fauna Guarantee Act 1988 (Victoria)

National status of species is designated by:

X	Extinct
CR	Critically endangered
EN	Endangered
VU	Vulnerable
K	Poorly Known
#	Records identified from EPBC Act Protected Matters Search Tool.

State status of species is designated by:

X	Extinct
e	Endangered
v	Vulnerable
r	Rare
k	Poorly Known
L	Listed

Likelihood of occurrence:

1	known occurrence
2	habitat present
3	habitat present, but low likelihood
4	unlikely
5	no suitable habitat

Scientific Name	Common Name	Last Documented Record (FIS)	Total number of documented records (FIS)	EPBC	VROTS	FFG	Likely occurrence within the study area
<b>NATIONAL SIGNIFICANCE</b>							
# <i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	-	VU	-	-	-	3
# <i>Caladenia fragrantissima subsp. orientalis</i>	Cream Spider-orchid	-	EN	e	L	L	4
# <i>Dianella amoena</i>	Matted Flax-lily	2008	8	EN	e	L	1
# <i>Prasophyllum frenchii</i>	Maroon Leek-orchid	1983	9	EN	e	L	3
# <i>Thelymitra epipactoides</i>	Metallic Sun-orchid	-	EN	e	L	L	4
# <i>Xerochrysum palustre</i>	Swamp Everlasting	-	VU	v	L	L	3
<i>Eucalyptus crenulata</i>	Buxton Gum	2007	1	EN	e	L	4
<i>Glycine latrobeana</i>	Clover Glycine	2003	1	VU	v	L	4
<b>STATE SIGNIFICANCE</b>							
<i>Acacia leprosa (Dandenong Range variant)</i>	Dandenong CinnamonWattle	2004	11	-	r	-	4
<i>Austrostipa rudis subsp. australis</i>	Veined Spear-grass	2004	5	-	r	-	1
<i>Burnettia cuneata</i>	Lizard Orchid	-	1	-	r	-	4
<i>Caladenia oenochila</i>	Wine-lipped Spider-orchid	2000	6	-	v	-	4
<i>Cardamine tenuifolia</i>	Slender Bitter-cress	1998	1	-	k	-	4
<i>Carex alsophila</i>	Forest Sedge	1980	1	-	r	-	4
<i>Carex chlorantha</i>	Green-top Sedge	1903	1	-	k	-	4
<i>Corybas aconitiflorus</i>	Spurred Helmet-orchid	1998	1	-	r	-	4
<i>Desmodium varians</i>	Slender Tick-trefoil	1999	3	-	k	-	4
<i>Diuris punctata var. punctata</i>	Purple Diuris	1986	15	-	v	L	3
<i>Entolasia stricta</i>	Upright Panic	2007	1	-	k	-	4
<i>Eucalyptus fulgens</i>	Green Scentbark	1994	22	-	r	-	1
<i>Geranium solanderi var. solanderi s.s.</i>	Austral Crane's-bill	2008	2	-	v	-	4
<i>Leionema bilobum</i>	Notched Leionema	-	1	-	r	-	4
<i>Olearia asterotricha</i>	Rough Daisy-bush	1914	2	-	r	-	4
<i>Potamogeton perfoliatus s.l.</i>	Perfoliate Pondweed	2005	1	-	k	-	4
<i>Prasophyllum lindleyanum</i>	Green Leek-orchid	2001	4	-	v	-	4

Scientific Name	Common Name	Last Documented Record (FIS)	Total number of documented records (FIS)	EPBC	VROTS	FFG	Likely occurrence within the study area
<i>Prasophyllum pyriforme</i> s.s.	Silurian Leek-orchid	1932	1	-	e	-	4
<i>Pterostylis grandiflora</i>	Cobra Greenhood	1940	4	-	r	-	3
<i>Pterostylis</i> sp. aff. <i>parviflora</i> (Southern Victoria)	Red-tip Greenhood	2003	1	-	r	-	4
<i>Pterostylis X ingens</i>	Sharp Greenhood	-	1	-	r	-	4
<i>Tetralthea stenocarpa</i>	Long Pink-bells	1935	1	-	r	-	4
<i>Xanthosia tasmanica</i>	Southern Xanthosia	2008	1	-	r	-	4

**Sources:** Flora Information System (FIS 2009) and EPBC Act Environmental Matters Tool (SEWPaC 2010)

## Appendix 3.1– Fauna results

**Table A3.1.** Fauna recorded during the present survey, and previously recorded within 10 kilometres of the study area.

Type of Record: Mi Migratory (EPBC Act)  
 H – Heard Ma Marine (EPBC Act)  
 S – Seen  
 I – Incidental (identified from feathers, bones or scats, etc)  
 T – Trapped / Handheld  
 \* Introduced species

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
<b>MAMMALS</b>						
Agile Antechinus	<i>Antechinus agilis</i>	2004	31	Partial	-	-
Dusky Antechinus	<i>Antechinus swainsonii</i>	1990	6	-	-	-
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	2002	19	Total	-	I
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	2002	30	Partial	-	-
Greater Glider	<i>Petauroides volans</i>	1925	2	Total	-	-
Sugar Glider	<i>Petaurus breviceps</i>	2004	16	Total	-	-
Feathertail Glider	<i>Acrobates pygmaeus</i>	1926	3	Total	-	-
Koala	<i>Phascolarctos cinereus</i>	1990	3	-	-	-
Common Wombat	<i>Vombatus ursinus</i>	2004	8	-	-	-
Black Wallaby	<i>Wallabia bicolor</i>	2004	16	-	-	S
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	2004	8	-	-	-
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	2003	1	-	-	-
Spot-tailed Quoll	<i>Dasyurus maculatus</i>	2003	1	-	-	-
Southern Brown Bandicoot	<i>Isodon obesulus obesulus</i>	1919	1	-	-	-

