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FINAL REPORT:

Werribee Employment Precinct: Targeted Flora and Fauna Surveys, Werribee, Victoria

PREPARED FOR:

VicUrban

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Ecology Partners Pty Ltd

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***Cover Photos*:** Secondary native grasslands (Background), Growling Grass Frog *Litoria raniformis* (Upper right inset), Golden Sun Moth *Synemon plana* (Middle left inset) and Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* (lower right inset) (Dan Weller, Ecology Partners Pty Ltd).

The following Ecology Partners Pty Ltd staff completed the site surveys and contributed to the report:
Aaron Organ, Dan Weller, Clio Gates Foale, Stuart Cooney, Warren Tomlinson and Amanda Feetham.

SUMMARY

Introduction

Ecology Partners Pty Ltd was commissioned by VicUrban to undertake targeted surveys for significant flora and fauna species within the Werribee Employment Precinct, Werribee, Victoria. 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's) Threatened Species Advisory List in Officer, Victoria.

The targeted surveys were undertaken for significant flora and fauna species to identify any areas within the study area that support these species, and to provide information in relation to potential impacts and mitigation measures associated with the future development of the precinct.

Targeted surveys were undertaken for Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens*, Curly Sedge *Carex tasmanica* and Large-headed Fireweed *Senecio macrocarpus*. In addition, surveys were undertaken for significant fauna species, including Golden Sun Moth *Synemon plana*, Growling Grass Frog *Litoria raniformis* and Dwarf Galaxias *Galaxias pusilla*.

Methods

A detailed methodology for the targeted flora and fauna surveys is provided later in this report. All surveys were undertaken broadly in accordance with DSE's Biodiversity Precinct Structure Planning Kit.

Results

No significant flora species were detected during targeted surveys and given the highly modified condition of the vegetation across the entire precinct due to the extensive land use over many decades there is a low likelihood of any of the targeted species occurring within the study area.

No significant fauna species were recorded within the study area during the targeted surveys. However, one significant fauna species (Growling Grass Frog), which is of national conservation significance, was recorded along an inundated drain located immediately adjacent to the southern boundary of the study area. Given the result of the targeted surveys there is a low likelihood that Golden Sun Moth is present within the precinct, although the majority of open grassland areas have been subject to past cropping regimes and as such, there is limited habitat for this species. There is limited habitat for Dwarf Galaxias within the precinct, given that the two drainage lines present are infested with introduced fish species (e.g. Plague Minnow *Gambusia holbrooki*) which are known to adversely impact Dwarf Galaxias populations.

Potential Impacts, Mitigation Measures and Further Requirements

There are several potential impacts that are likely to occur to flora and fauna species, as a result of the future development of the precinct. A discussion and summary of mitigation measures to reduce potential impacts is provided in Section 5.

Growling Grass Frog (EPBC Act-listed) was recorded during the targeted surveys immediately south of the study area.

The presence of a single individual immediately outside of the study area suggests that individuals may use habitats within the study area on occasions if habitat conditions improve over time. However, there are no large suitable waterbodies for this species currently present in the south-west of the precinct. As such, an EPBC Act referral to the Department of the Environment, Water, Heritage and the Arts (DEWHA) may be required as part of the future development of the precinct. Although the future development of the precinct may fall under the Strategic Impact Assessment Report under the EPBC Act.

In order to minimise any potential impacts of the proposed development within the precinct to Growling Grass Frog, a detailed Conservation Management Plan (CMP) may need to be developed. The CMP should incorporate relevant objectives of the National Recovery Plan prepared in accordance with the EPBC Act by the species' National Recovery Team. A salvage and translocation programme will also need to be included in the CMP.

1 INTRODUCTION

1.1 Background

Ecology Partners Pty Ltd was commissioned by VicUrban to undertake targeted surveys for significant flora and fauna species within the Werribee Employment Precinct, Werribee, Victoria. 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 in Officer, Victoria.

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

These surveys address DSE and Wyndham Shire Council's survey requirements as part of the Werribee Precinct Structure Planning process and also for the preparation of an EPBC Act referral to The Department of the Environment, Water, Heritage and the Arts (DEWHA) as part of the future development of the precinct.

1.2 Scope

Targeted surveys were undertaken for significant flora species including:

- Spiny Rice-flower *Pimelea spinescens*, which may occur in areas support modified native grassland, but is tolerant of minor disturbance; and,
- Curly Sedge *Carex tasmanica* and Large-fruit Fireweed *Senecio macrocarpus* which are most likely to occur near the drainage line which traverses the site, or low-lying areas including waterbodies.

In addition, surveys were undertaken for significant fauna species, including:

- Growling Grass Frog *Litoria raniformis*. This species may occur in several of the artificial waterbodies (i.e. farm dams), and along the drainage line which bisects the study area. Surveys for this species will occur over three nights between October and December;
- Golden Sun Moth *Synemon plana*. This species is known to occur principally in native grasslands, although the species has also recently been detected in exotic grasslands. Targeted surveys for this species will be undertaken between October and early January over four separate days during optimal surveys conditions (i.e. warm, still days over 20^{o}C); and,

- Dwarf Galaxias *Galaxias pusilla*. This species may also occur along fence lines, and it is proposed that this species is targeted during winter (when the Spiny Rice-flower assessment is being undertaken).

1.3 Study Area

The study area essentially forms a triangle that is commonly known as the Werribee Employment Precinct (WEP), and is bounded by Princes Highway, Werribee to the northwest, Hacketts Lane, Werribee and Werribee South to the east, and the irrigation channel and fence line extending along Wattle Avenue to Hoppers Lane in the southeast and Princes Highway in the northwest (Melways Reference Map 206 and 207). The study area is approximately 925 hectares in size and is highly modified due to past clearing and agricultural activities. The study area is flat apart from several large piles of dirt associated with drainage and irrigation works.

Although the land is yet to be declared surplus in the recent Melbourne 2030: A Planning Update - Melbourne @ 5 Million Policy Statement the Government announced the expansion of the vision for the WEP to provide a larger number of jobs across a wider range of industries and sectors coupled with a focus on sustainable urban growth.

According to the DSE Biodiversity Interactive Map (www.dse.vic.gov.au) the study area is within two bioregions, those being the Victorian Volcanic Plain bioregion that extends from the western suburbs of Melbourne to Hamilton in western Victoria, and the Otway Plain bioregion that extends from the western suburbs of Melbourne south to Geelong and southwest to Portland. The study area occurs within the Wyndham City Council and is predominantly zoned Special Use Zone 5, but also Public Use Zone 3, Public Use Zone 1 and Farming Zone 2. Whilst the study area is subject to a number of overlays, none of these relate to environmental and biodiversity protection under the Wyndham City Council Planning Scheme.

1.4 Target Flora Species

1.4.1 Spiny Rice-flower *Pimelea spinescens spinescens*

EPBC Act Conservation Status: Critically Endangered

FFG Act Conservation Status: Listed

DSE 2005 Conservation Status: Endangered

Species Description

Spiny Rice-flower is perennial, sub-shrubs with spinescent branches that grow to a height of approximately 30 centimetres (Walsh and Entwisle 1996). Plants are dioecious (separate males and females) and bear small yellow flowers from April to August (Carter and Walsh 2006). Spiny Rice-flower plants are slow growing and are known to produce a very large/long tap root (DEWHA 2009). Although plants may live greater than 100 years, they are thought to rarely recruit from seed (Mueck 2000, Carter and Walsh 2006).

Ecology

Spiny Rice-flower are typically associated with the ecological community Natural Temperate Grassland of the Victorian Volcanic Plain, which is listed as a critically endangered under the EPBC Act (1999) (see EPBC Act Policy Statement 3.8). Spiny Rice-flower also occurs in the Victorian Midlands and Riverina bioregions of Victoria. The species is found in a variety of Ecological Vegetation Classes (EVCs), such as Plains Grassland (EVC 132), Plains Grassy Woodland (EVC 55), Plains Woodland (803) and Plains Grassland/Grassy Woodland mosaic (EVC 897).

Spiny Rice-flower plants are typically found in undisturbed to moderate disturbed areas dominated by native grasses, including Kangaroo Grass *Themeda triandra*, and Wallaby-grasses *Austrodanthonia* spp. also usually with a host of other herb and graminoid species typical of grassy ecosystems.

Known Populations

Early estimates suggested that the total number of Spiny Rice-flower plants stood at less than 12,000 individuals (Carter and Walsh 2006). More recent surveys, however, indicate that there may be up to 55,000 plants scattered throughout 184 known sties (DEWHA 2009). Population sizes are generally small, with approximately 70% of sites containing less than 500 individuals (DEWHA 2009). Furthermore, populations are usually highly fragmented and are often threatened by development, as most plants are not currently reserved but are instead found along roadsides and rail lines.

Known Distribution

Spiny Rice-flower plants are Endemic to Victoria and are irregularly distributed from central Victoria to the western districts of the State (Walsh and Entwisle 1996; FIS 2007).

Spiny Rice-flower plants are obligate outcrossers, therefore geographic isolation can restrict pollen flow within and among populations. Restricted pollen flow in turn reduces viable seed formation, sexual recruitment, gene flow and overall genetic diversity (Mueck 2000). Poor sexual recruitment means that the majority of plants are mature and that the number of individuals at each site is predicted to decline over time (Mueck 2000).

1.4.2 Curly Sedge *Carex tasmanica*

Photo: Carter/ DSE 2010

EPBC Act Conservation Status: Vulnerable

FFG Act Conservation Status: Listed

DSE 2005 Conservation Status: Vulnerable

Species Description

The Curly Sedge *Carex tasmanica* is a wiry, densely tufted, perennial sedge growing to 50 cm high. Culms are erect, terete, smooth, 15–20 cm long and 0.8 mm wide. Leaves are 1.5 mm wide, exceed the culms and are typically curled at the apex (hence the common name); the leaf-sheath is pale red-brown and the ligule spotted with red. The inflorescence is narrow and erect, 5–25 cm long, with 2–4 spikes solitary at nodes, the lowest spike often distant from the rest. The lowest involucral bracts exceed the inflorescence. Spikes are sessile or on short pedicels, distant, erect at maturity and 15–20 mm long. The upper 1–2 spikes are male; the lower 2–3 are female. Glumes are red-brown with a paler midrib, and have a rounded to notched apex that is often shortly mucronate. Female glumes are 2.2–3.5 mm long. Utricles (fruits) are 3 mm long, including the beak, 1.5 mm wide and ellipsoid. Leaves are glabrous, pale green to brown with red spots and have many faint parallel veins. Nuts are ellipsoid to obovoid, triangular in cross-section and dark-yellow brown. The species can produce a long rhizome (description from Wilson 1994). Very little is known of its ecology. The Curly Sedge apparently requires some disturbance for seed germination and/or seedling establishment, and there is anecdotal evidence that it may resprout after fire (Gilfedder & Kirkpatrick 1996). Persistence of populations at some sites may be mainly via division of adult plants or spread via rhizomes.

Habitat

The Curly Sedge grows in seasonally damp sites in grassland or grassy woodland. Mean annual rainfall across the known geographic range is generally in the 300–600 mm range, (rarely to 800 mm in the Portland area and the Tasmanian midlands) (Cheal 1990). In Victoria, Curly Sedge occurs in seasonally wet, fertile, heavy basalt clay soils, usually around the margins of slightly saline drainage lines or freshwater swamps.

