Wyndham Vale, Proposed Retarding Basin:

Flora, Fauna, Net Gain and Targeted Surveys

Project: 10-078

Prepared for:

Melbourne Water

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Summary

Ecology Australia was commissioned by Melbourne Water in September 2010 to undertake a flora, fauna, Net Gain assessment and targeted fauna surveys within a c. 11 ha parcel of land, to the north of Macquarie Drive, Wyndham Vale.

Melbourne Water proposes to construct a retarding basin within the study area that aims to capture largely un-treated stormwater run-off from the surrounding catchment. The aim of this assessment was to determine the flora and fauna values of the study area, outline potential state and federal legislative implications and to provide recommendations for opportunities and constraints for the development of the retarding basin.

The targeted assessments included survey three fauna species listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Growling Grass Frog (*Litoria raniformis*) listed as Vulnerable under the EPBC Act, listed as threatened under the *Victorian Flora and Fauna Guarantee Act 1988* (FFG Act) and classified as Endangered in Victoria;
- Striped Legless Lizard (*Delma impar*) listed as Vulnerable under the EPBC Act, listed as threatened under the Victorian FFG Act and classified as Endangered in Victoria; and
- Golden Sun Moth (*Synemon plana*) listed as Critically Endangered under the EPBC Act, listed as threatened under the FFG Act and Critically Endangered in Victoria.

Flora Values

A total of 56 indigenous and naturalised exotic vascular plant species was recorded from the study area, of which 20 (36 %) are indigenous and 36 (64 %) are exotic. The majority of the study area supports Ecological Vegetation Class 132_62 *Lighter-soils* Plains Grassland of ± poor quality, with small areas supporting artefactual indigenous grassland vegetation and exotic grassland vegetation. A windrow of planted Sugar Gums (*Eucalyptus cladocalyx*) occurs along the western boundary.

All Plains Grassland occurring within the study area forms part of the threatened ecological community 'Natural Temperate Grassland of the Victorian Volcanic Plain' as listed under the federal *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*, and also comprises 'Western (Basalt) Plains Grassland Community' as listed under the Victorian *Flora and Fauna Guarantee* (FFG) *Act 1988*.

No plant species listed as rare or threatened under the commonwealth EPBC Act, the Victorian FFG Act or the Advisory List of Rare or Threatened Plants in Victoria (DSE 2005) were recorded during the field survey, or are considered likely to occur.

Fauna Values

Three main fauna habitats are recognised for the study area, these are: grassy vegetation; planted trees and exotic shrubs; and ephemeral drainage line and dam.

The grassy vegetation provides some key habitat elements required by many common native grassland dependent fauna species (e.g. tussock forming grasses, inter-tussock spaces and soil cracks), however the site has been subject to major soil disturbance during the removal of *in situ* and surface rocks. The degraded and ephemeral dam and drainage line, provide low habitat values for common water-dependent native fauna species when inundated.

During the surveys, 29 vertebrate fauna species were recorded within the study area. These comprised 23 bird species (including three exotic species); two mammal species (both exotic); two frog species and one reptile species. None of these species recorded are listed as threatened under the EPBC Act, the FFG Act or are otherwise considered threatened.

The Striped Legless Lizard, Growling Grass Frog and the Golden Sun Moth were not recorded during the current targeted surveys. These three species are considered to have a low likelihood of occurrence within the study area.

No other threatened fauna species previously recorded or predicted to occur within 5 km of the study area are considered to have a moderate or higher likelihood of occurrence due to the absence of suitable habitat.

Net Gain

Two Habitat Zones ranging from 37% to 47% of pre-European Condition were recorded in the study area, both of which were comprised of EVC 132_62 *Lighter-soils* Plains Grassland; no Scattered Trees were present. Habitat Zone 1 had a Conservation Significance of Very High and Habitat Zone 2 a Conservation Significance of High.

The proposed construction of the retarding basin will result in the loss of 1.03 Habitat Hectares (2.8 ha) of High Conservation Significance remnant Plains Grassland vegetation. The gain (offset) target for the loss is 1.55 Habitat Hectares.

As per information provided by the Client, the Department of Sustainability and Environment (DSE) have confirmed that as the site falls within Precinct Structure Plan 40 East, it is covered under the Melbourne Strategic Assessment. As such offsets for the removal remnant vegetation (all of which comprises EPBC-listed Natural Temperate Grassland of the Victorian Volcanic Plain) can be offset into the Western Grassland Reserve, and this can be done via a payment to DSE; as stated by DSE (August 2011) this is currently $137,500 per Habitat Hectare removed. Based on these figures the Client will meet all offset requirements through the payment of $213,125 to DSE.

Summary of Potential Impacts

Potential impacts associated with the proposed retarding basin on the ecological values within the study area and surrounding environs relate to:

- Loss of EVC 132_62 Lighter-soils Plains Grassland that comprises the threatened ecological communities 'Natural Temperate Grassland of the Victorian Volcanic Plain' as listed under the EPBC Act, and 'Western (Basalt) Plains Grassland Community' as listed under the Victorian FFG Act;
- Loss of grassland that provides habitat values for common reptile species (e.g. Common Blue-tongue Lizard) and grassland birds such as Stubble Quail;
- Potential changes to hydrology and associated potential floristic changes;
- Increased the invasion by environmental weeds.
- Litter accumulation within and downstream of the study area;
- A potential decrease in water quality during construction works flowing downstream into the Werribee West Drain and entering Lollypop Creek resulting in reduced vegetation quality and aquatic fauna diversity;
- Death or injury to common fauna species during construction activities.

Recommendations

Pre-Construction

- Where possible, retain remnant vegetation;
- The wetlands should be designed in accordance with Melbourne Waters key principles for Water Sensitive Urban Design;
- A combination of wetlands and bio retention ponds can be used to ensure that appropriate water filtration systems are installed and absorb the influx of nutrients (e.g. a wetland system);
- Incorporate sediment and pollution control measures (e.g. upstream sediment basin, sediment control fences, litter traps and other filtration devices) in accordance with best management practice and designed in accordance with water sensitive urban design principals; and
- Development of a wetland design that may attract and increase habitat diversity by providing a source of near permanent water and other resources for a variety of native fauna species.

Construction

- Appropriate fencing and No-Go signage should be used to define access restrictions and avoid accidental access/damage to vegetation that is to be retained;
- Implement sediment control measures in accordance with best management practice and designed in accordance with water sensitive urban design principals;

- During construction, do not store fill, excavated materials, fuels and oils near the drainage line or on remnant vegetation that is to be retained;
- Restore the site surrounding the development zone as soon as possible after construction with locally indigenous flora species of local provenance;
- Develop appropriate weed management and hygiene protocols; and
- Avoid works during heavy rainfall periods.

Post-construction

- Restore the site with locally indigenous flora species of local provenance;
- Sampling programs for water quality monitoring should follow existing Melbourne Water and Environment Protection Agency guidelines.

Further work

- Preparation of an Environmental Management Plan/Construction Management Plan to address the potential impacts and management strategies to be implemented pre-construction, during and post-construction (e.g. best management practices for urban run-off and water quality control).

1 Introduction

Ecology Australia Pty Ltd was commissioned by Melbourne Water in September 2010 to undertake a flora, fauna, Net Gain assessment and targeted survey for threatened fauna species within a c.11 ha parcel of land located to the north of Macquarie Drive, Wyndham Vale. The site is proposed for a retarding basin, as part of the Werribee West Development Services Scheme (DSS). Detailed flora and fauna assessments including, targeted fauna surveys have been previously undertaken within the study area (ABZECO 2010, 2009) and on adjacent land to the east (Practical Ecology 2008). This report therefore, aims to build on this knowledge and evaluate the flora and fauna values of the study area and identify possible opportunities and constraints for the proposed retarding basin development.

This assessment included targeted surveys for the following three threatened fauna species:

- Growling Grass Frog (*Litoria raniformis*) listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), listed as threatened under the *Victorian Flora and Fauna Guarantee Act 1988* (FFG Act) and classified as Endangered in Victoria (DSE 2007a);
- Striped Legless Lizard (*Delma impar*) listed as Vulnerable under the EPBC Act, listed as threatened under the Victorian FFG Act and classified as Endangered in Victoria (DSE 2007a); and
- Golden Sun Moth (*Synemon plana*) listed as Critically Endangered under the EPBC Act, listed as threatened under the FFG Act and Critically Endangered in Victoria (DSE 2009a).