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
White-striped Freetail Bat	<i>Tadarida australis</i>	2002	8	Total	-	H
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	1993	10	Total	-	-
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	1991	2	Total	-	-
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	1988	2	Total	-	-
Southern Forest Bat	<i>Vespadelus regulus</i>	1988	2	Total	-	-
Little Forest Bat	<i>Vespadelus vulturnus</i>	1991	7	Total	-	-
Large Forest Bat	<i>Vespadelus darlingtoni</i>	1991	4	Total	-	-
Bush Rat	<i>Rattus fuscipes</i>	2004	20	-	-	-
Swamp Rat	<i>Rattus lutreolus</i>	2001	2	-	-	-
*Black Rat	<i>Rattus rattus</i>	1992	3	-	-	-
*Brown Rat	<i>Rattus norvegicus</i>	2006	1	-	-	-
*House Mouse	<i>Mus musculus</i>	2006	7	-	-	S
*European Rabbit	<i>Oryctolagus cuniculus</i>	2005	19	-	-	S
*European Hare	<i>Lepus europeus</i>	2005	4	-	-	S
Dingo/Dog (feral)	<i>Canis lupus</i>	1992	3	-	-	-
*Red Fox	<i>Vulpes vulpes</i>	2005	19	-	-	S
*Cat	<i>Felis catus</i>	1991	2	-	-	-
Unidentified predator	<i>Unidentified predator</i>	1991	1	-	-	-
<b>BIRDS</b>						
Buff-banded Rail	<i>Gallirallus philippensis</i>	1994	1	-	Ma	-
Common Bronzewing	<i>Phaps chalcoptera</i>	2001	30	-	-	S
Brush Bronzewing	<i>Phaps elegans</i>	1999	4	-	-	-
Baillon's Crake	<i>Porzana pusilla</i>	2003	1	-	Ma	-
Spotless Crake	<i>Porzana tabuensis</i>	1992	1	-	Ma	-
Dusky Moorhen	<i>Gallinula tenebrosa</i>	2004	11	-	-	S
Purple Swamphen	<i>Porphyrio porphyrio</i>	2002	11	-	Ma	S
Eurasian Coot	<i>Fulica atra</i>	2005	20	-	-	-



Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Great Crested Grebe	<i>Podiceps cristatus</i>	2002	1	-	-	-
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	2006	20	-	-	-
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	2005	10	-	-	-
Great Cormorant	<i>Phalacrocorax carbo</i>	2005	8	-	-	-
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	2005	8	-	-	-
Pied Cormorant	<i>Phalacrocorax varius</i>	1997	2	-	-	-
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	2005	14	-	-	S
Darter	<i>Anhinga novaehollandiae</i>	2002	4	-	-	-
Australian Pelican	<i>Pelecanus conspicillatus</i>	2002	4	-	Ma	S
Whiskered Tern	<i>Chlidonias hybridus</i>	2004	1	-	Ma	-
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	2006	2	-	Ma	S
Red-kneed Dotterel	<i>Erythronyctes alba</i>	2004	1	-	-	-
Masked Lapwing	<i>Vanellus miles</i>	2005	18	-	-	S
Black-fronted Dotterel	<i>Euseyornis melanops</i>	2006	15	-	-	-
Black-winged Stilt	<i>Himantopus himantopus</i>	2004	3	-	Ma	-
Marsh Sandpiper	<i>Tringa stagnatilis</i>	2004	1	-	Mi/Ma	-
Latham's Snipe	<i>Gallinago hardwickii</i>	2006	12	-	Mi/Ma	S
Australian White Ibis	<i>Threskiornis molucca</i>	2004	11	-	Ma	S
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	2004	13	-	Ma	S
Royal Spoonbill	<i>Platalea regia</i>	2005	3	-	-	-
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	2002	4	-	-	-
Intermediate Egret	<i>Ardea intermedia</i>	0	1	-	Ma	-
Eastern Great Egret	<i>Ardea modesta</i>	1995	2	-	Mi/Ma	-
White-faced Heron	<i>Egretta novaehollandiae</i>	2006	22	-	-	S
White-necked Heron	<i>Ardea pacifica</i>	2002	3	-	-	-
Australian Wood Duck	<i>Chenonetta jubata</i>	2006	51	Total	-	S
Black Swan	<i>Cygnus atratus</i>	2004	12	-	-	-

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Australian Shelduck	<i>Tadorna tadornoides</i>	2004	6	Total	-	-
Pacific Black Duck	<i>Anas superciliosa</i>	2006	42	-	-	S
Chestnut Teal	<i>Anas castanea</i>	2005	23	Total	-	-
Grey Teal	<i>Anas gracilis</i>	2004	9	Total	-	-
Australasian Shoveler	<i>Anas rhynchotis</i>	2005	9	-	-	-
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	2004	4	Partial	-	-
Freckled Duck	<i>Stictonetta naevosa</i>	2002	1	-	-	-
Hardhead	<i>Aythya australis</i>	2005	15	-	-	-
Blue-billed Duck	<i>Oxyura australis</i>	2002	14	-	-	-
Musk Duck	<i>Biziura lobata</i>	1998	5	-	Ma	-
Spotted Harrier	<i>Circus assimilis</i>	2004	1	-	-	-
Swamp Harrier	<i>Circus approximans</i>	2005	6	-	Ma	-
Brown Goshawk	<i>Accipiter fasciatus</i>	2004	9	-	Ma	S
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>	2000	1	-	-	-
Wedge-tailed Eagle	<i>Aquila audax</i>	2001	26	-	-	S
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	0	1	-	Mi/Ma	-
Whistling Kite	<i>Haliastur sphenurus</i>	1992	2	-	Ma	-
Black-shouldered Kite	<i>Elanus axillaris</i>	2004	5	-	-	S
Australian Hobby	<i>Falco longipennis</i>	2005	6	-	-	-
Peregrine Falcon	<i>Falco peregrinus</i>	2005	2	Partial	-	-
Brown Falcon	<i>Falco berigora</i>	2002	5	-	-	-
Nankeen Kestrel	<i>Falco cenchroides</i>	1999	2	Partial	Ma	S
Southern Boobook	<i>Ninox novaeseelandiae</i>	2001	26	Total	Ma	-
Barking Owl	<i>Ninox connivens</i>	1999	1	Total	-	-
Powerful Owl	<i>Ninox strenua</i>	2003	4	Total	-	-
Pacific Barn Owl	<i>Tyto javanica</i>	2001	3	Partial	-	-
Sooty Owl	<i>Tyto tenebricosa</i>	1992	1	Total	-	-