The dominant vegetation type varies, but is often grassy/sedgy and generally lacks trees, although Woolly Tea-tree *Leptospermum lanigerum* occurs close to a number of sites in the south-west. Native species commonly associated with Curly Sedge include *Eleocharis acuta*, *Isolepis cernua*, *Schoenus nitens* and *Selliera radicans*. Habitat is usually too wet to support otherwise dominant grasses such as *Poa labillardierei*. Curly Sedge is often restricted to a narrow ecological range on the margins of drainage depressions or swamps (Morcom 1999; see photo 1). These areas may correspond to optimal (or tolerable) soil moisture, drainage or flooding conditions, or an inability to compete with associated species at other topographic positions (e.g. *Poa* spp. at higher, drier sites, or *Triglochin procerum* s.l. in lower, wetter sites). Curly Sedge can tolerate complete submersion, at least for short periods (see photo 2). Most Curly Sedge sites presently contain a high cover of introduced plants, including numerous introduced weed species such as *Arctotheca calendula*, *Critesion marinum*, *Holcus lanatus*, *Hypochoeris radicata*, *Juncus acutus* subsp. *acutus*, *Leontodon taraxacoides*, *Lolium* spp., *Plantago coronopus*, *Ranunculus muricatus*, *Sonchus* spp. and *Trifolium fragiferum*.

Distribution

Curly Sedge occurs in Victoria, near Melbourne and in the far south-west, in the Victorian Volcanic Plain IBRA bioregion; and in south-eastern Tasmania, in the Tasmanian Northern Midlands and Tasmanian Southern Ranges IBRA bioregions (DEH 2000) (Figure 1).

The precise distribution of Curly Sedge in Victoria is unclear due to confusion in identification with other similar species. Scattered records of Stream Sedge *Carex brownii* and Tussock Sedge *Carex iynx* from south-western Victoria might also include Curly Sedge, as the species are superficially similar (Cheal 1990). However, 19th century records of Curly Sedge from Whitestone Swamp (near Ballarat), Lake Jollicum Wildlife Reserve (near Streatham) and from Lake Omeo (near Benambra in far eastern Victoria) have been attributed to an undescribed species *Carex* sp. aff. *bichenoviana* (Morcom 1999).

Threats

The main current threats to Curly Sedge are summarised as follows:

- Weed invasion;
- Altered hydrological regimes;
- Grazing;
- Changing land use;
- Roadworks and other construction activities; and,
- Climate change.

1.4.3 Large-headed Fireweed *Senecio macrocarpus*

EPBC Act Conservation Status: Vulnerable

FFG Act Conservation Status: Listed

DSE 2005 Conservation Status: Endangered

Conservation Status

The species is listed as vulnerable under the EPBC Act, as threatened under the FFG Act, and as endangered under the *Advisory List of Rare or Threatened Flora in Victoria* (DSE 2005).

Species Description

The species grows as either as an erect long-lived herb or a small shrub (40–70 centimeters tall). Leaves are stalkless, greyish in colour and covered in cobweb like hairs, leaves are arranged alternately, to 10 centimetres long and 2-5 millimetres wide. Flower heads are yellow and generally 6- 8 in number, 20 millimetres long with each plant containing 50 – 100 individual flowers. Flowers are generally present on the plant from August through to October (Hills & Boekel 2003, Sinclair 2009).

Ecology

Within Victoria, the Large-headed Fireweed occurs predominately within Plains Grassland dominated by Kangaroo Grass *Themeda triandra* on heavy basalt clay soils. Several records exist from Yellow Gum *Eucalyptus leucoxylon* woodland, where they occur generally in low, flat areas (Hills & Boekel 2003, Sinclair 2009). At Yan Yean reservoir, Large-headed Fireweed has previously occurred on heavy soil on a broad flat along the upper edge of the water level of the reservoir in Plains Grassy Wetland/Swampy Woodland (C. Beardsell pers. comm., Sinclair 2009).

Within South Australia, the species is found in a range of habits including sedge lands, shrublands and woodlands, generally on sparsely vegetated sites on sandy loam to heavy clay soils, often in depressions that are waterlogged in winter (Sinclair 2009).

Known Populations

Currently there are thought to be 14 populations of Large-headed Fireweed remaining which contain an estimated 36,000 plants, although almost all of these (35,000) occur in a single population, in Messent Conservation Park near Salt Creek in South Australia (Sinclair 2009).

In Victoria, there are perhaps 10 populations containing less than 1,000 plants. The largest populations occur in the Deep Lead Nature Conservation Reserve and adjoining land near Stawell in western Victoria, on private land at Laverton and along a rail line near Werribee, to the south-west of Melbourne.

The remaining populations are largely on rail reserves or private land and all contain only a few plants. A recent survey found a total 338 individuals occurring within the Bendigo rail reserve in Diggers Rest (Ecology Partners Pty Ltd in prep).

Known Distribution

Large-headed Fireweed are known to still occur within Victoria, new South Wales and South Australia with the species considered extinct in Tasmania (Sinclair 2009). Within Victoria scattered records exist from Nhill in western Victoria, to Yan Yean reservoir and Seymour in central Victoria, a total of 101 records for the species are present on the FIS (2007). However, approximate population numbers are known for 10 sites (Sinclair 2009).

1.5 Target Fauna Species

1.5.1 Golden Sun Moth *Synemon plana*

EPBC Act Conservation Status: Critically Endangered

FFG Act Conservation Status: Listed

DSE 2007 Conservation Status: Endangered

Golden Sun Moth typically occurs in native grassland, grassy woodland, dominated by greater than 40% cover of wallaby-grass, in particular *Austrodanthonia* spp. (DSE 2004), but may also inhabit areas dominated by Kangaroo Grass *Themeda triandra* (Endersby and Koehler 2006) and introduced grassland dominated by Chilean Needle-grass *Nassella neesiana* and other introduced species (A. Organ pers. obs.).

Male flight is typically low, to about a metre above the ground, fast and can be prolonged, but they are generally not recorded flying more than 100 metres from suitable habitat (Clarke and O'Dwyer 2000). Small, disjunct populations are vulnerable as there is little likelihood of recolonisation in the event of a local extinction. For example, Dear (1996) suggested that many of the sites where Golden Sun Moth has previously been recorded are less than 40 metres x 40 metres in size, and therefore the species' long-term survival at these small sites is problematic. Indeed, habitat patches need to be sufficiently large to accommodate enough moths to maintain a genetically viable population.

Prior to European settlement, the Golden Sun Moth was widespread and relatively continuous throughout its range, inhabiting grassy open woodlands and grassland, although it now mainly inhabits small isolated sites (DSE 2004). The species is threatened by habitat loss, disturbance and fragmentation due to agricultural expansion and urbanisation. Many populations are isolated and fragmented, impeding the ability of the relatively immobile females to recolonise areas, thereby reducing the likelihood of genetic exchange (DSE 2004).

The species is known to exist in less than a dozen sites in each of New South Wales and the Australian Capital Territory and, until recently, only six active sites in Victoria.

However, recent targeted surveys around Melbourne have detected the species from at least an additional 40 sites (Biosis Research Pty Ltd 2008; Gilmore *et al.* 2008; Organ in prep.)

1.5.2 Growling Grass Frog *Litoria raniformis*

EPBC Act Conservation Status: Vulnerable

FFG Act Conservation Status: Listed

DSE 2007 Conservation Status: Endangered

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 Commonwealth 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 (Littlejohn 1963; 1982; Hero *et al*. 1991), the species has declined markedly across much of its former range. 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 (AVW 2007; Mahony 1999; Organ, A. pers. comm.).

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).

Based on previous investigations there is a strong correlation between the presence of the species and key habitat attributes at a given waterbody. For example, the species is typically associated with waterbodies supporting extensive cover of emergent, submerged and floating vegetation (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 (Heard *et al.* 2004a, 2004b).

For example, studies have shown 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).

1.5.3 Dwarf Galaxias *Galaxiella pusilla*

EPBC Act Conservation Status: Vulnerable

FFG Act Conservation Status: Vulnerable

DSE 2007 Conservation Status: Vulnerable

Dwarf Galaxias typically occurs in slow flowing and still, shallow, permanent and temporary freshwater habitats such as swamps, drains and the backwaters of streams and creeks, often (but not always) containing dense aquatic macrophytes and emergent plants (Cadwallader and Backhouse 1983; McDowall 1996; Hammer 2002). In larger pools, the species is usually found amongst marginal vegetation (Saddlier *et al.* 2008). The study area supports these habitat characteristics.

The Final Draft Dwarf Galaxias National Recovery Plan (Saddlier *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;

In addition, this species has declined primarily due to the destruction of habitats and fragmentation through wetland degradation (Wager and Jackson 1993). Management actions relevant to the conservation include exclude grazing from riparian zone, Enhance flow regime, improve water quality and enhance and restore riparian vegetation

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).

2 METHODS

2.1 Nomenclature

Common and scientific names of vascular plants follow the FIS (2007) and the Census of Vascular Plants of Victoria (Walsh and Stajsic 2007). Vegetation community names follow DSE Ecological Vegetation Class (EVC) Benchmarks (www.dse.vic.gov.au).

Terrestrial and aquatic vertebrate fauna (mammals, birds, reptiles, amphibians and fish) follow the AVW (2007), data which is managed by DSE.

2.2 Desktop Assessment

Both the FIS (2007) and AVW (2007), biological databases maintained by the DSE, were reviewed to obtain a list of records within the study area and within 10 kilometres of the study area. The Melbourne Water Fish Database (MWFD) was accessed for fish data. To determine anecdotal evidence of other fish records, the Fish Victoria records 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/).

Information referring to matters (listed taxa and ecological communities, Ramsar wetlands, etc.) protected under the EPBC Act was obtained from the Department of the Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Search Tool: http://www.environment.gov.au /erin/ert/epbc/ index.html.

Additionally, information on significant species habitat, distribution and morphology was obtained from 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 Targeted Flora Survey

Targeted surveys where undertaken in July 2009 by qualified botanists for significant flora species which have occurring habitat within the precinct. The surveys aimed to determine the occurrence of significant flora species and if present, map the locations and provide numbers of significant flora species within the study area. The exact locations of plants, and the number of plants in each population were recorded with a hand-held GPS.

The study area was searched systematically by traversing all areas within the precinct on foot which may provide habitat to significant flora. Paddocks dominated by exotic vegetation or which had been recently cropped were more rapidly sampled as these areas did not provide habitat to the target species of flora. The timing of the survey was considered suitable for all three target species.

2.4 Targeted Fauna Survey

2.4.1 Golden Sun Moth

Targeted Golden Sun Moth surveys were undertaken on five separate days on 9 November, 21 December and 28 December 2009, and 4 January 2010. The male generally flies between 11am and 2pm on calm, warm (over 20°C), sunny days, with the species emerging from pupae between October and December.

Transect surveys for the species were undertaken by qualified zoologists across the entire study area, field personnel focused in areas of potentially suitable habitat for the species (Figure 3). The survey focused on areas of indigenous grassland, specifically those areas dominated by wallaby-grasses *Austrodanthonia* spp., as well as in areas of Needle Grass *Nassella* spp. which is a known food source for the species.

This survey methodology is approved by regulatory authorities (i.e. DSE), maximises detection of the species and provides an estimate of the number of individuals occurring in the study area.

Fauna surveys were conducted under the Ecology Partner's Pty Ltd research permit (#10004532) issued by DSE under the *Wildlife Act 1975*.