2 Study Area

The study area is located within Wyndham Vale, approximately 30 km south-west of Melbourne (see Figure 1). The study area is approximately 11 ha and is bounded by residential development to the south (existing) and east (under construction) and agricultural areas (e.g. pasture) to the north and west. The study area is mostly flat with a slight undulation associated with the drainage line that continues into the upper reaches of the Werribee West Drain. A degraded ephemeral farm dam is also located on the drainage line. Werribee West Drain continues south-east under Boltan and Balan Roads before eventually flowing into Lollypop Creek south of Black Forest Road, Werribee. The drain and dam were dry during the first few months of assessment (e.g. from September till mid-November), then became inundated for the remainder of the survey period (e.g. till late February 2011). The study area has had a history of agricultural use with a large proportion of the area denuded of *in situ* and surface rock. Removed rocks have been stock piled on-site in 'rock jumbles'.

The study area is located within the Werribee West Development Services Scheme in the Wyndham City Council and forms part of the Port Phillip and Westernport Catchment Management Authority (CMA) region and Victorian Volcanic Plain bioregion. The site is currently zoned as Residential Zone 1 (R1Z) and Urban Growth Zone (UGZ). The site is not subject to any Environmental Significance Overlays.

The long term (1943-2010) average rainfall in the area is 540.7 mm (taken from Laverton), which falls relatively uniformly across the year with slight peaks in the spring months between September and November (Bureau of Meteorology 2011). While the rainfall over the last 10 years has been considerably lower than this average, the greater area has received a higher than average rainfall over the past 5 months (e.g. 579 mm from October 2010 till February 2011) (BOM 2011). The highest mean temperatures occur in January (25.6 ºC) while July is the coldest month (13.6 ºC) (Bureau of Meteorology 2011).

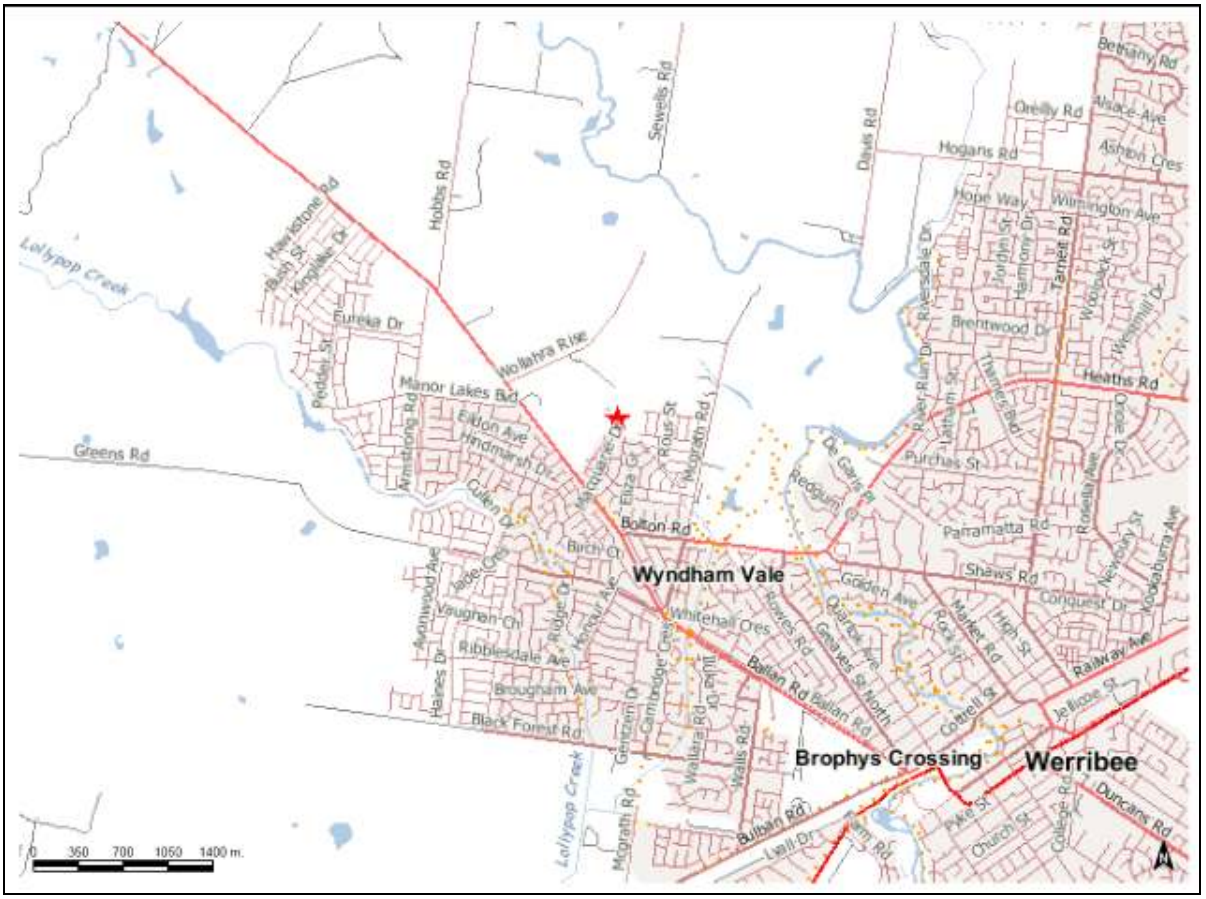

Figure 1 Macquarie Drive, Wyndham Vale – Proposed Retarding Basin: Approximate location of the study area shown by red star.

3 Methods

3.1 Desktop Review

Data and information were reviewed from databases and literature pertaining to the study area and surrounds, and included:

- Flora records within 5 km of the study area (referred to as the Data Review Area – DRA) held in the Flora Information System (FIS), a state-wide database maintained by DSE (DSE 2009a);
- Fauna records within 5 km of the study area (referred to as the Data Review Area - DRA) held in the Victorian Fauna Display (DSE 2009b), a CD-ROM version of the Atlas of Victorian Wildlife (AVW) database, maintained by DSE;
- A search for flora and fauna species listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), using the EPBC Protected Matters Search Tool (DSEWPC 2011) for species listed as potentially occurring (or potential habitat occurring) within 5 km of the study area;
- The Victorian Planning Schemes online (DPCD 2011);
- Aerial photography provided by the client and from Google Earth;
- Ecological Vegetation Class mapping/modelling (both extant and pre-1750) (DSE 2010a) of the area; and
- Ecological reports relevant to the study area (e.g. GHD 2007; Practical Ecology 2008; ABZECO 2009 and 2010).

3.2 Field Survey

3.2.1 Flora

The site was surveyed by two botanists on 28 October 2010 to identify and record vascular plant species and plant communities occurring within the study area, and potential impacts resulting from the proposed development.

Vegetation sampling

A species list of all indigenous and exotic plant species encountered was compiled. Floristic data collected were entered into the Flora Information System (FIS) database (DSE 2009a), and will be made available to the administrators of this database at DSE. The FIS was also used to generate an inventory of plant species recorded during the survey.

Remnant indigenous vegetation was assigned to an Ecological Vegetation Class (EVC) by reference to DSE's vegetation modelling (DSE 2010a) and EVC benchmarks (DSE 2010b). A Habitat Hectare assessment was completed for patches of remnant vegetation, following DSE's Vegetation Quality Assessment Manual (DSE 2004b).

3.3 Fauna

The site was surveyed by two zoologists on 28 September, 21 and 29 October, 9 and 30 November and 10 and 14 December 2010 and also the 5, 6, and 20 January and 14 February 2011. During these site visits and targeted surveys, fauna species and their habitats were recorded and identified and potential impacts resulting from the proposed development of a retarding basin in the study area were identified.

3.3.1 Habitat Assessment

The study area was assessed for its fauna habitat values, and potential to support threatened indigenous fauna, in particular the EPBC-listed Striped Legless Lizard (*Delma impar*), Growling Grass Frog (*Litoria raniformis*) and Golden Sun Moth (*Synemon plana*). The assessment first involved a review of aerial photographs and other maps, to gain an appreciation of the vegetation cover and to place the study area in a broader landscape context.

During the field survey, the habitat assessment focused on the extent of native vegetation cover, composition and structure of the vegetation, as well as other features important in determining habitat quality. For example, the presence or absence of rocky areas (in-situ rock), soil cracks, water bodies, stone walls, the level of disturbance (e.g. weed invasion) and shading, wetland vegetation and ground layer characteristics, including leaf litter, logs and rocks. Other habitat attributes noted include:

- Size and shape of patch;
- Connectivity (habitat links or corridors);
- Presence of specific habitat features (e.g. stony knolls, water bodies); and
- Structural heterogeneity of the vegetation.