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	2005	4	Total	-	H
Musk Lorikeet	<i>Glossopsitta concinna</i>	1999	1	Total	-	-
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	2005	37	Total	-	S
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	2004	28	Total	-	-
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	2005	26	Total	-	S
Little Corella	<i>Cacatua sanguinea</i>	2005	6	Total	-	-
Long-billed Corella	<i>Cacatua tenuirostris</i>	2002	3	Total	-	S
Galah	<i>Eolophus roseicapilla</i>	2005	19	Total	-	H
Superb Parrot	<i>Polytelis swainsonii</i>	0	1	Total	-	-
Australian King-Parrot	<i>Alisterus scapularis</i>	2001	8	Total	-	S
Crimson Rosella	<i>Platycercus elegans elegans</i>	2005	69	Total	-	S
Eastern Rosella	<i>Platycercus eximius</i>	2005	50	Total	-	S
Swift Parrot	<i>Lathamus discolor</i>	1989	1	Total	Ma	-
Tawny Frogmouth	<i>Podargus strigoides</i>	1993	6	-	-	-
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	2001	4	Total	-	-
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	2005	71	Total	-	H
Sacred Kingfisher	<i>Todiramphus sanctus</i>	2002	13	Partial	Ma	H
White-throated Needletail	<i>Hirundapus caudacutus</i>	2001	2	-	Mi/Ma	-
Pallid Cuckoo	<i>Cuculus pallidus</i>	2002	18	-	Ma	S
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	2002	19	-	Ma	-
Brush Cuckoo	<i>Cacomantis variolosus</i>	1999	2	-	-	-
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	2002	4	-	Ma	H
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>	2000	5	-	Ma	S
Welcome Swallow	<i>Hirundo neoxena</i>	2005	34	Partial	Ma	S
Tree Martin	<i>Hirundo nigricans</i>	2002	3	Total	Ma	S
Fairy Martin	<i>Hirundo ariel</i>	2004	1	Partial	-	-
Grey Fantail	<i>Rhipidura albiscarpa</i>	2006	93	-	-	S

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Rufous Fantail	<i>Rhipidura rufifrons</i>	2000	7	-	Mi/Ma	-
Willie Wagtail	<i>Rhipidura leucophrys</i>	2005	34	-	-	S
Leaden Flycatcher	<i>Myiagra rubecula</i>	2000	3	-	-	-
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	2000	8	-	Mi/Ma	-
Restless Flycatcher	<i>Myiagra inquieta</i>	1978	1	-	-	-
Jacky Winter	<i>Microeca fascians</i>	2000	3	-	-	-
Scarlet Robin	<i>Petroica boodang</i>	2001	33	-	-	-
Red-capped Robin	<i>Petroica goodenovii</i>	1991	1	-	-	-
Flame Robin	<i>Petroica phoenicea</i>	2001	2	-	Ma	-
Eastern Yellow Robin	<i>Eopsaltria australis</i>	2001	70	-	-	S
Golden Whistler	<i>Pachycephala pectoralis</i>	2002	37	-	-	S
Rufous Whistler	<i>Pachycephala rufiventris</i>	2002	36	-	-	-
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	2006	63	Partial	-	H
Magpie-lark	<i>Grallina cyanoleuca</i>	2005	57	-	Ma	H
Crested Shrike-tit	<i>Falcunculus frontatus</i>	2000	8	-	-	-
Eastern Whipbird	<i>Psophodes olivaceus</i>	2000	14	-	-	-
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	2006	34	-	Ma	-
White-winged Triller	<i>Lalage sueurii</i>	2005	1	-	-	-
Australasian Figbird	<i>Sphecotheres viridis</i>	1963	1	-	-	-
White-fronted Chat	<i>Epthianura albifrons</i>	1993	1	-	-	-
Weebill	<i>Smicromnis brevirostris</i>	1999	2	-	-	-
Striated Thornbill	<i>Acanthiza lineata</i>	2001	52	-	-	S
Yellow Thornbill	<i>Acanthiza nana</i>	2001	2	-	-	S
Brown Thornbill	<i>Acanthiza pusilla</i>	2005	80	-	-	S
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	1990	2	-	-	-
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	2004	11	-	-	S
White-browed Scrubwren	<i>Sericornis frontalis</i>	2002	39	-	-	H