2.4.2 Growling Grass Frog

Two personnel experienced in surveying for the Growling Grass Frog conducted two nocturnal surveys within waterbodies and water courses the study area during mild (~19^{o}C mean) conditions on the 23 November 2009 and 18 January 2010 (Figure 3). Nocturnal surveys comprised an initial listening period, followed by active searching at waterbodies and water courses throughout the study area. 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.

Surveys were conducted after dusk, on calm, still nights. The water surface and margins of specific dams upon request within the precinct were carefully searched for active frogs using 30 watt, 12 volt hand-held spotlights. Suitable refuge sites such as rocks and other ground debris were lifted opportunistically to locate inactive or concealed individuals.

2.4.3 Dwarf Galaxias

Surveys for Dwarf Galaxias were undertaken on the 31 August 2010 along the central drainage line within the study area using Backpack Electrofishing, bait trapping and dip netting techniques (Figure 3). 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 2008b).

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 the collected samples were screened for all fish species present.

2.5 Assessment Qualifications and Limitations

As with any biological survey, there is a chance that the presence of some species 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, reviewing habitat requirements for the species and the assessor's experience.

The site has been subject to intensive farming practises for many years which reduces the likelihood of occurrence of the target species. Targeted surveys were undertaken in July, which was outside of optimal conditions for a number of flora species. Conditions for targeted surveys were limited for a number of species due to ongoing drought within the region. Furthermore some paddocks are either currently grazed or had been recently cropped reducing the likelihood of occurrence.

The flight season for Golden Sun Moth was unusual during the 2009/10 season. Under normal circumstances the flight season commences in late October to early November, with Golden Sun Moth emerging regularly until early January. During the 2009/10 flight season there was a strong emergence commencing in mid-November, which continued through to mid-December. After this time the species was not detected at many sites where they had previously been recorded, until a re-emergence on 29 December 2009 up until early January. This information is based on the results of a large number of additional targeted Golden Sun Moth surveys Ecology Partners Pty Ltd was undertaking during the 2009/10 flight season.

Given the level of survey effort undertaken (i.e. five separate surveys conducted on separate days within the flight season) the information provided in this report meets the objectives of the project. That is, the surveys confirmed that the species is absent from the study area.

The above limitations not withstanding the level of survey effort undertaken is designed to be detailed and improve the confidence in likelihood of occurrence for the assessor. It therefore considered that the information provided in this report meets the objectives of the project.

3 RESULTS

3.1 Targeted Flora Surveys

3.1.1 Spiny Rice Flower

All areas of potential habitat within the study area were searched systematically. Potential habitat was considered to be areas which consist of Plains Grassland or recolonising grassland (Degraded Treeless Vegetation). Heavily grazed paddocks or cropped paddocks were surveyed for potential areas where the species may persist.

No individuals were identified and it is considered unlikely that any Spiny Rice-flower would persist given the heavily modified nature of the study area.

3.1.2 Curly Sedge

All areas of potential habitat within the study area were searched systematically. Potential habitat was considered to be areas along waterways or dams. Heavily grazed paddocks or cropped paddocks were surveyed for potential areas where the species may persist.

No individuals were identified and it is considered unlikely that any Curly Sedge would persist given the heavily modified nature of the study area.

3.1.3 Large-headed Fireweed

All areas of potential habitat within the study area were searched systematically. Potential habitat was considered to be areas which consist of Plains Grassland or recolonising grassland (Degraded Treeless Vegetation). Heavily grazed paddocks or cropped paddocks were surveyed for potential areas where the species may persist.

No individuals were identified and it is considered unlikely that any Large-fruit Fireweed would persist given the heavily modified nature of the study area

3.2 Targeted Fauna Surveys

3.2.1 Golden Sun Moth

Despite being undertaken on days with optimal weather conditions, and when Golden Sun Moth were known to be flying at other nearby known sites, no Golden Sun Moths were recorded within Werribee Employment Precinct during the current surveys (Table 1).

Table 1. Golden Sun Moth survey results within the Werribee Employment Precinct study area (2009/10 flight period).

	Targeted surveys undertaken within the WEP study area							
Known GSM reference sites (date, time, and approximate distance from study area)	Date of survey	Survey Times	Temperature (9am and 3pm)		Wind (0-3)	Average cloud cover (%) during surveys	No. of days since rain	No. GSM recorded within WEP
Flying Kirksbridge Road, Werribee – 9/11/09, 1:00pm - approximately 11 kilometres west of study area	9/11/2009	1100–1530	26°C	35°C	1	10	5	**0**
Flying Kirksbridge Road, Werribee - 15/12/09, 1:00pm - approximately 11 kilometres west of study area	21/12/2009	1200 –1500	17.7°C	26C	1	15	4	**0**
Flying Kirksbridge Road, Werribee – 28/12/09, 1.00pm – approximately 11 kilometres west of study area	28/12/2009	1130– 1430	19.2°C	24.5°C	1	40	4	**0**
Flying Sayers and Palmers Rd, Truganina - 2/1/2010, 1:00pm - approximately 5 kilometres north-east of study area	4/1/2010	1200–1500	17.5°C	25.4°C	1	20	4	**0**
					TOTAL NUMBER OF MOTHS			**0**

Notes: wind intensity 0 = still, 1 = slight wind, 2 = moderate wind, 3 = High wind speed. No females were detected during the targeted surveys.

There are no documented records of Golden Sun Moth within a 10 kilometre radius of the study area (AVW 2009). Within a 20 kilometre radius of the study area there are a total of three records of the species (AVW 2009).

In addition, there have also been a multitude of additional records by Ecology Partners Pty Ltd and other consultants which are not yet documented on the AVW. In recent surveys (i.e. over the last two survey periods), Golden Sun Moth have been recorded in Truganina, Werribee West and Avalon, 5, 11 and 25 kilometres north-east, west and south west of Werribee Employment Precinct respectively (Ecology Partners Pty Ltd in prep).

Targeted surveys for Golden Sun Moth surveys were carried out within all areas of suitable habitat for the species in large secondary native grassland patches throughout the study area. The optimal time to survey for this species is during late spring through summer when weather conditions are calm, warm and dry.

As recent records have been identified within 20 kilometres of the precinct, and habitat conditions in certain sections of the precinct are suitable for the species, there remains a low likelihood that this species may occur within the precinct even though it was not recorded during the targeted surveys.

3.2.2 Growling Grass Frog

A single Growling Grass Frog was recorded vocalising in the drainage line which runs along the precinct's south western boundary during the present survey (watercourse 6; Figure 3). Sixteen waterbodies or water courses were identified from aerial photographs (Figure 3). Six of these waterbodies were unable to be surveyed due to access limitations (3, 10, 11, 12, 13 and 14) (Appendix 2). The remaining eight dams and two drainage lines, at the time of being surveyed, were typically unsuitable for Growling Grass Frog as they contained high densities of introduced fish such as Plague Minnow *Gambusia holbrooki*, contained water of relatively poor quality, or were completely dry. The two drainage lines were extensively vegetated and contained relatively low water levels of moderate quality, but were overrun by introduced fish species.

The presence of a single individual immediately outside of the study area suggests that individuals may use habitats within the study area on occasions if habitat conditions improve over time. However, there are no large suitable waterbodies for this species currently present in the south-west of the precinct.

There are at least 18 documented records of the species in the local area (AVW 2009; Figure 7). The results of the surveys suggest that site occupancy is relatively low. The closest documented record of the species is less than one kilometre from the north eastern corner of the precinct, in Skeleton Creek. Additionally, a nationally significant metapopulation of Growling Grass Frogs exists at the Western Treatment Plant, approximately eight kilometres to the south west of the WEP study area.

Physical characteristics of suitable habitats within WEP may explain why only a single Growling Grass Frog was detected in the current survey. There is known to be a strong correlation between the presence of the Growling Grass Frog and the distance of waterbodies to main drainage channels (A. Organ pers. comm.).

From these investigations it appears that the species may move from drains and other water courses to suitable farm dams to breed when habitat (e.g. water levels, vegetation) and climatic conditions (e.g. prolonged rain) become more favourable. Conversely, the species may move from farm dams to drains and water courses when conditions at farm dams and artificial waterbodies become unfavourable.

This has been documented at a number of other sites occupied by the species, such as at the nearby Western Treatment Plant where frogs are known to move between treatment lagoons and drainage channels depending on habitat conditions (Organ 2003a, 2003b; Organ 2005). During the previous flora and fauna surveys by Ecology Partners Pty Ltd (2006), habitat conditions in selected dams were more favourable than the drainage lines for Growling Grass Frogs (i.e. containing suitable habitat/refuge in addition to good water quality).

Other factors which may account for apparent low numbers during the current surveys can be attributed to a natural fluctuation in any extant population, prevailing drought conditions, the prevalence of generally low quality habitat, and the presence of Plague Minnow or other predatory introduced fish species in all waterbodies and water courses surveyed.

The presence of a single individual immediately outside of the study area suggests that individuals may use habitats within the study area on occasions if habitat conditions improve over time. However, there are no large suitable waterbodies for this species currently present in the south-west of the precinct. It is possible that the two drainage lines that traverse the precinct may act as dispersal routes for the species through the study area.

There is potential for the establishment of suitable breeding and dispersal sites in close proximity to the drainage lines for this species.

3.2.3 Dwarf Galaxias

No Dwarf Galaxias were recorded within Werribee Employment Precinct during the current survey.

While physical habitat conditions in the two drainage lines that traverse the precinct are generally sub-optimal habitat for the species, there are no documented records of Dwarf Galaxias occurring within 10 kilometres of the Werribee Employment Precinct (AVW 2009).

Targeted Surveys were recommended as the presence of suitable habitat for the species was identified by the EPBC Act Protected Matters Search Tool. Within the precinct, only the central and south-western drainage lines support potential habitat for the species. The nearest known record of Dwarf Galaxias is over 35 kilometres to the north east.

4 LEGISLATIVE AND POLICY IMPLICATIONS

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

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth);
- *Flora and Fauna Guarantee Act 1988* (FFG Act) (Victoria);
- *Planning and Environment Act 1987* (Victoria);
- *Catchment and Land Protection Act 1994* (CALP Act) (Victoria);
- *Wildlife Act 1975* and Wildlife Regulations 2002 (Victoria);
- Victoria's Biodiversity Strategy 1997;
- Port Phillip and Westernport Native Vegetation Plan; and,
- Wyndham City Council.

4.1 *Environment Protection and Biodiversity Conservation 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, 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 national environmental significance. 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 matters of national conservation significance:

- World Heritage properties
- National Heritage places
- Ramsar wetlands of international significance
- Threatened species and ecological communities
- Migratory and marine species
- Commonwealth marine area
- Nuclear actions (including uranium mining)

World Heritage properties and National Heritage places

The study area is not located within or near a World Heritage property or National Heritage property.

Ramsar wetlands of international significance

The DEWHA Protected Matters Search Tool (http://www.environment.gov.au/erin/ert/epbc/index.html) does not list any wetlands of international significance as occurring within the

same catchment as the study area. As such, the proposed development is unlikely to impact upon any Ramsar values.

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: No flora listed under the EPBC Act were identified during the targeted surveys.

Fauna: With the exception of Growling Grass Frog which was recorded adjacent to the study area during the targeted surveys, based on the survey results there is a low likelihood that any additional EPBC Act-listed fauna species would occur within the study area. Any development that proposes to remove potential sites for this species should be preceded by the establishment of alternative sites located close to occupied sites to improve population viability. A Conservation Management Plan for this species may also be required as part of the future development of the precinct.

Communities: One ecological community, Natural Temperate Grassland of the Victorian Volcanic Plain, listed as Critically Endangered occurs within the study area.