3.3.2 Fauna Surveys

Fauna Inventory and Diurnal Searches

All vertebrates either directly observed, or heard calling (e.g. birds and frogs) during surveys were recorded to compile an inventory of fauna species. Active searches were carried out whenever observers were in the field, and involved raking litter on the ground, searching among fallen clumps of bark and branches and overturning rocks, and logs where these habitat elements were available (e.g. rock jumbles). Observers also searched for indirect evidence used to detect the

presence of animals, including bird nests, scats (droppings), diggings, tracks and burrows (Triggs 1996).

Targeted Surveys

Three threatened species recorded and/or predicted to occur within the fauna DRA require specialised methods of detection. Details of surveys undertaken for these species are provided below.

Golden Sun Moth (*Synemon plana*)

Targeted survey for Golden Sun Moth was undertaken on 14 December 2010, and 6 and 20 January and 14 February 2011. Targeted survey was severely restricted during the 2010/2011 flight season due to the unusually wet spring and summer over the greater Melbourne area. Observations of this species throughout Melbourne showed that the flight season appeared to be somewhat disrupted (e.g. delayed emergence and sporadic flight days – see Section 4.2.5 for further discussion) due to the high rainfall throughout November, December and January. As such, surveys were delayed until suitable weather conditions were present which resulted in targeted surveys being pushed back into January and February.

Surveys were undertaken on days when conditions were most favourable for detecting flying Golden Sun Moth and in accordance with DSE's protocols for detection and monitoring of this species. These conditions included warm sunny days above 25^{o}C, little or no wind, little or no cloud/fog and no rain. Surveys were conducted between 1000 hrs and 1600 hrs. Weather conditions were noted and the temperature was recorded with a hand-held digital thermometer at the beginning of the survey.

The technique used to record the presence and distribution of Golden Sun Moths was the transect method. This method has been used recently in other surveys for Golden Sun Moth in the region (Ecology Australia 2010, Gibson and New 2007, Gilmore 2007, Gibson 2008, Brian Bainbridge, MCMC, pers. comm.).

Two surveyors walked seven transects (approximately 30 m apart) across the entire site (see Figure 2). Transects were marked at the beginning and end with a hand held Global Positioning System (GPS). A hand tally counter was used to count any moths as the surveyor walked at an even pace along the transect line, looking in a c. 15 m arc for flying male moths.

Notes were taken regarding habitat features along transects. After conducting the transect surveys, additional time was spent looking for females and pupae cases.

Before commencing surveys, checks at sites known to support the Golden Sun Moth (e.g. Derrimut Grassland and Laverton North Grassland) were undertaken to see if moths are flying (i.e. moths have begun to emerge). Closer sites with Sun Moth populations are known e.g. Greens and Bulban Roads, Wyndham Vale but were not surveyed due to access restrictions on private property.

Incidental observations were also made in the land surrounding the study area during the surveys.

Striped Legless Lizard (*Delma impar*)

Targeted survey for Striped Legless Lizard involved two components: Active searches and artificial shelter site surveys.

Active searching

Active diurnal searches were undertaken concurrently with the setting of tiles and subsequent tile checks (see below). This method involves scraping or raking litter on the ground and overturning rocks, logs, fallen branches and human-generated debris to search for sheltering reptiles. Surveyors ensured that rocks, logs and other refugia were placed back in the same position to cause minimal disturbance. Active searches for the Striped Legless Lizard and other reptiles were conducted on 28 September, 21 and 29 October, 9 and 30 November and 10 and 14 December 2010.

Artificial shelter site surveys (e.g. roof tiles)

One of the most efficient methods of surveying for the Striped Legless Lizard is to conduct artificial shelter site surveys (tile surveys). This involves laying tiles in a grid formation within areas of potential habitat. The DSE's survey protocols for artificial shelter site surveys involves tiles set out in the winter months (June/July) and checked through the spring and summer months (September to December) for lizards sheltering underneath or for indirect evidence of lizard presence (e.g. sloughed skin).

As we were commissioned to undertake this project in mid-September, tiles were set out on 28 September 2010 and checked six times from late October to late December 2010. DSE protocols recommend one tile grid of 10 x 5 = 50 tiles, per two hectares for sites up to 40 hectares. Thus, within the study area, we placed 5 tile grids over the 11 ha site.

The tile survey was undertaken as follows:

- Five tile grids were placed within the study area comprising of 10 x 5 = 50 tiles each with 5 m spacing between tiles.
- The tiles were placed in vegetated areas within the most suitable habitat (grassy vegetation, with suitable cover and structure). Tiles were not placed in the drainage-lines, along the informal tracks around the boundary of the study area, or areas of predominantly bare ground (see Figure 2 for tile grid placement).
- Tiles were checked twice per month between October, November and December.
- The tiles were checked early in the morning to avoid warm temperatures. DSE's protocols state that tiles should be checked when ambient temperatures are below 25^{o}C.

It should be noted that a previous artificial tile survey has been undertaken within the study area (ABZECO 2009), with the two tile grids still present on-site during our current survey. These tiles were also checked during each site visit.

Growling Grass Frog (*Litoria raniformis*)

Targeted surveys for the Growling Grass Frog were undertaken in accordance with standard protocols for assessment, with two nocturnal surveys during the breeding season, on nights with suitable weather conditions are required to detect the presence of the Growling Grass Frog (Heard et al. 2006 and Alan Webster, DSE, pers comm.).

Targeted surveys for the Growling Grass Frog in the project area were undertaken at night using call playback (playing calls of male frogs and listening for a response) and also spotlighting along the banks of the dam and drainage line. Spotlight and call playback surveys were undertaken on 5 and 16 January 2011 between the hours of 2100 and 2300 DST, by two zoologists. A total of four person hours were spent spotlighting.

The following survey protocols were followed during each assessment:

- Upon arrival at a site (e.g. farm dam), a five minute period was spent listening for calling male frogs, and all frog species heard were recorded;
- If frogs were not heard calling, a short period (2-3 minutes) of call playback (pre-recorded Growling Grass Frog call) was used to initiate a response;
- Following this, a visual inspection of the site was made with the aid of binoculars and a hand-held 30 W spotlight to scan the aquatic vegetation and dam banks for frogs. Growling Grass Frogs have a distinctive eye-shine and can be detected from a short distance using this method;
- The dam and drainage line was traversed along the banks and grassy verges to search for active frogs;
- Searches were also conducted under surface debris for sheltering frogs;
- A hand-held GPS was used to record the location of all frogs (if present);
- If frogs were encountered, the number of individual frogs were counted or estimated when calling in chorus, and their activity and microhabitat recorded; and
- Any evidence of breeding activity, such as calling males, amplexus, tadpoles or metamorphs was also recorded.

Surveys for the Growling Grass Frog were limited to suitable weather conditions (i.e. night air temperature not less than 15ºC and absence of strong winds), and the following climatic conditions were recorded:

- Air temperature;
- Humidity;
- Previous rainfall;
- Wind levels; and

- Cloud cover.

Hygiene Protocols

Measures to reduce the possible spread of infectious pathogens (such as chytrid fungus) were implemented in accordance with standards described by the New South Wales National Parks and Wildlife Service (NPWS 2001). The following measures were used to mitigate the spread of disease between them:

- Footwear was thoroughly disinfected (saturated with bleach) at the commencement of fieldwork.
- Survey sites were only approached on foot to eliminate car tyres as a source of transmission.

3.4 Limitations

The seasonality of some plant species may be a limitation to the flora component of the survey. Some species may have been overlooked because they were inconspicuous when the survey was conducted, or have been identified to genus level only due to the absence of fertile material. These limitations are unlikely to alter the major findings regarding overall quality and significance of the vegetation.

The fauna survey was relatively brief and some species that occur or utilise the study area will not have been recorded. In particular, the cryptic and rare fauna species that are often the focus of threatened species legislation cannot always be expected to be detected. Other species may not have been recorded due to the seasonality of their occurrence in the study area (e.g. some nomadic or migratory bird species). These limitations have been mostly overcome through the use of the DSE databases, reviews of the literature, and the assessment of habitats for their suitability and potential to support rare and threatened species.

The Golden Sun Moth survey period was severely restricted due to the unusual weather condition over the 2010/2011 flight period. However, given that targeted survey for this species has been undertaken over two flight seasons and that the results are consistent (e.g. no Sun Moth recorded), it is considered unlikely that the weather conditions have significantly impacted on the survey results (see Sections 4.2.4 and 4.2.5 for further discussion).

Further, due to the commissioning of the project in mid-September, tiles for the Striped Legless Lizard were set out on 28 September and checked six times from late October to late December. As such, tiles were only allowed to weather-in for three weeks prior to the first tile check. Discussion of how this may impact on survey results is outlined in Section 4.2.5. Although the tiles were not left to 'weather in' for as long as recommended by DSE, given that the site has been previously surveyed for this species, and the tile grids from the 2009 (ABZECO) survey were still in place and checked by a zoologist during the site assessments, we consider that this reduced period of tile weathering will have had no to minimal impact on survey results.