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Large-billed Scrubwren	<i>Sericornis magnirostris</i>	1999	1	-	-	-
Brown Songlark	<i>Cincloramphus cruralis</i>	1982	1	-	-	-
Rufous Songlark	<i>Cincloramphus mathewsi</i>	2002	1	-	-	-
Little Grassbird	<i>Megalurus gramineus</i>	1978	1	-	-	H
Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	2005	11	-	Mi/Ma	-
Golden-headed Cisticola	<i>Cisticola exilis</i>	2002	9	-	-	H
Superb Fairy-wren	<i>Malurus cyaneus</i>	2005	86	-	-	S
White-browed Woodswallow	<i>Artamus superciliosus</i>	1982	1	-	-	-
Dusky Woodswallow	<i>Artamus cyanopterus</i>	2004	17	Partial	-	-
Varied Sittella	<i>Daphoenositta chrysoptera</i>	2001	9	-	-	S
Brown Treecreeper	<i>Climacteris picumnus victoriae</i>	2000	1	Total	-	-
White-throated Treecreeper	<i>Cormobates leucophaeus</i>	2001	52	Total	-	H
Mistletoebird	<i>Dicaeum hirundinaceum</i>	2001	5	-	-	-
Spotted Pardalote	<i>Pardalotus punctatus</i>	2005	63	-	-	H
Silvereye	<i>Zosterops lateralis</i>	2002	18	-	Ma	S
White-naped Honeyeater	<i>Melithreptus lunatus</i>	2001	26	-	-	S
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	2001	11	-	-	-
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	2001	43	-	-	H
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	2001	16	-	-	-
White-eared Honeyeater	<i>Lichenostomus leucotis</i>	2001	46	-	-	S
Helmeted Honeyeater	<i>Lichenostomus melanops cassidix</i>	1983	3	-	Mi	-
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>	2004	22	-	-	S
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	2001	12	-	-	H
Bell Miner	<i>Manorina melanophrys</i>	2005	38	-	-	H
Noisy Miner	<i>Manorina melanocephala</i>	2005	35	-	-	S
Little Wattlebird	<i>Anthochaera chrysoptera</i>	2000	5	-	-	-
Red Wattlebird	<i>Anthochaera carunculata</i>	2005	68	-	-	H

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Beautiful Firetail	<i>Stagonopleura bella</i>	1999	3	-	-	-
Zebra Finch	<i>Taeniopygia guttata</i>	-	1	-	-	-
Red-browed Finch	<i>Neochmia temporalis</i>	2004	26	-	-	S
Olive-backed Oriole	<i>Oriolus sagittatus</i>	2001	6	-	-	-
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	2001	1	-	-	-
Pied Currawong	<i>Strepera graculina</i>	2005	16	-	-	H
Grey Currawong	<i>Strepera versicolor</i>	2001	12	-	-	-
Grey Butcherbird	<i>Cracticus torquatus</i>	2005	62	-	-	S
Australian Magpie	<i>Gymnorhina tibicen</i>	2005	80	-	-	S
Bassian Thrush	<i>Zoothera lunulata</i>	2000	8	-	Ma	-
Unknown Raven	<i>Corvus sp.</i>	2004	7	-	-	-
Australian Raven	<i>Corvus coronoides</i>	2004	18	-	-	S
*Northern Mallard	<i>Anas platyrhynchos</i>	2004	1	-	-	-
Little Raven	<i>Corvus mellori</i>	2005	22	-	Ma	S
*Rock Dove	<i>Columba livia</i>	1988	1	-	-	-
Striated Pardalote	<i>Pardalotus striatus</i>	2002	12	Partial	-	-
Cattle Egret	<i>Ardea ibis</i>	2004	4	-	Mi/Ma	-
*Spotted Turtle-Dove	<i>Streptopelia chinensis</i>	2005	67	-	-	S
*Common Blackbird	<i>Turdus merula</i>	2006	67	-	-	S
*Song Thrush	<i>Turdus philomelos</i>	2002	1	-	-	-
*European Skylark	<i>Alauda arvensis</i>	2001	4	-	-	S
*House Sparrow	<i>Passer domesticus</i>	2005	8	-	-	S
*European Goldfinch	<i>Carduelis carduelis</i>	2004	17	-	-	-
*European Greenfinch	<i>Carduelis chloris</i>	2005	2	-	-	S
*Common Myna	<i>Acridotheres tristis</i>	2006	40	-	-	S
*Common Starling	<i>Sturnus vulgaris</i>	2006	44	Partial	-	S
<b>FISHES</b>						

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Short-finned Eel	<i>Anguilla australis</i>	2005	14	-	-	-
Long-finned Eel	<i>Anguilla reinhardtii</i>	1985	1	-	-	-
*Rainbow Trout	<i>Oncorhynchus mykiss</i>	1985	1	-	-	-
*Brown Trout	<i>Salmo trutta</i>	1985	2	-	-	-
Australian Grayling	<i>Prototroctes maraena</i>	1985	2	-	-	-
Broad-finned Galaxias	<i>Galaxias brevipinnis</i>	1997	6	-	-	-
Common Galaxias	<i>Galaxias maculatus</i>	1997	10	-	-	-
Spotted Galaxias	<i>Galaxias truttaceus</i>	1985	2	-	-	-
Dwarf Galaxias	<i>Galaxiella pusilla</i>	1999	9	-	-	-
*Eastern Gambusia	<i>Gambusia holbrooki</i>	1999	9	-	-	-
Southern Pygmy Perch	<i>Nannoperca australis</i>	1999	17	-	-	-
*Redfin Perch	<i>Perca fluviatilis</i>	2006	1	-	-	-
River Blackfish	<i>Gadopsis marmoratus</i>	1985	1	-	-	-
Tupong	<i>Pseudaphritis urvillii</i>	1997	3	-	-	-
<b>FROGS</b>						
Southern Bullfrog	<i>Limnodynastes dumerilii</i>	2006	16	-	-	H
Striped Marsh Frog	<i>Limnodynastes peronii</i>	2006	34	-	-	H
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	2004	10	-	-	H
Southern Toadlet	<i>Pseudophryne semimarmorata</i>	1981	83	-	-	-
Common Froglet	<i>Crinia signifera</i>	2006	61	-	-	H
Southern Brown Tree Frog	<i>Litoria ewingii</i>	2005	150	-	-	H
Growling Grass Frog	<i>Litoria raniformis</i>	2006	96	-	-	-
Verreaux's Tree Frog	<i>Litoria verreauxii</i>	1992	123	-	-	-
Southern Brown Tree Frog (southern)	<i>Litoria ewingii (southern)</i>	1989	3	-	-	-
Whistling Tree Frog	<i>Litoria verreauxii verreauxii</i>	2006	50	-	-	H
Spotted Marsh Frog SCR	<i>Limnodynastes tasmaniensis SCR</i>	2006	39	-	-	-
<b>INVERTEBRATES</b>						