Listed migratory and marine species

While a number migratory and marine species may occupy habitats within the study area on occasions, the study area does not provide habitat for an ecologically significant proportion of any of these species.

Commonwealth marine area and nuclear actions

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

Implications for the proposed development

No flora species listed under the EPBC Act were recorded within the precinct or are considered likely to occur. One ecological community, Natural Temperate Grassland of the Victorian Volcanic Plain listed under the EPBC Act does occur.

The Growling Grass Frog is an EPBC Act-listed species, and was recorded immediately adjacent to the study area during the present surveys.

An EPBC Act referral to the Commonwealth Minister for DEWHA may be required as part of the future Precinct Structure Plan process. However, the future development of the precinct is likely to fall under Part 10 of the EPBC Act – i.e. be assessed under the Strategic Impact Assessment Report.

4.2 *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.

Flora – No flora species listed as threatened under the FFG Act were recorded during the targeted assessment. Several flora species listed under protected flora controls do occur.

Fauna – No fauna species listed under the FFG Act were recorded within the study area during the present assessment. However, there have been a small number of fauna species listed under the FFG Act that have previously been recorded within the local area (AVW 2007) (Appendix 3.2).

Ecological Communities – One ecological community Western (Basalt) Plains Grasslands Community listed under the FFG Act occurs within the study area.

Recommendation

Given that the study area contains a community listed as threatened and flora species listed as 'protected flora' under the FFG Act, a FFG Act permit is likely to be required for the future development of the study area.

4.3 *Planning and Environment Act 1987*

All planning schemes contain native vegetation provisions at Clause 52.17. A planning permit is required under the *Planning and Environment Act 1987* to remove, destroy or lop native vegetation on a site of more than 0.4 hectares, unless:

- The application is exempt under the schedule to Clause 52.17
- A Native Vegetation Precinct Plan applies.

Planning schemes may contain other provisions in relation to the removal of native vegetation.

Recent changes to the planning provisions (DSE 2006a, DSE 2006b) have altered the criteria for when

DSE is the mandatory referral authority.

A permit must be referred to DSE if there is one or more of the following:

Scattered Trees (may include trees from patches of vegetation)

- Greater than 15 trees with a diameter less than 40 centimetres at 1.3 metres above ground.
- Greater than 5 trees with a diameter more than 40 centimetres at 1.3 metres above ground.

Areas of vegetation (may include trees)

- Greater than 0.5 hectares of vegetation in an Ecological Vegetation Class with Bioregional Conservation Status of Endangered, Vulnerable or Rare.
- Greater than 1 hectare of vegetation in an Ecological Vegetation Class with Bioregional Conservation Status of Depleted or Least Concern.

Other circumstances

- on Crown land managed by the responsible authority;
- where a property vegetation plan applies to the site.

Recommendation

Given that the site supports areas of Degraded Treeless Vegetation a Native Vegetation Precinct Plan (NVPP) is unlikely to be required. However, clarification from DSE on whether a NVPP is required as part of the PSP should be sort.

4.4 *Catchment and Land Protection 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 the State's land and water resources and their associated plant and animal life are maintained and enhanced.

Recommendation

While not directly associated with the proposed works, any infestation of noxious weeds (e.g. Blackberries), which may become established during and/ or after the completion of works,

should be appropriately controlled in areas of native vegetation to minimise their spread and overall impact on ecological values. In addition, increased levels of sediment should not enter any drainage lines during construction works (i.e. sediment laden stormwater runoff).

4.5 *Wildlife Act 1975 and* Wildlife Regulations 2002

Wildlife Act 1975

The *Wildlife Act 1975* is the primary legislation in Victoria providing for protection and management of wildlife. The Act requires people engaged in wildlife research (e.g. fauna surveys, salvage and translocation activities) to obtain a permit under the Act to ensure that these activities are undertaken in a manner consistent with the appropriate controls.

The *Wildlife Act 1975* has the following objectives:

- To establish procedures for the promotion of protection and conservation of wildlife, the prevention of species extinctions, and the sustainable use and access to wildlife; and
- To prohibit and regulate the conduct of those involved in wildlife related activities.

Wildlife Regulations 2002

The objectives of the Wildlife Regulations are:

- To make further provision in relation to the licensing system established by section 22 of the *Wildlife Act 1975*;
- To prescribe fees, offences, royalties and various other matters for the purposes of the *Wildlife Act 1975*; and
- To provide for exemptions from certain provisions of the *Wildlife Act 1975*.

Authorisation for habitat removal may be obtained under the Wildlife Act; through a licence granted under the *Forests Act 1958*, or under any other Act such as the *Planning and Environment Act 1987*.

Recommendation

While a permit will be required for removal of habitat within the study area, this could be in the form of a permit to remove native vegetation under the *Planning and Environment Act 1987*. Consequently, a separate permit to remove fauna for this project is unlikely to be required.

4.6 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. The Strategy should be taken into account for any proposed developments.

4.7 Port Phillip and Westernport Native Vegetation Plan

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 more strategic and coordinated approach to address ongoing degradation in quantity and quality of native vegetation across the Port Phillip and Westernport region.

Recommendation

The proposed rezoning and future development of the study area should address the key recommendations outlined under the *Port Phillip and Westernport Native Vegetation Plan* (PPWCMA 2006).

There are opportunities as part of any the future development of the study area to use locally indigenous species consistent with the former EVC which once occurred across the study area.

4.8 Wyndham City Council

No Vegetation Protection Overlay, Environmental Significance Overlay or Significant Landscape Overlays are located over the sites.

A Planning Permit from the Wyndham City Council is required to clear/remove native vegetation. A planning permit is also required under the *Planning and Environment Act 1987*.

5 POTENTIAL IMPACTS AND MITIGATION MEASURES

5.1 Flora Species

Potential Impacts

Given that there is no significant flora species within the precinct, it is unlikely that there will be any direct impacts, however there is potential for direct impacts on potential habitat including:

- Direct removal and/or disturbance to associated habitats;
- Increased soil disturbance, soil removal/dumping, unauthorised works and compaction which may have a negative impact on remnant native vegetation including the identified significant species within the study area; and,
- Increase fragmentation of remnant native vegetation.

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

- Potential for further spread of weeds and soil pathogens from on-site activities and subsequent degradation of remaining native vegetation including the identified significant species; and,
- Indirect impacts to adjoining native vegetation/habitat, and potential offsite affects such as sedimentation and pollution to ephemeral drainage lines;

Mitigation Measures

There are several measures which can be undertaken to mitigate/ameliorate impacts to significant flora species of any proposed development within the study area. If the development was to proceed then the following measures could be adopted, although measures are more effective if adopted during the design and planning stages, rather than the construction phase, and these include;

- Any site disturbance should only be undertaken in accordance with a Conservation Management Plan which would need to be approved by relevant authorities (i.e. DEWHA and DSE).
- Avoid areas wherever possible that support conservation significant species habitat should be fenced off and labelled as 'no go' areas during any construction activities;
- Avoid significant vegetation communities especially those that may provide habitat for conservation significant species (e.g. Plains Grassland);
- Where possible, avoid native vegetation through construction and micro-siting techniques. If indeed necessary, trees should be lopped or trimmed rather than removed. Similarly, soil disturbance and sedimentation within wetlands should

be avoided or kept to a minimum, to avoid, or minimise impacts to fauna habitats; and,

- Weeds should be treated appropriately and replaced with locally indigenous species appropriate to the EVC, if natural indigenous regeneration is poor.

5.2 Fauna Species

Given that the study area has been identified as potentially supporting Growling Grass Frog (despite the species not being recorded during the targeted surveys), and is unlikely to support Golden Sun Moth or Dwarf Galaxias based on existing habitats and their relative condition, impacts and mitigation measures outlined in the following section are focused on Growling Grass Frog.

5.2.1 Potential Impacts

A summary of potential impacts associated with the proposed development are outlined below.

5.2.1.1 Habitat Loss

The loss of potential habitat areas is not likely to have a significant impact on any local population, given that the species hasn't been recorded within the study area. Despite this, to compensate for the loss of these areas, extensive areas of habitat should be created as part of the development plan, through the provision of extensive wetlands and frog ponds in key areas.

5.2.1.2 Habitat Fragmentation

The proposed Werribee Employment Precinct has the potential to fragment Growling Grass Frog habitat, and limit potential north-south dispersal through the area.

Most of the potential dispersal habitat for Growling Grass Frog within the study area is restricted to the two existing drainage lines. The retention, modification and enhancement of these areas will aid in maintaining habitat connectivity across the precinct.

5.2.1.3 Hydrology and Water Quality

Construction activities associated with the development have the potential to result in sedimentation of nearby waterways and produce sediment-laden runoff into the drainage lines. Sediment-laden water also has the potential to be transported offsite, downstream to areas containing potential habitat for the Growling Grass Frog. There is also the potential for accidental spillage of chemicals from the construction area to runoff into drainage lines and ultimately wetlands and creeks.

Increase in sediment input and input of toxic substances into Victorian rivers and streams due to human activities are both threatening processes under Schedule 3 of the FFG Act.

Once the development is complete, stormwater runoff from roads and paved surfaces has the potential to drain into any created wetlands and the drainage lines. Runoff in post construction would be of a greater volume and velocity than existing runoff from the current subject site due to the increase in impervious catchment areas. Runoff from developed areas often contains pollutants such as fertilisers, herbicides, litter, seeds of weed species and most importantly in this case, harmful chemicals. Therefore, a reduction in water quality and weed invasion may occur in created wetlands, drainage lines, and further south as a result of development of the precinct. Altered drainage patterns resulting from the development also have the potential to modify the length of time current waterbodies and water courses hold water.

5.2.1.4 Human Access

Human occupancy within the study area has the potential to result in disturbance by persons entering the Growling Grass Frog habitat areas. This may lead to the degradation of habitat in these areas due to rubbish dumping, mechanical disturbance of vegetation from trampling, and weed invasion.

5.2.1.5 Weeds

Increased weed encroachment into areas of terrestrial and aquatic indigenous vegetation in the study area may occur due to runoff from the development. Weeds may also be transported via construction equipment and machinery, and people/animals entering the site. Invasion of native vegetation by "environmental weeds" is a threatening process under Schedule 3 of the FFG Act. Excessive weed growth can smother frog habitat, rendering it unsuitable as a breeding and/or foraging site.

5.2.1.6 Exotic Predators

Plague Minnow

The introduced Plague Minnow *Gambusia holbrooki* has been identified as a possible factor in the decline of the species (Mahony 1993; White and Pyke 1996; Hamer *et al.* 2002) because it eats the eggs and tadpoles of these species (Morgan and Buttermer 1996). Predation by Plague Minnow on tadpoles of the Growling Grass Frog has been identified as a significant threat to the species (Department of Environment and Conservation 2005a).

This species may reduce the potential of a site to support breeding populations, although the extent of predation depends on aquatic vegetation and habitat complexity, and water body permanency (Hamer *et al.* 2002). Plague Minnow was recorded in all waterbodies and courses within the study area, including the drainage channels. They are also likely to occur in other drainage lines and farm dams in the local area.

The presence of this fish in waterbodies, together with the lack of established emergent vegetation, limits the habitat potential of waterbodies for the Growling Grass Frog.