3.5 Conservation Status

Species of State and/or National significance are determined by reference to DSE's advisory lists (DSE 2005a, 2007a, 2009c), listings under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) and the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and by reference to National Action Plans for vertebrates (Cogger et al. 1993, Maxwell et al. 1996, Tyler 1997, Garnett and Crowley 2000).

3.6 Nomenclature and Taxonomy

Plant taxonomy and the use of common names follow A Census of the Vascular Plants of Victoria (Walsh and Stajsic 2007) and the Flora Information System database (DSE 2009a). For fauna, scientific names, common names and systematic orders used here follow DSE (2009b).

The scientific names, common names, and systematic orders of fauna species follow: Churchill (1998), Stanger et al. (1998), Birds Australia (2003), Wilson and Swan (2003) and DSE (2009b).

In general, common names are used in the text. Where an asterisk (*) precedes a plant or animals name it is used to signify non-indigenous taxa, those species which have been introduced to Victoria or Australia. A hash (#) is used to denote Victorian native plants that are not indigenous to the relevant vegetation type.

4 Values

4.1 Flora

A total of 56 indigenous and naturalised exotic vascular plant species was recorded from the study area, of which 20 (36 %) are indigenous and 36 (64 %) are exotic. A list of these species is located in Appendix 1.

4.1.1 Vegetation communities

The study area supports highly-disturbed remnant and artefactual indigenous grassland vegetation, as well as exotic grassland vegetation. A windrow of planted Sugar Gums (*Eucalyptus cladocalyx*) occurs along the western boundary. A brief description of each community is outlined below.

Ecological Vegetation Class (EVC) 132_62 *Lighter-soils* Plains Grassland

The majority of the study area supports EVC 132_62 *Lighter-soils* Plains Grassland of ± poor quality. Weed cover was generally high throughout. Two Habitat Zones of Plains Grassland were identified (Figure 2) and are discussed in Section 4.1.3.

Dominant indigenous species were Brown-back Wallaby-grass (*Austrodanthonia duttoniana*), Bristly Wallaby-grass (*Austrodanthonia setacea*), Kneed Spear-grass (*Austrostipa bigeniculata*) and Windmill Grass (*Chloris truncata*). A small suite of indigenous herb species were present with low overall cover, and included Australian Stonecrop (*Crassula tetramer*a), Varied Raspwort (*Haloragis heterophylla*), Small Loosestrife (*Lythrum hyssopifolia*), Shady Wood-sorrel (*Oxalis exilis*) and Grassland Wood-sorrel (*Oxalis perennans*). The indigenous sub-shrub Berry Saltbush (*Atriplex semibaccata*) was also scattered throughout at low density.

Numerous weed species were present with overall weed cover exceeding 50% throughout much of the site. Given the abundance of several annual exotic grass species, overall weed cover is likely to drop significantly in some areas over summer-autumn. Commonly occurring weed species included Wimmera Rye-grass (**Lolium rigidum*), Bearded Oat (**Avena barbata*), Common Onion-grass (**Romulea rosea var. australis*), Ribwort (**Plantago lanceolata*), Buck's-horn Plantain (**Plantago coronopus*), Artichoke Thistle (**Cynara cardunculus*), Serrated Tussock (**Nassella trichotoma*) and Galenia (**Galenia pubescens* var. *pubescens*).

Non-remnant (artefactual) indigenous vegetation

Two locations were identified as supporting indigenous grassland vegetation of an artefactual nature. Vegetation in these areas is not considered to be remnant as it is: a) located on an artificial substrate, or b) dominated by species that are unlikely to have originally dominated the site (Modified Treeless Vegetation).

Modified Treeless Vegetation

The Department of Sustainability and Environment (2010c) define Modified Treeless Vegetation as 'vegetation that has more than 25% understorey cover that is native, but is now dominated by species that are unlikely to have originally dominated the site'.

Within the study area a linear strip of Modified Treeless Vegetation occurs in association with a planted windrow of Sugar Gums (*Eucalyptus cladocalyx*) on the western boundary (Figure 2). Indigenous understorey vegetation in this area was largely dominated by oppurtunistic small-shrub and scrambler species common in such situations within the region, most notably Bower Spinach (*Tetragonia implexicoma*), Seaberry Saltbush (*Rhagodia candolleana* ssp. *candolleana*), Ruby Saltbush (*Enchylaena tomentosa* var. *tomentosa*) and Berry Saltbush. A small suite of other indigenous species was present, as was a greater than 50% cover of predominantly dicot weed species (most notably *Galenia).

Indigenous vegetation on artificial substrate

A greater than 25% cover of indigenous Plains Grassland species (predominantly Kneed Spear-grass and Wallaby Grasses) occur on a spoil heap to the south of a dam (presumably generated during the construction of the dam) (Figure 2). Because this vegetation is located on an artificial substrate it cannot be considered 'remnant' (DSE 2007c) and is therefore not incorporated into Habitat Zones 1 or 2 as shown in Figure 2.

Exotic vegetation

A defined patch of exotic grassland was located in the centre of the site. Dominant species were *Wimmera Rye-grass, Perennial Rye-grass (**Lolium perenne*), *Bearded Oat and Barley-grass (**Hordeum leporinum*). Indigenous grasses occurred as scattered plants throughout with low overall cover.

4.1.2 Significant plant species

No plant species listed as rare or threatened under the *Commonwealth Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*, the Victorian *Flora and Fauna Guarantee* (FFG) *Act 1988* or the Advisory List of Rare or Threatened Plants in Victoria (DSE 2005) were recorded during the field survey.

Of the 401 vascular plant species previously recorded within 5 km of the study area (DSE 2009a), 15 species are listed as rare or threatened (Table 1). Of these, two are listed under the EPBC Act, eight are listed under the FFG Act and 13 are listed under the DSE Advisory List (DSE 2005). Six additional species were identified as potentially occurring within 5 km of the study area by the EPBC Protected Matters Search Tool (Table 1; DSEWPC 2010).

All species in Table 1 have been assigned a Likelihood of Occurrence within the study area, based on the following:

- Comparisons of site factors (climate, soils, topography) between the study area and sites known to support populations of each threatened species;
- General condition and land use history of the study area, i.e. level of disturbance;
- Date(s) and number of records; and
- Whether there is a reasonable expectation that the species would have been recorded during the field survey.

None of the threatened flora species listed below in Table 1 are considered likely to occur within the study area.

Best or Remaining 50% of habitat for rare or threatened flora species

The study area does not contain the best or remaining 50% of habitat for any rare or threatened flora species (as listed under DSE 2005a).

Table 1 Significant plant species recorded within a 5 km radius of the study area using the 'Flora Information System' and the 'EPBC protected matters search tool', with their likelihood of occurrence, October 2010.

Key:
VROT = Victorian rare or threatened: r = rare, e = endangered, v = vulnerable, k = insufficiently known, x = presumed extinct in Victoria;
FFG = Listed under the Flora and Fauna Guarantee Act 1988: f = FFG listed;
EPBC = Listed under the Environmental Protection and Biodiversity Conservation Act 1999: V = Vulnerable, E = Endangered.

Likelihood of occurrence: N = negligible; L = low; M = moderate; H = high

Species with a diamond (♦) after their name were not recorded within the 5 km search on the Flora Information System database, but were identified using the EPBC protected matters search tool.

FFG	EPBC	VROT	Scientific Name	Common Name	Likelihood of occurrence
f			*Allocasuarina luehmannii*	Buloke	N
		k	*Alternanthera* sp. 1 (Plains)	Plains Joyweed	N
	V		*Amphibromus fluitans* ♦	River Swamp Wallaby-grass	N
		r	*Atriplex paludosa* subsp. *paludosa*	Marsh Saltbush	N
	E	e	*Caladenia fragrantissima ssp. orientalis* ♦	Cream Spider-orchid	N
f	E	e	*Caladenia robinsonii* ♦	Frankston Spider-orchid	N
f	E	x	*Caladenia thysanochila* ♦	Fringed Spider-orchid	N
f		e	*Cullen parvum*	Small Scurf-pea	N
		v	*Eucalyptus leucoxylon* subsp. *connata*	Melbourne Yellow-gum	N
f	V	v	*Glycine latrobeana* ♦	Clover Glycine	N
		k	*Lachnagrostis filiformis* var. 2	Wetland Blown-grass	N
f	E	e	*Prasophyllum frenchii* ♦	Maroon Leek-orchid	N
		r	*Rhagodia parabolica*	Fragrant Saltbush	N
f	E	e	*Rutidosis leptorrhynchoides*	Button Wrinklewort	N
f	V	v	*Xerochrysum palustre* ♦	Swamp Everlasting	N

4.1.3 Significant ecological communities

Remnant vegetation within the study area was assessed to determine if it comprised the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed 'Natural Temperate Grassland of the Victorian Volcanic Plain' vegetation community (Critically Endangered) and/or the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) listed 'Western (Basalt) Plains Grassland Community'.