Common Name	Scientific Name	Last Documented Record (AVW)	Total # of Documented Records (AVW)	Hollow Use	Mi/ Ma	Present Survey
Granular Burrowing Cray	<i>Engaeus cunicularius</i>	1982	1	-	-	-
<b>REPTILES</b>						
Tree Dragon	<i>Amphibolurus muricatus</i>	1972	1	Partial	-	-
McCoy's Skink	<i>Nannoscincus maccoyi</i>	2000	5	-	-	-
Delicate Skink	<i>Lampropholis delicata</i>	1981	12	-	-	-
Swamp Skink	<i>Egernia coventryi</i>	1999	1	-	-	-
Garden Skink	<i>Lampropholis guichenoti</i>	2005	26	-	-	-
Weasel Skink	<i>Saproscincus mustelinus</i>	2002	9	-	-	-
Metallic Skink	<i>Niveoscincus metallicus</i>	1977	2	-	-	-
Blotched Blue-tongued Lizard	<i>Tiliqua nigrolutea</i>	2000	5	-	-	-
Eastern Small-eyed Snake	<i>Rhinoplocephalus nigrescens</i>	1981	6	-	-	-
White-lipped Snake	<i>Drysdalia coronoides</i>	1964	3	-	-	-
Eastern Three-lined Skink	<i>Bassiana duperreyi</i>	1964	1	-	-	-
Black Rock Skink	<i>Egernia saxatilis intermedia</i>	1904	1	Partial	-	-
Southern Water Skink	<i>Eulamprus tympanum tympanum</i>	1977	1	-	-	-
Lowland Copperhead	<i>Austrelaps superbis</i>	1996	26	-	-	-
Unidentified scincid	<i>Scincidae sp.</i>	2000	1	-	-	-
Unidentified grass skink	<i>Pseudemoia sp.</i>	1993	1	-	-	-

Source: DSE Atlas of Victorian Wildlife (AVW 2009).



## Appendix 3.2 – Significant fauna species

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

Sources used to determine species status:

EPBC Environment Protection and biodiversity Conservation Act 1999 (Commonwealth)

DSE Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2007c)

FFG Flora and Fauna Guarantee Act 1988 (Victoria)

National Action Plan for mammals and monotremes (Maxwell et al. 1996), bats (Duncan et al. 1999), rodents (Lee 1995), birds (Garnett and Crowley 2000), reptiles (Cogger et. al. 1993), and amphibians (Tyler 1997).

Species status:

EX	Extinct
RX	Regionally extinct
CR	Critically endangered
EN	Endangered
VU	Vulnerable
RA	Rare
NT	Near threatened
CD	Conservation dependent
LR	Lower risk (least concern)
DD	Data deficient (insufficiently or poorly known)
L	Listed as threatened under FFG Act
I	Invalid or ineligible for listing under the FFG Act
#	Protected Matters Search Tool (SEWPaC)

Use of the study area:

1	Known resident
2	Possible resident
3	Frequent visitor
4	Occasional visitor
5	Rare visitor
6	Vagrant visitor
7	Unlikely/no suitable habitat

Common Name	Scientific Name	Last documented record	Total # of records	EPBC Act	DSE (2009)	FFG ACT	National Action Plan	Likely use of study area
<b>NATIONAL SIGNIFICANCE</b>								
Superb Parrot	<i>Polytelis swainsonii</i>	0	1	VU	EN	L	VU	4
# Swift Parrot	<i>Lathamus discolor</i>	1998	2	EN	EN	L	EN	4
Helmeted Honeyeater	<i>Lichenostomus melanops cassidix</i>	1983	3	EN	CE	L	CR	5
# Spot-tailed Quoll	<i>Dasyurus maculatus</i>	2003	1	EN	EN	L	VU	7
# Southern Brown Bandicoot	<i>Isoodon obesulus obesulus</i>	1919	1	EN	NT	-	NT	2
# Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	2003	1	VU	VU	L	VU	3
# Growling Grass Frog	<i>Litoria raniformis</i>	2006	96	VU	EN	L	VU	1
# Australian Grayling	<i>Prototroctes maraena</i>	1985	2	VU	VU	L	VU	7
# Dwarf Galaxias	<i>Galaxiella pusilla</i>	1999	9	VU	VU	L	VU	1
# Australian Painted Snipe	<i>Rostratula australis</i>	-	-	VU	CR	L	VU	7
# Golden Sun Moth	<i>Synemon plana</i>	-	-	CR	EN	L		7
# Long-nosed Potoroo	<i>Potorous tridactylus</i>	-	-	VU	EN	L	VU	7
# Regent Honeyeater	<i>Anthochaera phrygia</i>	-	-	EN	CR	L	EN	5
# Smoky Mouse	<i>Pseudomys fumeus</i>	-	-	EN	CR	L	RA	7
<b>STATE SIGNIFICANCE</b>								
Lewin's Rail	<i>Lewinia pectoralis</i>	1988	2	-	VU	L	NT	3
Baillon's Crake	<i>Porzana pusilla</i>	2003	2	-	VU	L	-	3
Royal Spoonbill	<i>Platalea regia</i>	2005	3	-	VU	-	-	4
Eastern Great Egret	<i>Ardea modesta</i>	1995	3	-	VU	L	-	4
Intermediate Egret	<i>Ardea intermedia</i>	0	1	-	CR	L	-	5
Australasian Shoveler	<i>Anas rhynchos</i>	2005	10	-	VU	-	-	4
Freckled Duck	<i>Stictonetta naevosa</i>	2002	1	-	EN	L	-	4
Hardhead	<i>Aythya australis</i>	2005	15	-	VU	-	-	3
Blue-billed Duck	<i>Oxyura australis</i>	2002	14	-	EN	L	-	4
Musk Duck	<i>Biziura lobata</i>	1998	5	-	VU	-	-	4
Grey Goshawk	<i>Accipiter novaehollandiae</i>	0	1	-	VU	L	-	5
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	1979	2	-	VU	L	-	4