Red Fox

The Red Fox *Vulpes vulpes* has been recorded on the subject site. The Red Fox is known to eat adult members of the bell frog species complex (NSW DEC 2005), although it has not been identified as a threat to the Growling Grass Frog in the Draft Recovery Plan (NSW DEC 2005). Additionally, in the NSW Threat Abatement Plan for Predation by the Red Fox (NPWS 2001), the Growling Grass Frog is considered to be a species with a low sensitivity rating, which indicates that population impacts are unlikely to result from predation by the Red Fox. Nonetheless, there is likely to be some predation on frogs in the Werribee area by the Red Fox.

Dog and Cats

Unrestrained dogs and cats are likely to roam into the study area. Cats in particular are known to predate upon dispersing or sheltering frogs. Predation of native wildlife by the Cat is a threatening process under Schedule 3 of the FFG Act.

5.2.2 Potential Improvements

If wetlands and connecting habitats on each site are constructed, there is potential for Growling Grass Frogs to colonise habitats in the future. Some of the potential improvements to Growling Grass Frog habitats associated with the proposed development include:

- The construction of wetlands designed to rehabilitate current low quality habitats, such as currently uninhabited artificial waterbodies, thus increasing the amount of high quality habitat within the area;
- The overall improvement of water quality in creeks and wetlands; and,
- The provision of additional breeding habitat in the form of ephemeral waterbodies and stormwater treatment wetlands.

5.2.3 Mitigation Measures

There are several measures that can be incorporated into the proposed precinct design to reduce the potential adverse impacts that may result from the development on the site.

Measures that can be adopted at the design, planning, construction and post-construction phases of the Werribee Employment Precinct development include:

- Avoiding the loss of artificial waterbodies and drainage lines. If the removal of waterbodies or watercourses is unavoidable, it is recommended that pre-clearance surveys be undertaken by a suitably qualified herpetologist to salvage and translocate any resident Growling Grass Frogs which may be present to nearby suitable habitat;
- Provision and routine maintenance of any created wetland complexes. Wetlands would need to support key habitat attributes such as emergent, submerged and floated vegetation, and extensive terrestrial refuge sites such as rocks and timber;

- Retention, modification and enhancement of existing drainage lines, allowing frogs to move between north and south sides of the precinct. Linear reserves should be created along theses drainage lines, and revegetated with indigenous grasses and sedges, or species typical of the relevant EVC. Introduced weeds should also be controlled;
- Establishment of a suitable distance between wetlands or drainage lines and development areas, with a road, car park or preferably parkland or open space separating frog habitat from developed areas. Frog exclusion fences should be installed at strategic locations to reduce the potential of frog mortality through road kill;
- Water and drainage should be treated appropriately on-site to minimise impacts on the created wetlands and dispersal corridors;
- Appropriate signage along wetland perimeters to prevent accidental entry by construction personnel, machinery and after construction is completed, the general public;
- The preparation and implementation development of an Erosion and Sediment Control Plan (i.e. a Site EMP in accordance with the EPA Victoria Guidelines);
- The preparation and implementation development of a Weed Management Plan;
- The preparation and implementation development of a Feral Animal Control Plan aimed at reducing the Red Fox population on the study area; and,
- The preparation and implementation of a species specific Conservation Management Plan which will outline management protocol and detailed mitigation measures to ensure ecological values on the site are protected during construction activities and reinstated or managed and monitored after works are completed.

6 CONCLUSION

With the exception of Growling Grass Frog which may use the study area (i.e. given the species was detected immediately adjacent to the study area) there is a low likelihood that any other of the targeted significant fauna species occur within the precinct.

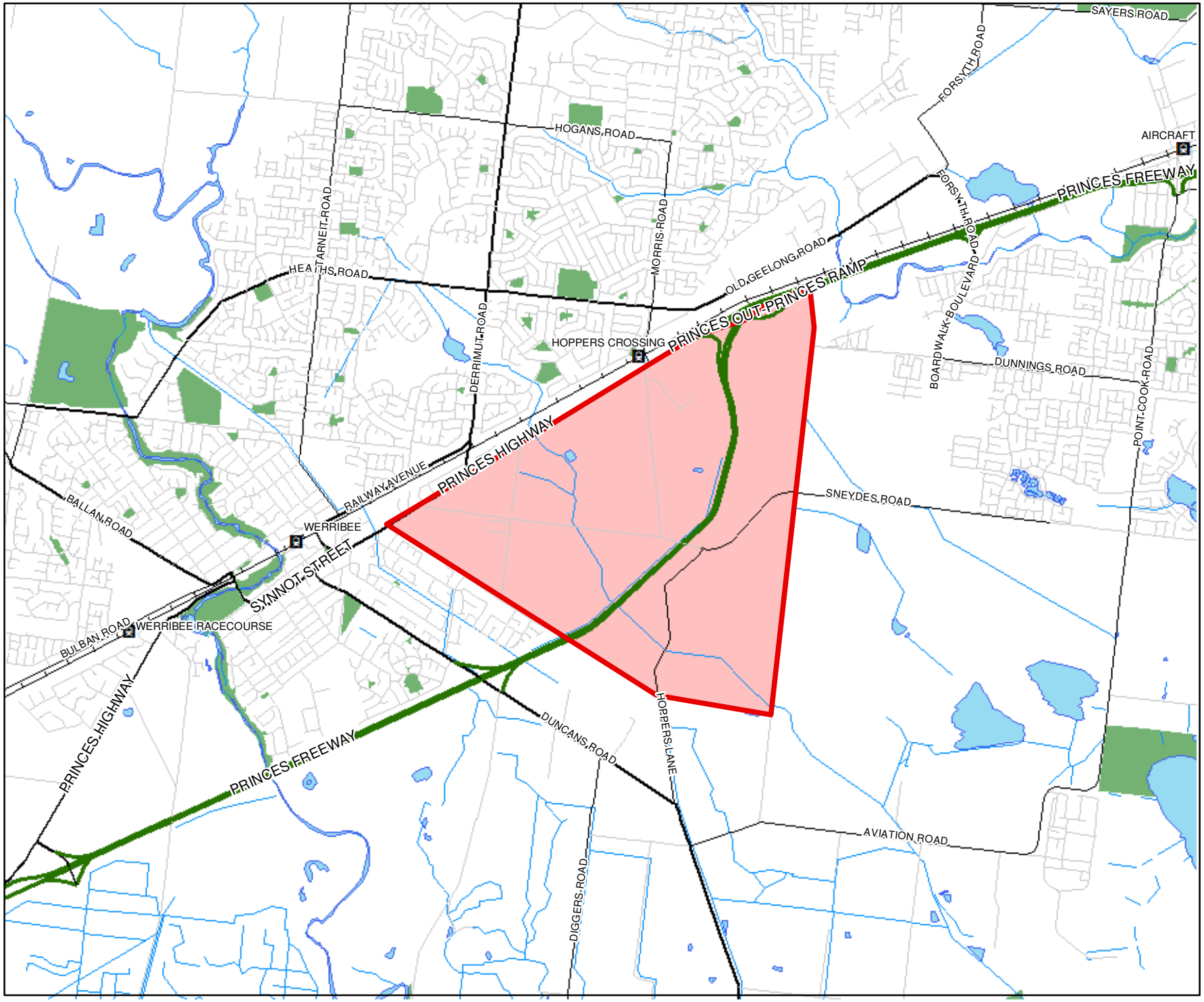
Similarly, no significant flora species were detected during targeted surveys and it is considered unlikely for them to occur within the study area.

Further Recommendations

Growling Grass Frog is an EPBC Act-listed species and was recorded adjacent to the study area during the surveys. The species may use habitat within the study area, given that there are waterbodies present within the precinct in close proximity to the location at which the frog was recorded. As such an EPBC Act referral to the Commonwealth Minister for DEWHA may be required as part of the rezoning and future development of the precinct. Although this precinct is likely to fall under the Strategic Impact Assessment under the EPBC Act.

In order to minimise any potential impacts of the proposed development within the precinct on Growling Grass Frog, a detailed CMP may need to be developed. The CMP should incorporate relevant objectives of the National Recovery Plan prepared in accordance with the EPBC Act by the species' National Recovery Team.

FIGURES



Legend

Study Area

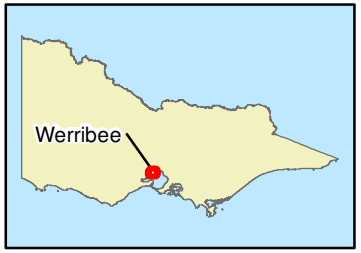


Figure 1
Study Area
Werribee Employment Precinct

N

0 365 730 1,460
Meters

ecologypartners

EP Map # : 1424
File Path: 1424_Fig01_StudyArea_09Apr10.mxd
Issue Date: 12/04/2010

Legend

- Study Area
- Flora Survey Areas

Figure 2
Flora Survey Area
Werribee Employment Precinct

N

0 165 330 660
Meters

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EP Map # : 1424
File Path: 1424_Fig03_FloraSurveyAreas_12Apr10.mxd2
Issue Date: 12/04/2010

Legend

- Growling Grass Frog Record
- Study Area
- DG & GGF Survey Areas
- GGF Survey Areas
- GSM Survey Areas

Figure 3
Fauna Survey Area
Werribee Employment Precinct

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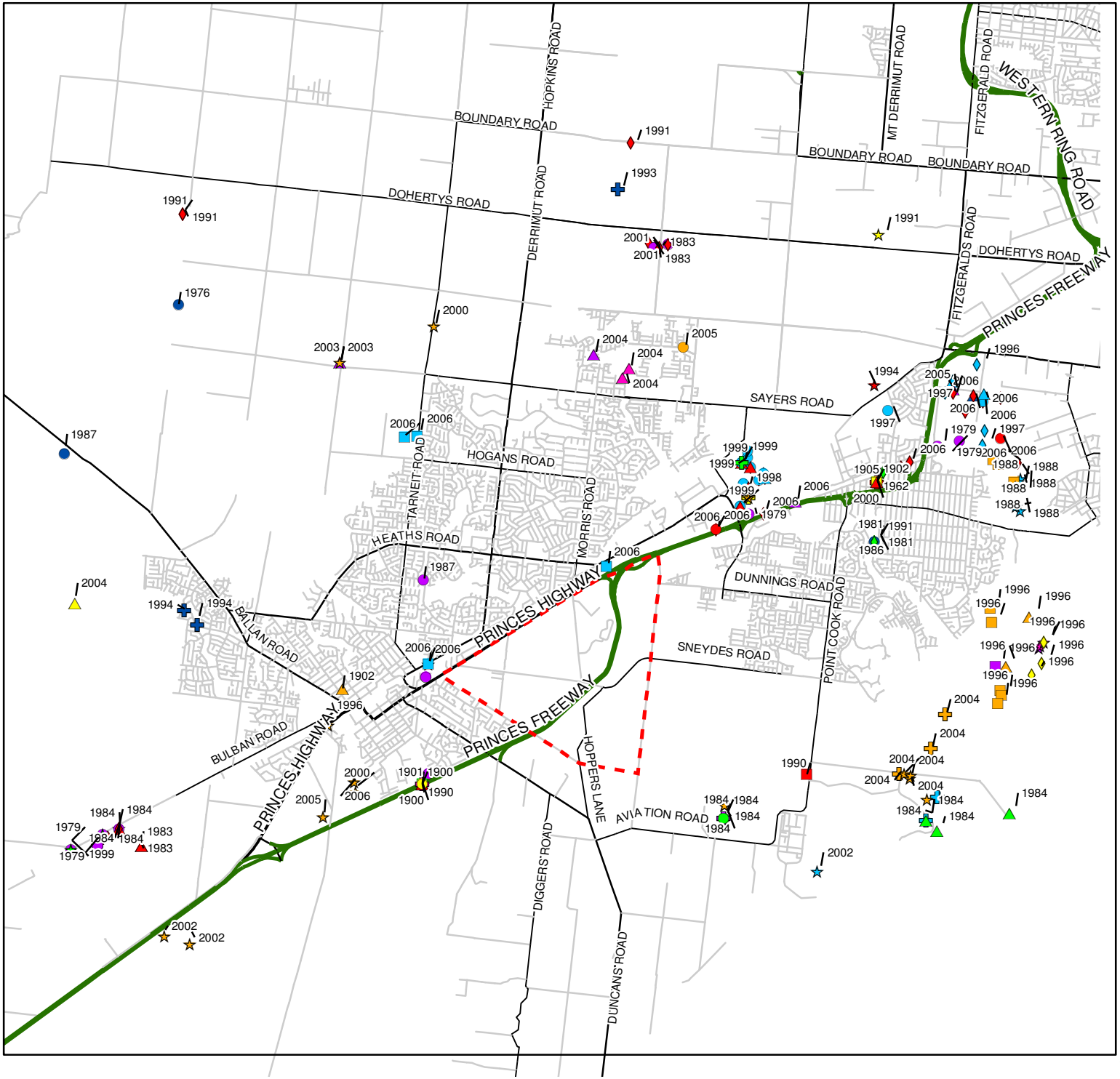
EP Map # : 1424
File Path: 1424_Fig03_FaunaSurveyAreas_12Apr10.mxd
Issue Date: 27/04/2010