Natural Temperate Grassland of the Victorian Volcanic Plain (EPBC listed)

For vegetation to be considered Natural Temperate Grassland of the Victorian Volcanic Plain it must meet specific criteria as outlined in the policy statement for this community (DEWHA 2008). Remnant vegetation within the study area was assessed against these criteria and was identified as comprising this community on the grounds that:

- Indigenous perennial grasses of the genera *Austrodanthonia* and *Austrostipa* account for >50% of the perennial grass cover; and

- Non-grassy weeds account for <30% of the total vegetation cover; and
- The grassland patch is greater than 0.5 ha.

Therefore all patches of EVC 132_62 *Lighter Soils* Plains Grassland (as shown in Figure 2) comprise 'Natural Temperate Grassland of the Victorian Volcanic Plain'.

Western (Basalt) Plains Grassland Community (FFG listed)

It was determined that all Plains Grassland occurring within the study area forms part of the Western (Basalt) Plains Grassland vegetation community as listed under the FFG Act. The community is described in the benchmark for Plains Grassland Ecological Vegetation Class (DSE 2004a).

4.2 Fauna

4.2.1 Fauna habitats

The study area supports three fauna habitat types: Grassy vegetation; planted trees and exotic shrubs; and the ephemeral dam and drainage line.

Grassy Vegetation

This habitat type covers the vast majority of the study area and comprises predominantly of Plains Grassland vegetation community. The grassland provides some key habitat elements important for a variety of native fauna species including, tussock-forming grasses, soil cracks, and inter-tussock spaces (bare ground). However, due to a land history of cultivation on-site, most of the surface and sub-surface basalt rocks / small boulders have been removed and stocked in two piles on-site (e.g. rock jumbles).

The main types of fauna species associated with this modified grassy habitat within the study area include ground-dwelling birds that utilise tussock grasses for shelter and foraging (e.g. Stubble Quail and Australasian Pipit) and raptors that hunt over open grassland areas (e.g. Nankeen Kestrel). Further, the tussock grasses, soil cracks and rock jumbles are utilised for shelter by common reptile species (e.g. Blue-tongue Lizard and Tiger Snake) and bare ground patches for basking and foraging. The threatened grassland dependent fauna species (e.g. EPBC-listed Striped Legless Lizard and the Golden Sun Moth) were not recorded during the current or previous (e.g. ABZECO 2010) targeted fauna surveys in the study area (see Section 4.2.4 and 4.2.5 for further discussion). The soil disturbance associated with the rock removal is likely to have resulted in a loss of habitat suitability for the Striped Legless Lizard. Similarly, this disturbance is likely to have impacted on grassland habitat values for the Fat-tailed Dunnart (Listed as Near Threatened in Victoria – DSE 2007b).

Portions of the dense grassy vegetation of the study area were inundated during the site assessments. When inundated these areas may provide occasional foraging habitat for Latham's

Snipe *Gallinago hardwickii* - classified as Near Threatened in Victoria (DSE 2007a) and listed under the Migratory and Marine Schedules of the EPBC Act 1999. This species is further discussed in Section 4.2.5.

Exotic species such as *Rabbits (*Oryctolagus cuniculus*) would utilise the grassland habitat for foraging. *Rabbits were observed adjacent to the study area.

The exotic vegetation on-site, provides low habitat values for most native fauna species, but may be used by open-country birds (e.g. Australian Magpie) and also locally common reptile species as described above.

Planted trees and exotic shrubs

A windrow of planted Sugar Gums is present within the study area. These trees are utilised by common birds (e.g. Australian Magpie, Little Raven, Galah, and *Indian Mynas) for perching, roosting and nesting. Straw-necked Ibis was also observed utilising these trees for perching, after foraging within the farm dam. Exotic shrubs (e.g. *Box-thorn) are scattered across the site, mostly under the Sugar Gums. These shrubs mostly support small passerine birds such as Yellow-rumped Thornbill (observed on-site) and other species such as the Superb Fairy-wren.

Ephemeral Drainage line / Dam

The unnamed drainage line extends from the north-west to the south-east of the study area, with a farm dam situated on-line in the north-west corner of the site. The dam and drainage line are ephemeral and support exotic grassy vegetation and other weeds (e.g. Galenia, thistles, etc.), with no emergent, submergent or floating aquatic vegetation. The drain and dam were dry between September and mid-November, after which the heavy rains resulted in complete inundation that continued throughout the remainder of the site assessments (e.g. to mid-February). Downstream, the drainage line connects to the Werribee West drain (see Section 4.2.2). Upstream, the drainage line peters out into a shallow depression north-west of site and appears to capture overflow from a large farm dam on the neighbouring property and run-off from the mostly agricultural areas to the north-west.

Given the intermittent input of water, the drain and dam provides low habitat values for most water-dependent native fauna species. When inundated, these degraded waterbodies provide low habitat values for common water dependant fauna species such as frogs (e.g. Spotted March Frog *Limnodynastes tasmaniensis* and Eastern Banjo Frog *Limnodynastes dumerilii*) and birds (e.g. Pacific Black Duck, Chestnut Teal and Straw-necked Ibis), as observed during the site assessments. Water dependent species such as frogs are likely to be able to persist in larger pools upstream (e.g. large farm dam to the north-west and move into the study area after heavy rain events. Given the degraded nature of the dam and intermittent input of water, the dam is considered unlikely to support the EPBC-listed Growling Grass Frog and this species was not recorded during the targeted surveys (also refer to Section 4.2.5).

4.2.2 Landscape Context

The study area is bounded by residential development to the south (existing) and east (under construction) and is connected to larger areas of pasture / grassland to the north and west towards the Werribee River.

When inundated, the drain may provide some connectivity for common water dependent species such as frogs (as outlined above). Downstream of the study area, the drainage line connects to the Werribee West Drain that continues south-east under Boltan and Balan Roads before flowing into Lollypop Creek south of Black Forest Road, Werribee. The Werribee West Drain is a highly modified waterway consisting of underground piping, large open grassy swales through residential areas and channels that may present a barrier to dispersal for most fauna species. Lollypop Creek flows south through Werribee and Cocoroc, eventually entering the Western Treatment Plant, part of the Ramsar listed wetland: Port Phillip Bay (western shoreline) and Bellarine Peninsula, c. 6 km south of the study area.

4.2.3 Recorded Species

During the surveys, 29 vertebrate fauna species were recorded within the study area. These comprised 23 bird species (including three exotic species); two mammal species (both exotic); two frog species and one reptile species (Appendix 2).

Striped Legless Lizard, Growling Grass Frog or the Golden Sun Moth were not recorded during the targeted surveys. See below for further results of the survey and discussion of the likelihood of regular occurrence for these EPBC-listed species.

No other rare or threatened fauna species were recorded on-site. Most of the native fauna known or likely to occur within the study area are generally adapted to modified grasslands in semi-rural areas. These are predominantly bird species, and those recorded during the assessment are common and frequently occur within the Greater Melbourne region.

Some potential habitat exists for other threatened fauna; these are discussed in Section 4.2.5.

4.2.4 Targeted Fauna Survey Results

Striped Legless Lizard surveys

Six tile checks and active searching were undertaken between October and December 2010 by two zoologists. During the surveys, no Striped Legless Lizards were recorded. One reptile species was recorded: Common Blue-tongue Lizard. Table 2 outlines the results of each of the surveys. Discussion of the likelihood of occurrence for Striped Legless Lizard within and surrounding the study area is outlined below in Section 4.2.5.

Table 2 Wyndham Vale, Proposed Retarding Basin: Results of Striped Legless Lizard tile surveys (October – December 2010).