Common Name	Scientific Name	Last documented record	Total # of records	EPBC Act	DSE (2009)	FFG ACT	National Action Plan	Likely use of study area
Black Falcon	<i>Falco subniger</i>	1979	1	-	VU	-	-	4
Barking Owl	<i>Ninox connivens</i>	1999	1	-	EN	L	NT	4
Powerful Owl	<i>Ninox strenua</i>	2003	14	-	VU	L	-	3
Sooty Owl	<i>Tyto tenebricosa</i>	1992	3	-	VU	L	-	5
Major Mitchell's Cockatoo	<i>Lophocroca leadbeateri</i>	1979	1	-	VU	L	NT	6
Hooded Robin	<i>Melanodryas cucullata</i>	1979	1	-	NT	L	NT	5
Brown Treecreeper (south-eastern ssp.)	<i>Climacteris picumnus victoriae</i>	2000	1	-	NT	-	NT	4
Lace Goanna	<i>Varanus varius</i>	1981	1	-	VU	-	-	4
Swamp Skink	<i>Egernia coventryi</i>	1999	1	-	VU	L	-	2
Southern Toadlet	<i>Pseudophryne semimarmorata</i>	1981	83	-	VU	-	-	2
<b>REGIONAL SIGNIFICANCE</b>								
Brown Quail	<i>Coturnix ypsilophora</i>	2003	2	-	NT	-	-	3
Pied Cormorant	<i>Phalacrocorax varius</i>	1997	3	-	NT	-	-	3
Whiskered Tern	<i>Chlidonias hybridus</i>	2004	1	-	NT	-	-	3
Latham's Snipe	<i>Gallinago hardwickii</i>	2006	12	-	NT	-	-	3
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	1979	1	-	NT	-	-	3
Spotted Harrier	<i>Circus assimilis</i>	2004	2	-	NT	-	-	4
Spotted Quail-thrush	<i>Cinclosoma punctatum</i>	2000	2	-	NT	-	-	4

**Source:** DSE Atlas of Victorian Wildlife (AVW 2009); SEWPaC Protected Matters Search Tool (<http://www.environment.gov.au/erin/ert/epbc/index.html>)

**Note:** Marine species were removed from this table as they will not be affected by the proposed development.

## Appendix 4 – Habitat descriptions of dams surveyed during the 2005/2006 and 2009 Growling Grass Frog surveys

Table A4. Habitat descriptions for dams surveyed during the 2005/2006 and 2009 Growling Grass Frog surveys.

Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF
1a	6/11/05, 16/11/05, 21/11/05, 29/11/05	Farm dam 70x40	<i>Eleocharis acuta</i> , <i>E. phacelata</i> , <i>Chara</i> sp.	Pasture and Gum Scrub Creek	Cracked clay, rocks	Good	No	0	90	80	5	40	0	12
1b	6/11/05, 16/11/05, 21/11/05, 29/11/05	Farm dam 50x50	<i>Eleocharis acuta</i> , <i>Chara</i> sp.	Pasture and Gum Scrub Creek	Cracked clay, rocks	Good	Common Jolly-tail Short-finned Eel	0	95	20	0	40	0	6
1c	16/11/05, 21/11/05, 29/11/05	Farm dam 40x10	<i>Juncus</i> sp.	Pasture	None	Poor	Mosquito Fish Short-finned Eel	0	95	20	0	0	0	1
1d	16/11/05, 21/11/05, 29/11/05	Farm dam 10x15	<i>Phragmites australis</i>	Pasture remnant swamp scrub	Vegetation debris	Good	Mosquito Fish	0	70	25	20	0	0	0
1e	16/11/05, 21/11/05, 29/11/05	Farm dam 50x20	<i>Phragmites australis</i>	Pasture	None	Moderate	Short-finned Eel	0	60	0	40	0	0	1
1f	21/11/05, 29/11/05	Farm dam 15x15	<i>Eleocharis acuta</i> ,	Pasture	Farm debris	Good	No	0	10	10	30	0	60	4

Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF
			<i>E. phacelata</i> , <i>Azolla</i> sp., <i>Lemna</i> sp.											
1g*	24/11/2005	Nursery irrigation dam 40x10	None	Pasture and plant nursery	Nursery equipment	Poor	No	0	100	0	0	0	0	0
1h	24/11/05, 7/12/05	Farm dam 10x10	<i>Eleocharis acuta</i>	Pasture	Farm debris	Poor	No	0	95	5	0	0	0	0
1i	24/11/05, 7/12/05	Farm dam 30x15	<i>Eleocharis acuta</i> , <i>Potamogeton ochreatus</i> , <i>Ottelia ovalifolia</i>	Pasture	Farm debris	Good	No	0	70	10	0	20	20	0
1j	24/11/2005	Reclaimed effluent dam 50x40	None	Plant nursery	Nursery equipment/ debris	Poor	No	0	100	0	0	0	0	0
1k	24/11/05, 7/12/05	Farm dam 25x15	<i>Eleocharis acuta</i> , <i>E. sphacelata</i>	Pasture	None	Moderate	No	5	70	100	30	0	0	0
1l	24/11/2005	Deeply canalised drainage line	None	Pasture	None	Poor	European Carp, Mosquito Fish	0	90	10	10	0	5	0
1m	16/11/05, 21/11/05, 29/11/05	Farm dam 25x15	<i>Typha</i> sp.	Pasture	None	Poor	Short-finned Eel, Mosquito Fish	0	95	20	5	0	0	0

Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF
2a	24/11/05, 7/12/05	Farm dam 50x25	<i>Eleocharis sphacelata</i> , <i>Juncus</i> sp.	Pasture planted <i>Eucalyptus</i> sp.	Leaf litter, rocks	Good	No	0	80	95	20	0	0	0
2b	22/11/05, 24/11/05, 7/12/05	Large farm dam 130x40	<i>Phragmites australis</i> , <i>Typha</i> sp., <i>Juncus</i> sp., <i>Melaleuca ericifolia</i>	Pasture	Vegetation debris	Moderate	Short-finned Eel	0	90	30	0	0	0	0
3a	22/11/05, 24/11/05, 7/12/05	Large farm dam 100x60	<i>Typha</i> sp.	Pasture	Vegetation debris	Good	No	0	75	60	10	0	0	0
3b	6/11/05, 24/11/05, 7/12/05	Farm dam 40x30	<i>Eleocharis sphacelata</i> , <i>Juncus</i> sp.	Pasture	Leaf litter	Moderate	Mosquito Fish	0	70	90	25	0	0	0
3c	24/11/05, 7/12/05	Farm dam 25x15	<i>Juncus</i> sp.	Pasture	Rocks	Moderate	No	0	95	10	0	0	0	0
3d	24/11/05, 7/12/05	Farm dam 50x30	<i>Juncus</i> sp., <i>Eleocharis sphacelata</i>	Pasture	None	Poor	?	0	40	70	50	0	0	0
3e	6/11/05, 24/11/05, 7/12/05	Large farm dam 100x50	<i>Juncus</i> sp.	Pasture	None	Poor	?	0	95	80	0	0	0	0
3f	6/11/05, 24/11/05, 7/12/05	Farm dam 30x20	<i>Paspalum distichum</i> , <i>Eleocharis acuta</i>	Pasture	Logs	Poor	No	0	95	100	0	0	0	0

Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF	
3g	6/11/05, 24/11/05, 7/12/05	Farm dam 30x15	<i>Typha</i> sp., <i>Juncus</i> sp., <i>Potamogeton ochreatus</i>	Pasture	Rocks	Moderate	No	0	90	5	5	5	0	0	
3h	24/11/2005	Drainage line 20x10	<i>Typha</i> sp., <i>Eleocharis sphacelata</i>	Pasture and old quarry	Rocks	Good	No	0	5	0	95	0	0	0	
3i*	24/11/2005	Nursery irrigation dam 40x20	<i>Eleocharis acuta</i>	Plant nursery	Nursery equipment/ debris	Moderate	No	0	95	5	0	0	0	0	
3j	24/11/05, 7/12/05	Farm dam 15x15	<i>Eleocharis sphacelata</i> , <i>Potamogeton ochreatus</i> , <i>Chara</i> sp.	Pasture	Farm debris	Good	No	0	50	0	20	70	30	0	
3k	24/11/05, 7/12/05	Farm dam 50x40	<i>Eleocharis acuta</i> , <i>Chara</i> sp.	Pasture	Farm debris	Good	No	0	50	90	0	80	50	0	
3l	24/11/05, 7/12/05	Farm dam 20x10	<i>Eleocharis acuta</i> , <i>E. sphacelata</i> , <i>Ottelia ovalifolia</i>	Pasture	None	Good	No	0	20	0	60	0	20	0	
							<b>Mean</b>	<b>(range)</b>	<b>0.2 (0-5)</b>	<b>74 (5-100)</b>	<b>35 (0-100)</b>	<b>16 (0-95)</b>	<b>9 (0-80)</b>	<b>7 (0-60)</b>	<b>24 (0-12)</b>
1A	18/03/2009, 26/03/2009	Farm Dam 20 x 8	<i>Eleocharis acuta</i>	Pasture	Logs	Poor	No	0	100	2	0	0	0	0	
1B	18/03/2009, 26/03/2009	Farm Dam 4 x 4	<i>Juncus</i> sp.	Pasture	None	Poor	No	0	100	20	0	0	0	0	

Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF
1C	18/03/2009, 26/03/2009	Farm Dam 5x4	<i>Juncus</i> sp.	Pasture	None	Poor	No	0	100	10	0	0	0	0
1D	18/03/2009, 26/03/2009	Farm Dam 50 x 40	<i>Eleocharis sphacelata</i>	Pasture	None	Moderate	No	0	60	20	40	0	0	0
2A	18/03/2009, 26/03/2009	Farm Dam 30 x 30	<i>Eleocharis sphacelata</i>	Pasture	None	Good	Unknown (Snake-necked Turtles)	0	80	60	20	0	0	0
3A	18/03/2009, 26/03/2009	Farm Dam 70 x 60	<i>Eleocharis sphacelata</i>	Grassy Forest	Logs, Water Lillies	Good	Unknown (Snake-necked Turtles)	10	75	90	25	0	15	0
4A	18/03/2009, 26/03/2009	Farm Dam 40 x 15	<i>Eleocharis sphacelata</i>	Grassy Forest	Logs	Good	Unknown	5	75	10	25	0	0	0
6A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Potamogeton</i> sp.	Pasture	None	Moderate	Unknown	0	100	5	0	0	0	0
7A	18/03/2009, 26/03/2009	Farm Dam 40 x 30	<i>Eleocharis sphacelata</i>	Pasture	None	Poor	European Carp	0	70	20	30	0	0	0
7B	18/03/2009, 26/03/2009	Farm Dam 60 x 50	<i>Juncus</i> sp.	Pasture	None	Poor	No	5	95	5	5	0	0	0
7C	18/03/2009, 26/03/2009	Farm Dam 40 x 40	<i>Eleocharis acuta</i>	Swampy Woodland	Logs	Moderate	No	30	80	80	20	0	0	0
7D	18/03/2009, 26/03/2009	Farm Dam 50 x 50	<i>Triglochin procerum</i>	Swampy Woodland	Car Tyres	Good	No	0	100	0	0	0	30	0
9A	18/03/2009, 26/03/2009	Farm Dam 10 x 8	<i>Juncus</i> sp.	Pasture	None	Low	No	0	100	10	0	0	0	0
12A	18/03/2009, 26/03/2009	Farm Dam 10 x 8	<i>Azolla</i> sp.	Pasture	None	Good	No	0	100	0	0	0	0	0



Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF
13A	18/03/2009, 26/03/2009	Farm Dam 11 x 10	<i>Eleocharis sphacelata</i>	Pasture	None	Good	Mosquito Fish	0	80	5	20	0	0	0
15A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Eleocharis acuta</i>	Pasture	None	Poor	No	0	95	5	5	0	0	0
16A	18/03/2009, 26/03/2009	Farm Dam 10 x 5	<i>Juncus sp.</i>	Pasture	None	Poor	No	0	90	0	10	0	0	0
17A	18/03/2009, 26/03/2009	Farm Dam 8 x 5	<i>Eleocharis acuta</i>	Pasture	None	Poor	No	0	100	5	0	0	0	0
18A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Juncus sp.</i>	Pasture	None	Poor	No	0	100	0	0	0	0	0
19A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Juncus sp.</i>	Pasture	None	Poor	No	0	100	0	0	0	0	0
20A	18/03/2009, 26/03/2009	Farm Dam 20 x 10	<i>Juncus sp.</i>	Pasture	Logs	Poor	No	5	95	10	5	0	0	0
<b>Mean (range)</b>								<b>3 (0-30)</b>	<b>90 (90-100)</b>	<b>18 (0-90)</b>	<b>10 (0-40)</b>	<b>0</b>	<b>2 (0-30)</b>	<b>0</b>

Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF
1A	18/03/2009, 26/03/2009	Farm Dam 20 x 8	<i>Eleocharis acuta</i>	Pasture	Logs	Poor	No	0	100	2	0	0	0	0
1B	18/03/2009, 26/03/2009	Farm Dam 4 x 4	<i>Juncus</i> sp.	Pasture	None	Poor	No	0	100	20	0	0	0	0
1C	18/03/2009, 26/03/2009	Farm Dam 5x4	<i>Juncus</i> sp.	Pasture	None	Poor	No	0	100	10	0	0	0	0
1D	18/03/2009, 26/03/2009	Farm Dam 50 x 40	<i>Eleocharis sphacelata</i>	Pasture	None	Moderate	No	0	60	20	40	0	0	0
2A	18/03/2009, 26/03/2009	Farm Dam 30 x 30	<i>Eleocharis sphacelata</i>	Pasture	None	Good	Unknown (Snake-necked Turtles)	0	80	60	20	0	0	0
3A	18/03/2009, 26/03/2009	Farm Dam 70 x 60	<i>Eleocharis sphacelata</i>	Grassy Forest	Logs, Water Lillies	Good	Unknown (Snake-necked Turtles)	10	75	90	25	0	15	0
4A	18/03/2009, 26/03/2009	Farm Dam 40 x 15	<i>Eleocharis sphacelata</i>	Grassy Forest	Logs	Good	Unknown	5	75	10	25	0	0	0
6A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Potamogeton</i> sp.	Pasture	None	Moderate	Unknown	0	100	5	0	0	0	0
7A	18/03/2009, 26/03/2009	Farm Dam 40 x 30	<i>Eleocharis sphacelata</i>	Pasture	None	Poor	European Carp	0	70	20	30	0	0	0
7B	18/03/2009, 26/03/2009	Farm Dam 60 x 50	<i>Juncus</i> sp.	Pasture	None	Poor	No	5	95	5	5	0	0	0
7C	18/03/2009, 26/03/2009	Farm Dam 40 x 40	<i>Eleocharis acuta</i>	Swampy Woodland	Logs	Moderate	No	30	80	80	20	0	0	0
7D	18/03/2009, 26/03/2009	Farm Dam 50 x 50	<i>Triglochin procerum</i>	Swampy Woodland	Car Tyres	Good	No	0	100	0	0	0	30	0
9A	18/03/2009, 26/03/2009	Farm Dam 10 x 8	<i>Juncus</i> sp.	Pasture	None	Low	No	0	100	10	0	0	0	0

Site Surveys for 2006	Survey date/s	Waterbody type and size (approx. metres)	Dominant flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF
12A	18/03/2009, 26/03/2009	Farm Dam 10 x 8	<i>Azolla sp.</i>	Pasture	None	Good	No	0	100	0	0	0	0	0
13A	18/03/2009, 26/03/2009	Farm Dam 11 x 10	<i>Eleocharis sphacelata</i>	Pasture	None	Good	Mosquito Fish	0	80	5	20	0	0	0
15A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Eleocharis acuta</i>	Pasture	None	Poor	No	0	95	5	5	0	0	0
16A	18/03/2009, 26/03/2009	Farm Dam 10 x 5	<i>Juncus sp.</i>	Pasture	None	Poor	No	0	90	0	10	0	0	0
17A	18/03/2009, 26/03/2009	Farm Dam 8 x 5	<i>Eleocharis acuta</i>	Pasture	None	Poor	No	0	100	5	0	0	0	0
18A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Juncus sp.</i>	Pasture	None	Poor	No	0	100	0	0	0	0	0
19A	18/03/2009, 26/03/2009	Farm Dam 15 x 5	<i>Juncus sp.</i>	Pasture	None	Poor	No	0	100	0	0	0	0	0
20A	18/03/2009, 26/03/2009	Farm Dam 20 x 10	<i>Juncus sp.</i>	Pasture	Logs	Poor	No	5	95	10	5	0	0	0
<b>Mean</b>							<b>(range)</b>	<b>3 (0-30)</b>	<b>90 (90-100)</b>	<b>18 (0-90)</b>	<b>10 (0-40)</b>	<b>0</b>	<b>2 (0-30)</b>	<b>0</b>

### Summary of Habitat Descriptions Used in Appendix A3:

%CAN: Percentage of Canopy over dam

%OP: Percentage of Open Water

%FR: Percentage of Fringing Vegetation

%SUB: Percentage of Submergent Vegetation

%FL: Percentage of Floating Vegetation

%EM: Percentage of Emergent Vegetation

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