Legend

Threatened Flora Species

- Arching Flax-lily
- Austral Crane's-bill
- Austral Trefoil
- Basalt Peppercress
- Basalt Podolepis
- Buloke
- Button Wrinklewort
- Clover Glycine
- Coast Wirilda
- Creeping Rush
- Floodplain Fireweed
- Fragrant Leek-orchid
- Giant Honey-myrtle
- Golden Cowslips
- Grey Mangrove
- Grey Spike-sedge
- Large-headed Fireweed
- Marsh Saltbush
- Melbourne Yellow-gum
- Native Peppercress
- Pale Swamp Everlasting
- Pale-flower Crane's-bill
- Plains Joyweed
- Plump Swamp Wallaby-grass
- Proud Diuris
- River Red-gum
- River Swamp Wallaby-grass
- Rough-grain Love-grass
- Salt Lawrencia
- Sand Brome
- Sea Nymph
- Shore Spleenwort
- Short Sun-orchid
- Slender Bindweed
- Slender Tick-trefoil
- Small Golden Moths
- Small Milkwort
- Small Scurf-pea
- Southern Blue-gum
- Southern Swainson-pea
- Spiny Rice-flower
- Swamp Diuris
- Tasman Grass-wrack
- Tough Scurf-pea
- Wetland Blown-grass
- Study Area

Figure 4
Significant Flora Records
Werribee Empolyment Precinct

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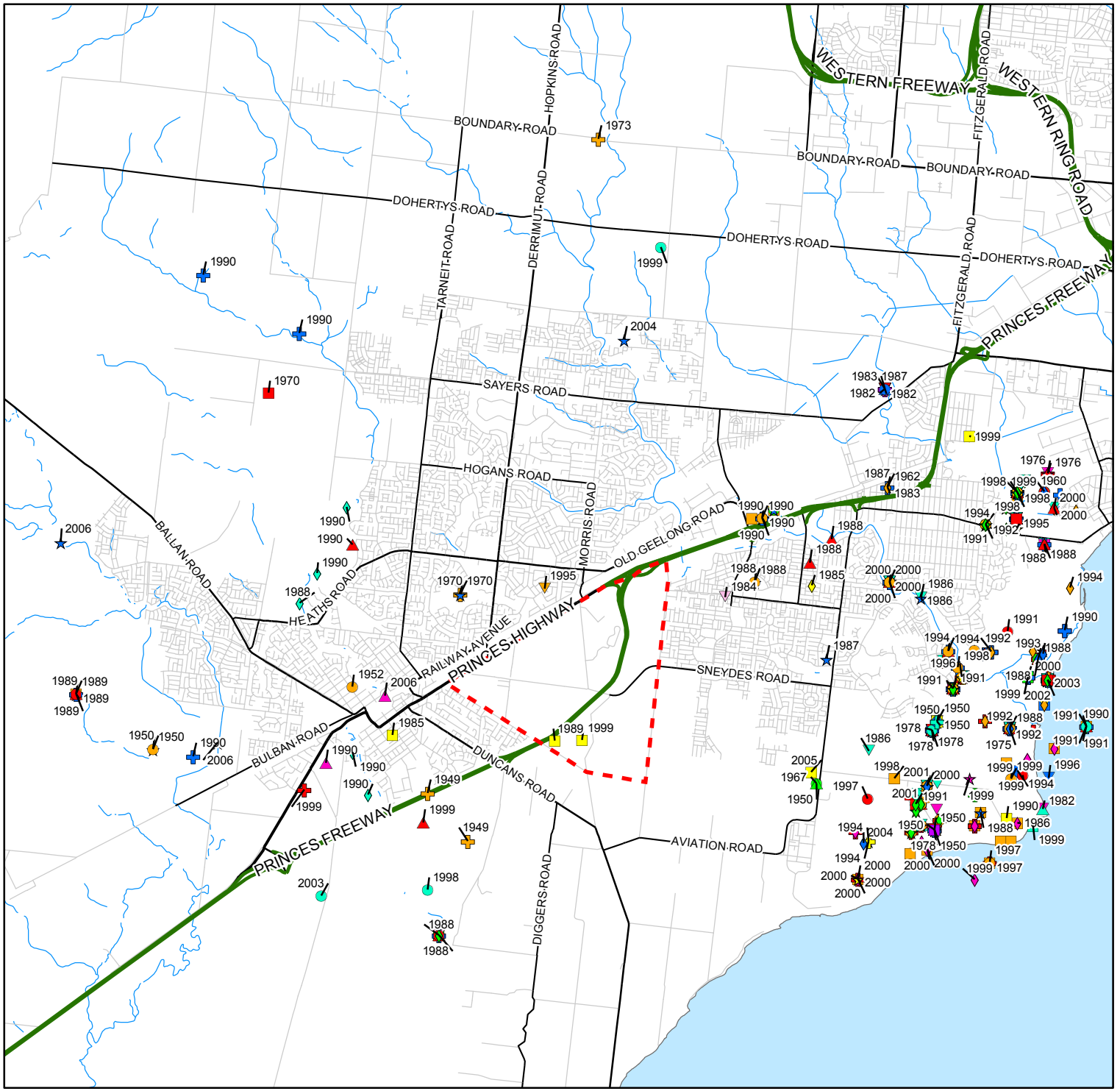
Kilometers

EP Map # : 1424
File Path: 1424_Fig04_SigFlora_09Apr10.mxd
Issue Date: 09/04/2010



Legend

Threatened Fauna Records

- Australasian Bittern
- Australasian Shoveler
- Australian Pratincole
- Baillon's Crake
- Black Falcon
- Black-eared Cuckoo
- Black-faced Cormorant
- Black-tailed Godwit
- Blue-billed Duck
- Brown Quail
- Cape Barren Goose
- Caspian Tern
- Common Diving-Petrel
- Common Sandpiper
- Diamond Firetail
- Eastern Curlew
- Eastern Great Egret
- Elegant Parrot
- Fairy Prion
- Fairy Tern
- Glossy Ibis
- Great Knot
- Greater Sand Plover
- Grey Goshawk
- Grey Plover
- Grey-tailed Tattler
- Hardhead
- Hooded Plover
- Intermediate Egret
- Latham's Snipe
- Lesser Sand Plover
- Lewin's Rail
- Little Button-quail
- Little Egret
- Little Tern
- Musk Duck
- Nankeen Night Heron
- Orange-bellied Parrot
- Pacific Golden Plover
- Pacific Gull
- Pied Cormorant
- Plains-wanderer
- Red Knot
- Red-chested Button-quail
- Regent Honeyeater
- Royal Spoonbill
- Sanderling
- Sooty Oystercatcher
- Spotted Harrier
- Swift Parrot
- Terek Sandpiper
- Whimbrel
- Whiskered Tern
- White-bellied Sea-Eagle
- White-faced Storm-Petrel
- White-winged Black Tern
- Wood Sandpiper
- Study Area

Figure 5
Significant Fauna Records
Werribee Empolyment Precinct

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0 0.5 1 2
Kilometers

EP Map # : 1424
File Path: 1424_Fig05_SigFauna_09Apr10.mxd
Issue Date: 09/04/2010

APPENDICES

Appendix 1.1 – Flora results

Table A1.1. 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)
* Walsh and Stajsic (2007)
DSE Advisory List of Threatened Flora in Victoria (DSE 2005)
FFG *Flora and Fauna Guarantee Act 1988* (Victoria)
\# EPBC Act Protected Matters Search Tool (DEWHA)

National status of species (EPBC) is designated by:

EX Extinct
CE Critically Endangered
EN Endangered
VU Vulnerable
R Rare*
K Poorly Known*

State status of species (DSE and FFG) is designated by:

e Endangered
v Vulnerable
r Rare
k Poorly Known
L Listed on FFG Act

Likelihood of occurrence:

1 Known occurrence
2 Possible occurrence
3 Low likelihood
4 Unlikely
5 No suitable habitat

Scientific Name	Common Name	Total number of documented records (FIS)	EPBC Act	DSE (2005)	FFG Act	Likely occurrence within the study area
NATIONAL SIGNIFICANCE						
#*Amphibromus fluitans*	River-swamp wallaby grass	1	VU	-	-	4
#*Carex tasmanica*	Curly Sedge	-	VU	-	-	4
#*Diuris basaltica*	Small Golden Moths Orchid	1	EN	v	L	4
#*Diuris fragrantissima*	Sunshine Diuris	1	EN	e	L	4
#*Glycine latrobeana*	Clover Glycine	1	VU	v	L	4
Lepidium hyssopifolium	Basalt Peppercress	3	EN	e	L	4
#*Pimelea spinescens* subsp. *spinescens*	Spiny Rice-flower	1	CE	v	L	2 (low likelihood)
#*Prasophyllum frenchii*	Maroon Leek-orchid	-	EN	-	-	4
Prasophyllum suaveolens	Fragrant Leek-orchid	2	EN	e	L	4
#*Rutidosis leptorhynchoides*	Button Wrinklewort	5	EN	e	L	4
#*Senecio macrocarpus*	Large-fruit fireweed	4	VU	e	L	4
STATE SIGNIFICANCE						
Acacia uncifolia	Coast Wirilda	1	-		-	4
Allocasuarina luehmannii	Buloke	1	-	-	L	4
Alternanthera sp. 1 (Plains)	Plains Joyweed	4	-	k	-	3
Amphibolis antarctica	Sea Nymph	2	-	k	-	4
Amphibromus pithogastrus	Plump Swamp Wallaby-grass	2	-	e	L	4
Asplenium obtusatum subsp. *northlandicum*	Shore Spleenwort	1	-	v	-	4
Atriplex paludosa subsp. *paludosa*	Marsh Saltbush	3	-	r	-	4
Avicennia marina subsp. *australasica*	Grey Mangrove	1	-	r	-	4
Bromus arenarius	Sand Brome	2	-	r	-	4
Comesperma polygaloides	Small Milkwort	4	-	v	L	4
Convolvulus angustissimus	Slender Bindweed	3	-	k	-	4