Date	Tile Check #	Time	Weather conditions	Species recorded
Tiles laid 28/9/2010				
21/10/2010	Tile Check 1	7.45 am to 9 am	Cool, c. 11°C, Moderate to low wind, clear skies	None
29/10/2010	Tile Check 2	7.30 am – 8.30 am	Mild ~ 19 °C, slight wind	1 x Common Blue-tongue Lizard
9/11/2010	Tile Check 3	7.30 am – 8.45 am	Mild with a moderate breeze, 17°C	1 x House Mouse and 1 x Common Blue-tongue Lizard
30/11/2010	Tile Check 4	9 am – 11 am	Clear skies, slight wind, 16°C	1 x House Mouse
10/12/2010	Tile Check 5	8.30 am - 10 am	Rain previous evening, mostly clear skies, 15°C	2 x House Mouse
14/12/2010	Tile Check 6	9 am - 10 am	Mostly clear skies, 18°C, slight breeze	2 x House Mouse

Golden Sun Moth surveys

Four Golden Sun Moth transect surveys were undertaken by two zoologists between December 2010 and February 2011. No Golden Sun Moths were recorded during the targeted assessments. Results of the surveys are summarised in Table 3. Discussion of the likelihood of occurrence for Golden Sun Moth within and surrounding the study area is outlined below in Section 4.2.5.

Table 3 Wyndham Vale, Proposed Retarding Basin: Results of Golden Sun Moth surveys (December 2010 – February 2011).

Site	Start time	Weather conditions	Number recorded
Survey 1: 14/12/10			
Study area	10.30 am – 11.45 am	Warm 23°C, cloudy, slight wind	None
Reference site - Derrimut grassland	1 pm	As above	None
Survey 2: 6/1/11			
Study area	1.45 pm to 2.45 pm	Warm, no cloud cover, no wind, 26°C	None
Reference site - Derrimut grassland	10.50 am to 12.15pm	As above	One male Golden Sun Moth
Survey 3: 20/1/11			
Study area	12 pm – 1.10 pm	Sunny, clear skies, slight wind, 24°C	None
Reference site - Derrimut grassland and Greens Road, Wyndham Vale	10.30 am to 11.30 am	As above	None
Survey 4: 14/2/11			
Study area	11 am – 12 pm	Sunny and warm, some cloud cover, no wind, ~ 25°C	None
Reference site - Derrimut grassland and Laverton North Grassland	1.30 pm to 3 pm	As above	None

Growling Grass Frog

Growling Grass Frog was not recorded within the dam or along the drainage line within the study area. Two common frog species were recorded during the diurnal and nocturnal field surveys: Spotted Marsh Frog (*Limnodynastes tasmaniensis*) and Eastern Banjo Frog (*Limnodynastes dumerilii*).

Table 4 Wyndham Vale, Proposed Retarding Basin: Results of the Growling Grass Frog survey (January 2011)

BOM – Bureau of Meteorology

Date	Time	Air temp (approx.)	Cloud Cover (0-8)	Rain mm/day (from BOM -Laverton)	Species Recorded
5/1/11	9.45 pm – 10.45 pm (2 person hours)	19.2°C	6	0 mm	5 to 10 adult male Spotted March Frog males calling 100 + sub-adult Spotted Marsh Frogs 1 x Eastern Banjo Frog
16/1/11	9.15 pm	18°C,	8	0 mm on day, 13 mm previous day	1 to 5 adult male Spotted Marsh Frog 30-50 sub-adult Spotted March Frogs 1 x Eastern Banjo Frog

4.2.5 Significant Species

Victorian Fauna Database

A number of threatened fauna species have been previously recorded within 5 km of the study area for the fauna DRA (DSE 2009b) (Appendix 3). These include:

- Five species listed under the EPBC Act (Southern Brown Bandicoot *Isoodon obesulus obesulus*, Eastern Barred Bandicoot *Perameles gunnii*, Plains-wanderer *Pedionomus torquatus*, Growling Grass Frog *Litoria raniformis* and Australasian Bittern *Botaurus poiciloptilus*);
- Two species listed under the FFG Act (Blue-billed Duck *Oxyura australis* and Great Egret *Ardea alba*);
- Seven species classified as threatened in Victoria (DSE 2007a) (Nankeen Night-Heron *Nycticorax caledonicus hilli*, Grey Goshawk *Accipiter novaehollandiae*, Australasian Shoveler *Anas rhynchotis*, Latham's Snipe *Gallinago hardwickii*, Australian Pratincole *Stiltia isabella*, Brown Quail *Coturnix ypsilophora*, Royal Spoonbill *Platalea regia*); and

- One species classified as threatened under a National Action Plan (Koala *Phascolarctos cinereus*).

For most threatened fauna previously recorded for the DRA, the study area does not support suitable habitat. For example, the study area does not contain habitat for the Southern Brown Bandicoot and Eastern Barred Bandicoot. The latter is a grassland species and one of the most endangered mammals in Victoria, with only one remnant population on the mainland (e.g. Hamilton, Victoria) and a few highly managed reintroduced populations.

Australasian Bittern are found in coastal and sub-coastal wetlands, preferring those with tall reed beds of Cumbungi (*Typha* spp.), sedges and rushes for foraging and shelter and are unlikely to utilise the study area for shelter or foraging. The dam and drainage line are also unsuitable habitat for many of the threatened duck species such as Blue-billed Duck and the Australasian Shoveler that show a preference for large, deep and permanent wetlands that are well vegetated. Furthermore, Royal Spoonbill inhabits large shallow marine or freshwater wetland and tidal estuaries. Although this species will utilise inundated grasslands and artificial habitats such as dams, it is considered to have a low likelihood of regular occurrence, given the degraded nature of the site. Similarly, the Great Egret is not expected to be a regular visitor to the study area and may only visit occasionally during times of grassland inundation.

EPBC Protected Matters Search Tool

The Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC) EPBC Protected Matters Search Tool (DSEWPC 2011) identified a further 10 species listed as threatened under the EPBC Act, as potentially occurring or suitable habitat potentially occurring within a 5 km radius of the study area (Appendix 3). These include three birds (Regent Honeyeater *Anthochaera phrygia*, Swift Parrot *Lathamus discolour*, Australian Painted Snipe *Rostratula australis*), three mammals (Grey-headed Flying Fox *Pteropus poliocephalus*, Spot-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) and New Holland Mouse *Pseudomys novaehollandiae*), two reptiles (Grassland Earless Dragon *Tympanocryptis pinguicolla* and Striped Legless Lizard *Delma impar*), and two fish (Dwarf Galaxias *Galaxiella pusilla* and Australian Grayling *Prototroctes maraena*).

The study area is not considered likely to regularly support or contain suitable habitat for most of these vertebrate species. For example, both the Regent Honeyeater and Grassland Earless Dragon are considered to be extinct in southern Victoria. Most of these species identified in the DSEWPC search have either never occurred, not recently been recorded in the vicinity of the study area or suitable habitat does not exist within the study area. The DSEWPC database predicts these species to occur on the basis of broad drainage basins and Bioclim modelling. Therefore, the predicted occurrences of some species extend well beyond their natural range.

The likelihood of occurrence for the Striped Legless Lizard is discussed below.

Note: The likelihood of regular occurrence for Golden Sun Moth is also discussed below, this species is not recorded on the AVW (DSE 2009b) or predicted to occur on the EPBC Protected Matters Search Tool but populations of this species exist within 5 km of the study area.

Species listed under the Migratory and/or Marine Overfly Schedules of the EPBC Act

There are 50 species that have previously been recorded for the DRA which are listed under the Migratory and/or Marine Overfly Schedules of the EPBC Act.

Ten of these species were recorded within the study area during the site assessments (see Appendix 2 and 3). All ten species are considered common within the region. A further 14 of these species have a moderate or higher LRO in the study area due to the presence of suitable habitat (Appendix 3). None of these species are considered to be rare or threatened. The study area does not support an ecologically significant population, represent the edge range for a species and does not constitute 'important' or limiting habitat for those species with a moderate or high LRO. All of the remaining migratory species, all are common species in the region except one: Latham's Snipe listed as Near Threatened in Victoria (DSE 2007a). This species is considered to have a low-moderate likelihood of occurrence within the study area and is discussed briefly below.

No Migratory and Marine Overly species predicted to occur on the EPBC Protected Matters Search is likely to occur in the study area due to the lack of suitable habitat.

The likelihood of regular occurrence (LRO) of threatened species most relevant to the study area and surrounds is discussed below. The assessment of LRO is based upon: reporting rates (i.e. number, distribution and age of records) of the species as given in the AVW Records (DSE 2009b); their known habitat requirements; the presence of suitable habitat on the study area; and results of the field inspection and literature review (Appendix 3).

Species listed under the Federal Environment Protection and Biodiversity Conservation Act 1999

Striped Legless Lizard (*Delma impar*)

Prior to European settlement, the Striped Legless Lizard was probably quite common and widely distributed across the native lowland grassland areas of south-eastern Australia. Ensuing loss and modification of grassland habitats through varying land uses such as developments (e.g. residential and industrial) and agricultural practices have substantially reduced and degraded the available habitat for this species (Webster et al. 2003).

Little is known of the ecology of the Striped Legless Lizard due to its highly cryptic nature. Basic information such as population size, densities and home range sizes is lacking (Webster et al. 2003). Initially it was thought that suitable habitat for Striped Legless Lizard consisted of relatively undisturbed native grassland and grassy woodland, with a dense groundcover, on flat or undulating plains (Coulson 1990; Cogger et al. 1993; Smith and Robertson 1999). Recent observations however, have shown that this species also can occur in degraded grassy environments, including areas dominated by exotic grasses and some with a history of grazing and pasture improvement (Coulson 1995; Smith & Robertson 1999). It seems that Striped Legless Lizard can utilise areas that retain a suitable tussock grass structure, as long as the soil has not had major disturbances such

as ploughing. Many of the known locations of this lizard are within areas that are grazed by introduced herbivores, however, the intensity of grazing they can withstand is unknown.

There are no records for the Striped Legless Lizard within the fauna DRA (DSE 2009b), although this could reflect the lack of survey effort rather than the absence of individuals or populations. The closest known records of this species occur along Lollypop Creek at Quandong, 8 km to the north-west of the study area and the RAAF Laverton Airbase in 1997, 10.8 km north-east of the study area.

The Striped Legless Lizard was not detected in both the current targeted surveys and those undertaken between November 2009 and February 2010 (e.g. ABZECO 2010) (see also Section 4.2.4). During the current assessment, the tiles were placed out at the end of September and allowed to 'weathered in' for only three weeks prior to the first tile check in late October (e.g. tiles should ideally be placed in July). This also reduced the survey effort from the recommended eight (e.g. two per month during September, October, November and December) to only six tile checks between October and December. This is not considered to have impacted on the survey results due to the absence of records over two 'active' seasons and further, the current surveys also included checks of tile grids placed by ABZECO in late 2009, thus allowing these tile grids to 'weather in' for at least 15 months prior to checking in late 2010.

Although the Plains Grassland and exotic grassy vegetation of the study area provides some habitat elements important for the Striped Legless Lizard (e.g. tussock-forming grasses, soil cracks and inter-tussock spaces), the majority of the site has been subject to major soil disturbance due to a land use history of cultivation and removal of most the *in situ* and surface basalt rocks / boulders. The Striped Legless Lizard can inhabit native and exotic grasslands with a history of some disturbance (e.g. grazing), however, the soil disturbance associated with the rock removal is considered to have significantly lowered habitat suitability for this species on-site. It is likely that if any historical population existed on-site, this major soil disturbance would have impacted on their survival. The surrounding land to the north and west appears to have had a similar history of land use and rock removal and therefore it appears unlikely that the Striped Legless Lizard could recolonise from nearby populations. As such, the Striped Legless Lizard is considered to have a low likelihood of regular occurrence within the study area.

Golden Sun Moth (*Synemon plana*)

The Golden Sun Moth is a small, day-flying moth that was historically distributed widely across native temperate grasslands and open grassy woodlands through New South Wales, ACT, and Victoria to the South Australian border (DEWHA 2009). Potential habitat for this species includes all areas which have, or once had, native grasslands or grassy woodlands (including derived grasslands), with areas of bare ground, stony knolls and Gilgai formation (DEWHA 2009).

Until recently, the Golden Sun Moth was considered to only utilise areas with at least 40% cover of Wallaby-grass species. However, over the last five years observations suggest that this is no longer the case, with populations recorded in areas dominated by Wallaby Grasses

(*Austrodanthonia* spp.) to areas supporting Spear Grasses (*Austrostipa* spp.) and Kangaroo Grasses (*Themeda triandra*), through to exotic grasslands dominated by Chilean Needle-grass (**Nasella neesiana*) a weed of National Significance (DEWHA 2009, Bainbridge et al. 2006, Gilmore 2007, pers. obs.).

Golden Sun Moth lay eggs on these grass species with moth larvae burrowing into the plant to feed on underground parts. Adults generally begin to emerge from the ground in late October and are by and large only active during the warmest parts of the day from October/November through to early January (Cook and Edwards 1993; Gibson and New 2007). Compared to the males, females of this species are relatively sedentary and attract males by flashing their golden hind wings. Adults have a life span of only a few days, as they lack functional mouthparts, and are not able to eat during their adult life (O'Dwyer and Attiwil 2000).

Prior to 2003, there were only four records of Golden Sun Moth for Victoria (ACT Government 1998; AVW, DSE 2009b; Gilmore 2007). However, in recent years the drier climate has apparently produced more favourable conditions for the Golden Sun Moth (e.g. a more open grassland habitat supporting a moderate cover of food-plants). Consultants and researchers have also undertaken more surveys, and gained a better understanding of the species' broader habitat requirements and the specific survey conditions required. As a result, the Golden Sun Moth has been identified to occur in well over 40 new sites (possibly considered to be several large populations rather than individual populations) within the greater Melbourne region (Gilmore et al. 2008; Alan Webster, DSE, pers. com.) and recent surveys will also add to this number. Many of the extant populations recently recorded are across the western basalt plains, including areas within Wyndham Vale (Daniel Gilmore, Biosis Research, pers. comm.), Craigieburn, Epping, Wollert, Greenvale, Campbellfield and the Merri Creek valley (Bainbridge et al. 2006, Endersby and Koheler 2006, Gilmore 2007, Gilmore et al. 2008).

The AVW does not contain any records of the Golden Sun Moth within 5 km of the study area (DSE 2009b). However, recently populations of this species have been recorded in the surrounding area including: Bulban and Greens Roads, Wyndham Vale (DSE 2010a; Daniel Gilmore, Biosis Research pers. comm.), approximately 2 km north-west and 6 km south-west of the study area respectively.

The study area supports some suitable habitat elements within the study area such as the presence of potential food plants (e.g. Wallaby Grasses *Austrodanthonia* spp.) and inter-tussock spaces (e.g. patches of bare ground for females displaying), however, this species was not recorded during the current (2010 / 2011 flight season) or previous targeted surveys undertaken during the 2009 / 2010 flight season (ABZECO 2010).

Derrimut Grasslands was used as a reference site for the study area, within only one male Sun Moth recorded flying on the same day as the study area surveys (see Table 3 for survey results). Closer sites were attempted to be surveyed (e.g. Greens Road, Wyndham Vale) but were unavailable due to access restrictions on private property. Communication with consultants surveying the Greens Road site, identified that the Sun Moth was observed flying up until late December 2010 (Daniel Gilmore, Biosis Research, pers. comm.).

Despite the unusual weather conditions during the 2010 / 2011 flight season (cold with heavy and prolonged rain events during October, November and December 2010) potentially delaying the emergence of this species and severely restricting survey ability (e.g. surveys undertaken on clear, sunny days, above 20° C by 10 am), the Sun Moth is considered to have a low likelihood of regular occurrence within the study area (Low LRO). The weather conditions are considered unlikely to have significantly impacted on the survey results given that this species was not recorded over two consecutive flight seasons (e.g. 2009 / 2010 and 2010 / 2011).

Growling Grass Frog (*Litoria raniformis*)

The Growling Grass Frog is listed as Vulnerable under the EPBC Act, listed as threatened under the FFG Act and classified as Vulnerable in Victoria (DSE 2007a). This large species has been reported to occur in a wide variety of wetland habitats. Growling Grass Frogs are highly mobile, and drainage lines, creeks and rivers, are important for the landscape ecology of the species, facilitating dispersal, movement between wetlands and the passage of individuals between sub-populations. A number of suitable wetlands in close proximity to one another (e.g. less than 500 m apart), are essential to accommodate for dispersal, provided there are no or few barriers such as sealed roads or housing (Wildlife Profiles 2002).

There are three records of the Growling Grass Frog within 5 km of the study area. These include records to the south of Greens Road, Mambourin in 1989, records along the Werribee River in 1987 and records along Lollypop Creek in 1988, approximately 2.4 km to the south-west, 3.6 km to the south-east and 5.4 km to the north-west of the study area, respectively.

The Growling Grass Frog was not recorded within the study area during the targeted surveys. The Growling Grass Frog is considered to have a low likelihood of regular occurrence (Low LRO) within the study area due to:

- Poor quality habitat within the degraded ephemeral dam and drainage line (e.g. intermittent water and no emergent, submergent or floating vegetation);
- No recent records (last 20 years) or known populations of the Growling Grass Frog within 3 km of the study area (i.e. thus the likelihood of the species moving through the study area is very low);
- Numerous fish observed in the dam that are likely to be the exotic and predatory Eastern Gambusia *Gambusia holbrooki* (e.g. washed into the dam during the recent flooding events) (John McGuckin, Streamline Research, pers. comm.). Eastern Gambusia are a potential predator of the Growling Grass Frog eggs and tadpoles (Anstis 2002) and have been implicated in the decline of this species (Robertson et al. 2002) thus further degrading habitat values for the Growling Grass Frog on-site.