Scientific Name	Common Name	Total number of documented records (FIS)	EPBC Act	DSE (2005)	FFG Act	Likely occurrence within the study area
subsp. *omnigracilis*						
Cullen parvum	Small Scurf-pea	3	-	e	L	2 (low likelihood)
Cullen tenax	Tough Scurf-pea	4	-	e	L	2 (low likelihood)
Desmodium varians	Slender Tick-trefoil	1	-	k	-	4
Dianella sp. aff. *longifolia (*Benambra)	Arching Flax-lily	2	-	v	-	4
Diuris behrii	Golden Cowslips	1	-	v	-	4
Diuris palustris	Swamp Diuris	1	-	v	L	4
Diuris X *fastidiosa*	Proud Diuris	2	-	e	-	4
Eleocharis macbarronii	Grey Spike-sedge	1	-	k	-	4
Eragrostis trachycarpa	Rough-grain Love-grass	1	-	r	-	4
Eriocaulon scariosum	Common Pipewort	1	-	r	-	4
#*Eucalyptus globulus* subsp. *globulus*	Southern Blue-gum	1	-	r	-	4
Geranium solanderi var. *solanderi* s.s.	Austral Crane's-bill	1	-	v	-	4
Geranium sp. 3	Pale-flower Crane's-bill	1	-	r	-	4
Helichrysum aff. *rutidolepis* (Lowland Swamps)	Pale Swamp Everlasting	2	-	v	-	4
Heterozostera tasmanica	Tasman Grass-wrack	4	-	-	-	4
Juncus revolutus	Creeping Rush	4	-	r	-	4
Lachnagrostis filiformis var. 2	Wetland Blown-grass	4	-	k	-	4
Lawrencia spicata	Salt Lawrencia	4	-	r	-	4
Lepidium pseudohyssopifolium	Native Peppercress	3	-	k	-	4
Lotus australis var. *australis*	Austral Trefoil	2	-	k	-	4
Podolepis sp. 1	Basalt Podolepis	5	-	e	-	3
Salsola tragus subsp. *pontica*	Coast Saltwort	2	-	r	-	4
Senecio campylocarpus	Floodplain Fireweed	1	-	r	-	4
Swainsona behriana	Southern Swainson-pea	1	-	r	-	4
Thelymitra exigua	Short Sun-orchid	1	-	k	-	4

Sources: Flora Information System (FIS 2005) and EPBC Act Protected Matters Search Tool (DEWHA)

Appendix 1.2 – 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 2007)
FFG *Flora and Fauna Guarantee Act 1988* (Victoria)

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 (DEWHA)

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 (2007)	FFG ACT	National Action Plan	Likely use of study area
NATIONAL SIGNIFICANCE								
Grey-headed Flying-fox	*Pteropus poliocephalus*	-	-	VU	VU	L	VU	4 (fly over)
Smoky Mouse	*Pseudomys fumeus*	-	-	EN	CR	L	RA	7
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	-	-	EN	NT	I	NT	7
Spot-tail Quoll	*Dasyurus maculatus maculatus*	-	-	EN	EN	L	VU	7
Plains-wanderer	*Pedionomus torquatus*	1974	4	VU	CR	L	EN	7

Common Name	Scientific Name	Last documented record	Total # of records	EPBC Act	DSE (2007)	FFG ACT	National Action Plan	Likely use of study area
Fairy Prion	*Pachyptila turtur*	1999	2	VU	VU	-	-	7
Hooded Plover	*Thinornis rubricollis*	1950	1	-	VU	L	VU	7
Australian Painted Snipe	*Rostratula australis*	1985	4	VU	CR	L	VU	7
Australasian Bittern	*Botaurus poiciloptilus*	1997	16	-	EN	L	VU	7
Orange-bellied Parrot	*Neophema chrysogaster*	2004	13	CE	CR	L	CR	7
Swift Parrot	*Lathamus discolor*	1995	1	EN	EN	L	EN	5
Regent Honeyeater	*Anthochaera phrygia*	1950	1	EN	CR	L	EN	6
Striped Legless Lizard	*Delma impar*	2005	10	VU	EN	L	VU	7
Growling Grass Frog	*Litoria raniformis*	2006	14	VU	EN	L	VU	2
Golden Sun Moth	*Synemon plana*	2005	3	CR	EN	L	-	7
#Grassland Earless Dragon	*Tympanocryptis pinguicolla*	-	-	EN	CR	L	VU	7
#Dwarf Galaxias	*Galaxiella pusilla*	-	-	VU	VU	L	VU	7
#Australian Grayling	*Prototroctes maraena*	-	-	VU	VU	L	VU	7
		STATE SIGNIFICANCE						
Red-chested Button-quail	*Turnix pyrrhothorax*	1986	1	-	VU	L	-	7
Lewin's Rail	*Lewinia pectoralis*	1999	12	-	VU	L	NT	7
Baillon's Crake	*Porzana pusilla*	1999	14	-	VU	L	-	4
White-faced Storm-Petrel	*Pelagodroma marina*	1950	1	-	VU	-	-	7
Gull-billed Tern	*Gelochelidon nilotica*	1982	1	-	EN	L	-	7
Caspian Tern	*Hydroprogne caspia*	2002	17	-	NT	L	-	7
Little Tern	*Sternula albifrons*	2003	17	-	VU	L	-	7
Fairy Tern	*Sternula nereis*	1996	11	-	EN	L	-	7
Lesser Sand Plover	*Charadrius mongolus*	1994	4	-	VU	-	-	7
Greater Sand Plover	*Charadrius leschenaultii*	1978	2	-	VU	-	-	7
Whimbrel	*Numenius phaeopus*	1986	2	-	VU	-	-	7
Black-tailed Godwit	*Limosa limosa*	1986	7	-	VU	-	-	7
Wood Sandpiper	*Tringa glareola*	1996	15	-	VU	-	-	7
Grey-tailed Tattler	*Heteroscelus brevipes*	2006	4	-	CR	L	-	7
Common Sandpiper	*Actitis hypoleucos*	2000	17	-	VU	-	-	7

Common Name	Scientific Name	Last documented record	Total # of records	EPBC Act	DSE (2007)	FFG ACT	National Action Plan	Likely use of study area
Terek Sandpiper	*Xenus cinereus*	1997	5	-	EN	L	-	7
Great Knot	*Calidris tenuirostris*	1982	5	-	EN	L	-	7
Royal Spoonbill	*Platalea regia*	2006	133	-	VU	-	-	5
Little Egret	*Egretta garzetta*	2006	114	-	EN	L	-	6
Intermediate Egret	*Ardea intermedia*	2000	5	-	CR	L	-	7
Eastern Great Egret	*Ardea modesta*	2006	130	-	VU	L	-	5
Little Bittern	*Ixobrychus minutus*	1980	2	-	EN	L	-	7
Magpie Goose	*Anseranas semipalmata*	2000	1	-	NT	L	-	7
Australasian Shoveler	*Anas rhynchotis*	2003	110	-	VU	-	-	5
Freckled Duck	*Stictonetta naevosa*	1985	6	-	EN	L	-	7
Hardhead	*Aythya australis*	2005	103	-	VU	-	-	5
Blue-billed Duck	*Oxyura australis*	2002	25	-	EN	L	-	6
Musk Duck	*Biziura lobata*	2003	38	-	VU	-	-	6
Grey Goshawk	*Accipiter novaehollandiae*	2006	2	-	VU	L	-	6
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	1996	2	-	VU	L	-	6
Black Falcon	*Falco subniger*	2003	16	-	VU	-	-	6
Elegant Parrot	*Neophema elegans*	1950	1	-	VU	-	-	7
REGIONAL SIGNIFICANCE								
Brown Quail	*Coturnix ypsilophora*	2004	50	-	NT	-	-	4
Little Button-quail	*Turnix velox*	1950	1	-	NT	-	-	6
Common Diving-Petrel	*Pelecanoides urinatrix*	1999	1	-	NT	-	-	7
Black-faced Cormorant	*Phalacrocorax fuscescens*	2006	4	-	NT	-	-	7
Pied Cormorant	*Phalacrocorax varius*	2006	154	-	NT	-	-	7
White-winged Black Tern	*Chlidonias leucopterus*	1999	15	-	NT	-	-	7
Whiskered Tern	*Chlidonias hybridus*	2003	88	-	NT	-	-	6
White-fronted Tern	*Sterna striata*	1975	1	-	NT	-	-	7
Pacific Gull	*Larus pacificus pacificus*	2006	230	-	NT	-	-	7
Sooty Oystercatcher	*Haematopus fuliginosus*	2001	23	-	NT	-	-	7
Grey Plover	*Pluvialis squatarola*	1992	6	-	NT	-	-	7

Common Name	Scientific Name	Last documented record	Total # of records	EPBC Act	DSE (2007)	FFG ACT	National Action Plan	Likely use of study area
Pacific Golden Plover	*Pluvialis fulva*	2006	13	-	NT	-	-	7
Eastern Curlew	*Numenius madagascariensis*	1997	6	-	NT	-	-	7
Red Knot	*Calidris canutus*	2000	9	-	NT	-	-	7
Sanderling	*Calidris alba*	2000	8	-	NT	-	-	7
Latham's Snipe	*Gallinago hardwickii*	2004	26	-	NT	-	-	3
Australian Pratincole	*Stiltia isabella*	1950	2	-	NT	-	-	6
Glossy Ibis	*Plegadis falcinellus*	2000	15	-	NT	-	-	5
Nankeen Night Heron	*Nycticorax caledonicus*	1999	9	-	NT	-	-	4
Cape Barren Goose	*Cereopsis novaehollandiae*	2005	7	-	NT	-	-	5
Spotted Harrier	*Circus assimilis*	1987	11	-	NT	-	-	5
Black-eared Cuckoo	*Chrysococcyx osculans*	1987	2	-	NT	-	-	5
Long-toed Stint	*Calidris subminuta*	1986	6	-	NT	-	-	7
Pectoral Sandpiper	*Calidris melanotos*	1987	14	-	NT	-	-	7

Source: DSE Atlas of Victorian Wildlife (AVW 2007); DEWHA Protected Matters Search Tool (http://www.environment.gov.au/erin/ert/epbc/index.html)

Appendix 2 – Habitat descriptions for surveyed dams and drainage lines

Table A2.1 Habitat descriptions for dams and drainage lines surveyed for Growling Grass Frog surveys.

Site (see Figure 3)	Survey date/s	Waterbody type and size (approx. metres)	Dominant Aquatic flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF	Other frog species
1	23/11/2010 18/01/2010	Dam	*None*	Exotic Grasses, drainage line	Dense vegetation	Moderate	Gambusia	0	100	10	0	0	0	0	Crinia signifera, Limnodysnastes tasmaniensis, Limnodynastes dumerilii
2	23/11/2010 18/01/2010	Dam	*Phragmites australis, Juncus* sp.	Putting course, Exotic Grasses	Various landscaping	Moderate	None	5	95	95	40	0	0	0	Crinia signifera, Limnodysnastes tasmaniensis,
3	No Access	Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
4	23/11/2010 18/01/2010	Dam	*None – all topsoil had been removed during assessment.*	Exotic Grasses	Limited	Very Poor	Gambusia	0	0	0	0	0	0	0	Crinia signifera
5	23/11/2010 18/01/2010	Drainage Line	*Phragmites australis, Juncus* sp. *Exotic Pasture Grasses*	Cropping Land	Dense vegetation	Moderate	Gambusia Short-finned Eel	0	100	90	10	0	5	0	Crinia signifera, Limnodysnastes tasmaniensis, Limnodynastes dumerilii, Limnodynastes peronii
6	23/11/2010 18/01/2010	Drainage Line	*Phragmites australis, Juncus* sp. *Exotic*	Cropping Land	Dense vegetation	High	Gambusia Short-finned Eel	0	100	95	90	0	5	1	Crinia signifera, Limnodysnastes tasmaniensis, Limnodynastes

Site (see Figure 3)	Survey date/s	Waterbody type and size (approx. metres)	Dominant Aquatic flora	Surrounding habitat	Refuge sites	Water quality	Fish present	%CAN	%OP	%FR	%EM	%SUB	%FL	Max. abundance of GGF	Other frog species
			Pasture Grasses												peronii
7	23/11/2010	Dam	*Exotic Grasses*	Cropping Land	none	Dry	-	-	-	-	-	-	-	-	-
8	23/11/2010	Dam	*Phragmites australis,*	Cropping Land	Dense vegetation	Dry	-	0	100	95	90	0	0	-	-
9	23/11/2010	Dam	*Exotic grasses*	Cropping Land	Limited	Dry	-	0	100	95	0	0	0	-	-
10	No Access	Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
11	No Access	Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
12	No Access	Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
13	No Access	Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
14	No Access	Dam	-	-	-	-	-	-	-	-	-	-	-	-	-
15	23/11/2010 18/01/2010	Dam	*Phragmites australis, Juncus* sp.	Exotic Grasses	Limited	Poor	None	10	90	100	40	0	0	0	Crinia signifera
16	23/11/2010 18/01/2010	Dam	*Phragmites australis, Exotic Grasses Typha sp.*	Cropping Land	Limited	Poor	Gambusia	0	100	95	90	0	5	-	Limnodysnastes tasmaniensis,

Summary of Habitat Descriptions Used in Appendix A3:

%CAN: Percentage of Canopy over dam, %FR: Percentage of Fringing Vegetation, %SUB: Percentage of Submergent Vegetation

REFERENCES

References

Australian New Guinea Fish Association. *Aquatic Survey Database*. Available at: http://db.angfa.org.au/index.php?option=doco

Ashworth, J.M. 1998. An appraisal of the Conservation of *Litoria raniformis* (Kefferstein) in Tasmania. University of Tasmania March 1998. Unpublished Masters thesis.

AVW 2009. *Atlas of Victorian Wildlife*. Viridians Biological Databases Pty Ltd, Melbourne.

Barker, J., Grigg, G.C. & Tyler, M.J. 1995. A Field Guide to Australian Frogs. Surrey Beatty & Sons. New South Wales.

Biosis Research Pty Ltd 2008. Targeted Survey of Golden Sun Moth in the Melbourne Area. Unpublished report for FKP Property Group.

Cadwallader, P.L. & G.N. Backhouse. 1983. A guide to the freshwater fish of Victoria. Government Printers. Melbourne.

Carter, O. & Walsh, N. 2006. *National recovery plan for the Spiny Rice-flower (Pimelea spinescens subspecies spinescens)*. Department of Sustainability and Environment.

Carter, O. 2010. *National Recovery Plan for the Curly Sedge (Carex tasmanica)*. Department of Sustainability and Environment.

Cheal, D. 1990. Curly Sedge *Carex tasmanica*, In: Threatened Australian Plants, Leigh, J.H. and Briggs, J.D. (eds), Australian National Parks and Wildlife Service, Canberra.

Clarke, G.M. & C. O'Dwyer 1999. Further survey in southeastern New South Wales for the endangered golden sun moth, Synemon plana. Pg 77. *CSIRO Entomology*, Canberra.

Cogger, H. 1996. Reptiles and Amphibians of Australia. Reed Books, Sydney.

Cogger, H.G. 2000. Reptiles and Amphibians of Australia. Reed New Holland, Frenchs Forest.

Dear, C. 1996. Distribution of *Synemon plana*: a new encounter. Victorian *Entomologist* **26**: 26-28.

DEH 2000. Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and the Development of Version 5.1. - Summary Report, Department of Environment and Heritage, Canberra.

DEH 2006. EPBC Act Policy Statement 1.1 – Significant Impact Guidelines. Department of the Environment and Heritage, Canberra.

DEWHA 2008. Natural Temperate Grassland of the Victorian Volcanic Plain - A nationally threatened ecological community. Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA 2009. EPBC Act Policy Statement 3.11 – Significant Impact Guidelines for the Critically Endangered Spiny Rice-flower (*Pimelea spinescens* subsp. *spinescens*). Department of the Environment, Water, Heritage and the Arts, Canberra.

DSE 2005. Advisory List of Rare or Threatened Plants in Victoria – 2005. Department of Sustainability & Environment, Victoria, East Melbourne, Victoria.

DSE 2007. Advisory List of Threatened Vertebrate Fauna in Victoria –- 2007. Department of Sustainability & Environment, Victoria.

DSE 2007. Aquatic Fauna Database. Department of Sustainability and Environment, East Melbourne, Victoria.

DSE 2009. Flora and Fauna Guarantee Act 1988 Action Statement No. 68 – Large-fruit Fireweed *Senecio macrocarpus*.

Ecology Partners Pty Ltd 2008. Ecology Partners Pty Ltd Fish Survey Standard Operating Procedures. Unpublished report by Ecology Partners Pty Ltd

Ecology Partners Pty Ltd 2009. Preliminary Flora and Fauna Assessment, Werribee Employment Precinct, Werribee, Victoria. Unpublished report prepared for VicUrban.

Endersby, I & Koehler, S. 2006. Golden Sun Moth *Synemon plana*: discovery of new populations around Melbourne. The Victorian Naturalist **123**: 362-365.

FIS 2007. *Flora Information System*. Viridians Biological Databases Pty Ltd and Department of Sustainability and Environment, Melbourne, Victoria.

Gilfedder, L. & Kirkpatrick, J. B. 1996. The distribution, ecology and management of two rare Tasmanian sedges - *Schoenus absconditus* and *Carex tasmanica*. Papers and Proceedings of the Royal Society of Tasmania **130**: 25-30.

Gilmore, D., Koehler, S. O'Dwyer, C. & Moore, W. 2008. Golden Sun Moth *Synemon plana* (Lepidoptera: Castniidae): results of a broad survey of populations around Melbourne. Victorian Naturalist Vol. **125** (2).

Hamer, A.J., Lane, S.J. & Mahony, M. 2002. Management of freshwater wetlands for the endangered Green and Golden Bell Frog *Litoria aurea*: roles of habitat determinants and space. Biological Conservation **106**: 413-424.

Hammer M. 2002. The South East fish inventory: distribution and conservation of freshwater fishes of south east South Australia. Native Fish Australia (SA) Inc., Adelaide.

Heard, G.W., Robertson, P. & Moysey E.D. 2004a. Management Plan for the Growling Grass Frog *Litoria raniformis* within the 'Fairway Waters' development, Pakenham, Victoria. Unpublished report to Westmont Holdings Pty Ltd & Simons Builders Pty Ltd Wildlife Profiles Pty Ltd., Ecology Australia Pty Ltd.

Heard, G.W., Robertson, P. & Scroggie, M. 2004b. The ecology and conservation status of the Growling Grass Frog *Litoria raniformis* within the Merri Creek corridor. Wildlife Profiles Pty Ltd and Arthur Rylah Institute for Environmental Research.

Hero, J.M., Littlejohn, M. & Marantelli, G. 1991. Frogwatch Field Guide to Victorian Frogs. Department of Conservation and Environment, East Melbourne.

Hills, A. & R. Boekel (2003). *Flora & Fauna Guarantee Action statement - Large-fruit Groundsel Senecio macrocarpus*. Department of Sustainability and Environment.

Jackson, J.E. 2003. *Draft Tasmanian Galaxiidae Recovery Plan 2003-2007*. Inland Fisheries Service, Hobart.

Littlejohn, M.J. 1963. *Frogs of the Melbourne area*. Victorian Naturalist 79: P 296-304.

Littlejohn, M.J. 1982. *Amphibians of Victoria*. Victorian, Yearbook 85: P1-11

Maxwell, S., Burbidge, A. & Morris, K. 1996. *Action Plan for Australian Marsupials and Monotremes*. IUCN Species Survival Commission.

Mahoney, M. 1999. Review of the declines and disappearances within the bell frog species group (*Litoria aurea* species group) in Australia. In: Declines and Disappearances of Australian Frogs. The University of Newcastle, Newcastle, NSW.

McDowall, R.M. 1996. Freshwater Fishes of South-Eastern Australia. Reed Books, Sydney.

Morcom, L. 1999. *Flora & Fauna Guarantee Action statement - Curly Sedge Carex tasmanica*. Department of Sustainability and Environment.

Mueck, S. 2000. Translocation of Spiny Rice-flower (Pimelea spinescens subsp. spinescens) Laverton, Victoria. Technical report, Ecological Management and Restoration 1:111–116.

NRE 2002. Victoria's Native Vegetation Management: A Framework for Action. Department of Natural Resources and Environment, Victoria.

Organ, A. 2003a. Growling Grass Frog *Litoria raniformis* monitoring over the 2002/03 breeding period, Western Treatment Plant, Werribee, Victoria Unpublished report prepared for Melbourne Water by Biosis Research Pty Ltd

Organ, A. 2003b. Management Plan for the Growing Grass Frog *Litoria raniformis* at the Western Treatment Plant, Werribee, Victoria. Unpublished report prepared for Melbourne Water by Biosis Research Pty Ltd, Melbourne.

Organ, A. 2005. Growling Grass Frog *Litoria raniformis* Monitoring 2004/05, Western Treatment Plant, Werribee, Victoria. Unpublished report prepared for Melbourne Water by Biosis Research Pty Ltd

PPWCMA 2006. *Port Phillip and Westernport Native Vegetation Plan.* Port Phillip and Westernport Catchment Management Authority.

Robertson, P. 2003. Draft Flora and Fauna Guarantee Action Statement for the Growling Grass Frog, *Litoria raniformis*. (Department of Sustainability and Environment, Victoria).

Robinson, M. 2000. *A Field Guide to Frogs of Australia*. Reed New Holland, Sydney.

Saddlier, S., Jackson, J. and Hammer, M. 2008. *Final Draft of the National Recovery Plan for the Dwarf Galaxias Galaxiella pusilla*. Department of Sustainability and Environment, Melbourne.

Strahan, R. 2004. (ed) *The Mammals of Australia.* Reed New Holland, Sydney.

Sinclair, S.J. 2009. National Recovery Plan for the Large-fruit Groundsel *Senecio macrocarpus*. Department of Sustainability and Environment.

Tyler, M.J. 1997. The Action Plan for Australian Frogs. Environment Australia, Canberra.

Wager, R. & P. Jackson 1993. The Action Plan For Australian Freshwater Fishes. Australian Nature Conservation Agency, Canberra, ACT:

Walsh, N.G. & Entwisle T.J. 1994, Flora of Victoria, Volume 2 Ferns and Allied Plants, Conifers and Monocotyledons, Inkata Press, Royal Botanic Gardens, Melbourne.

Walsh, N.G. & Entwisle T.J. 1996, Flora of Victoria, Volume 3 Dicotyledons, Inkata Press, Royal Botanic Gardens, Melbourne.

Walsh, N.G. & Stasjic, V. 2007. *A Census of the Vascular Plants of Victoria*. Royal Botanic Gardens, Victoria.