Species otherwise classified as threatened in Victoria (DSE 2007a)

Latham's Snipe *(Gallinago hardwickii)*

Latham's Snipe is listed under the Migratory and Marine Overfly Schedules of the EPBC Act and is classified as 'Near Threatened' in Victoria (DSE 2007a).

This species is a summer migrant to Victoria from breeding grounds in Japan and the Kurile Islands. Latham's Snipe disperse widely upon arrival in Victoria, occupying a range of permanent and ephemeral wetlands throughout the state, except for in the dry north-west (Higgins and Davies 1996, Emison et al. 1987). They have previously been recorded in bogs, swamps, lagoons, lakes, marshes, billabongs, creek and drainage lines and rank, inundated grasslands. In particular this species prefers fresh meadows and seasonal and semi-permanent swamps.

There are four records for Latham's Snipe within the DRA. The two most recent are from records in 2006 located along Lollypop Creek, 2.4 km to the west and 2.6 km to the south-east of the study area.

When inundated the dense cover of exotic grasses within and adjacent to drainage line and dam may provide suitable foraging and shelter habitat for Latham's Snipe during the migration period to Victoria (i.e. August to March). However, the highly ephemeral nature of the drainage line may restrict suitability of this site for regular visits or for a large number of Snipe (e.g. the drainage line only inundated after multiple and heavy rain events over a couple of months). It is considered unlikely that the study area supports important habitat for this species as determined by the Draft EPBC Act Policy Statement for Migratory Species – Significant Impact Guidelines for 36 Migratory Shorebird Species (DEWHA in prep.). Individuals of this species are considered likely to utilise the area occasionally only during times of inundation and as such, Latham's Snipe is considered to have a low - moderate likelihood of regular occurrence within the study area.

Fat-tailed Dunnart (*Sminthopsis crassicaudata*)

The Fat-tailed Dunnart is a small dasyurid that occurs widely in southern Australia (Strahan 1995). This species predominantly inhabits sparse grasslands and low, open shrublands with areas of bare ground. Other habitats include grassy and open woodland, samphire shrubland, low shrubland of saltbush and bluebush, tussock grassland on clay or sandy soils, and gibber plain. A key habitat requirement for the Fat-tailed Dunnart is the availability of nest sites, typically located in cavities under rocks, logs or in deep cracks in the soil in arid regions. Individuals shelter in nests of grass and other plant material to avoid temperature extremes (Menkhorst 1995a, Morton 1995). The Fat-tailed Dunnart is sometimes found to occur in farmland because of its preference for sparse grassland and low shrubland; however, it is unlikely to occur in heavily degraded grasslands or farmlands (Morton 1995). This species has been known to survive well in pastoral areas with adequate rocks or logs for nesting in. However, with intensive farming practices, such as the cultivation of improved pastures and removal of rocks, logs and stumps, occurrences in these areas are becoming rarer.

There are no records of the Fat-tailed Dunnart from the fauna DRA (AVW, DSE 2009b). This is likely to reflect lack of survey rather than the absence of individuals or populations. Although some suitable habitat attributes for this species (e.g. tussock grasses, soil cracks) may exist within the study area, the site disturbance from removal of basalt rocks and boulders is considered to have severely impacted on the habitat suitability for this species. The Fat-tailed Dunnart can often be detected through the use of artificial tile surveys (i.e. they use the tile for shelter and/or nesting) and active searches (e.g. rock rolling) (pers. obs.), however no individuals or indirect signs (e.g. scats or nests) were observed. Further, considering the presence of predators within the area (e.g. notably foxes), if the species is present in the surrounding landscape, it is likely to be in low abundance. Fat-tailed Dunnart are considered to have a low LRO.

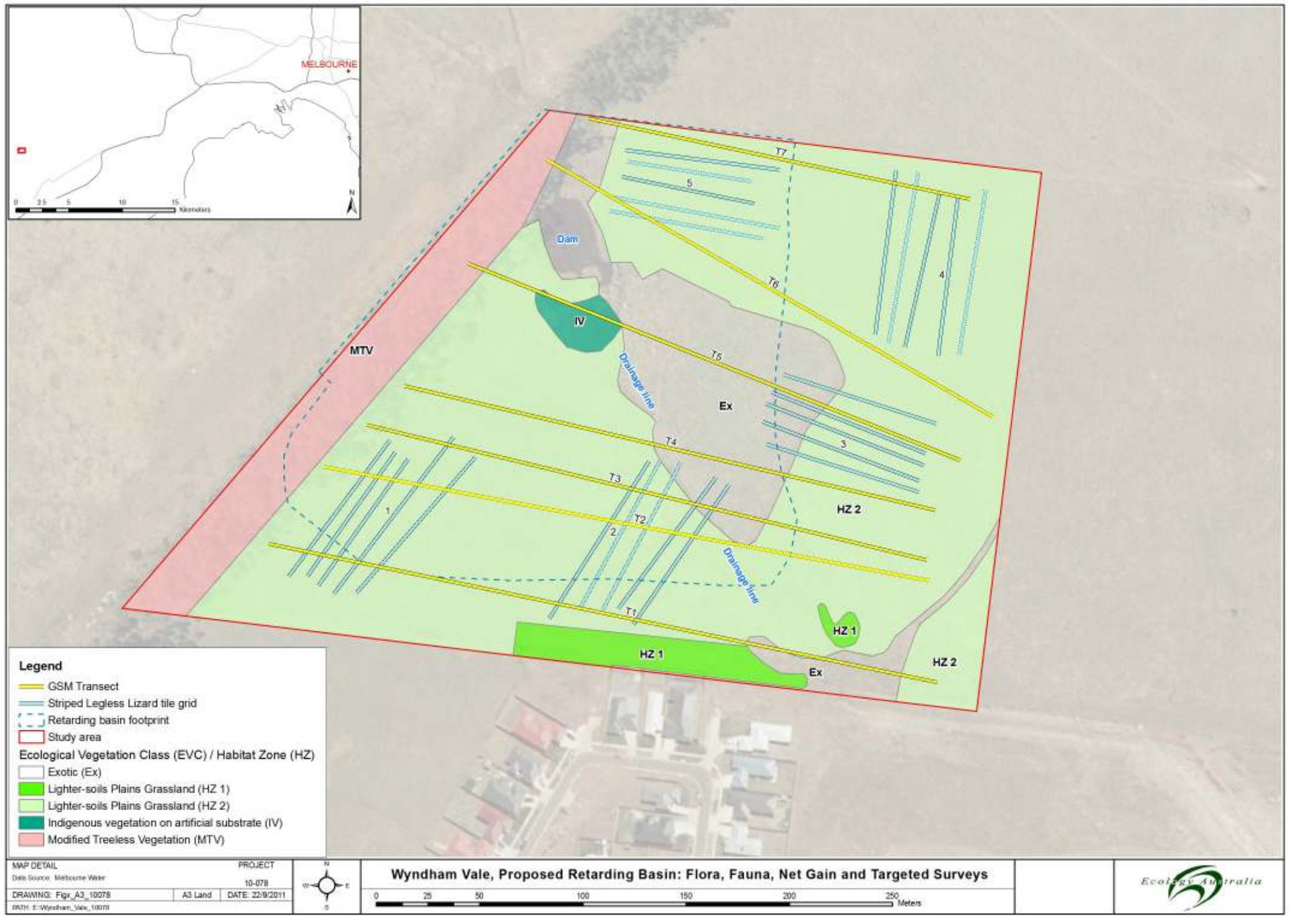

Figure 2 Macquarie Drive, Wyndham Vale - Proposed Retarding Basin: Location of vegetation communities, Habitat Zones (October 2010) and Striped Legless Lizard tile grids, Golden Sun Moth transects and the drainage line and dam, along which the Growling Grass Frog survey was undertaken.

5 Plates

Plate 1 Macquarie Drive, Wyndham Vale: Study area, showing the FFG-listed *Lighter Soils* Plains Grassland and planted Sugar Gums *Eucalyptus cladocalyx* (28 September 2010).

Plate 2 Macquarie Drive, Wyndham Vale: Western boundary of the study area showing the planted Sugar Gum in the background and dry dam supporting exotic vegetation in the foreground (21 October 2010).

Plate 3 Macquarie Drive, Wyndham Vale: Study area facing south from the north-west corner, showing the inundated dam (9 November 2010).

Plate 4 Macquarie Drive, Wyndham Vale: Study area, facing south-east from the north-west corner showing the 'rock jumbles' of removed basalt rocks / boulders and Plains Grassland EVC (28 September 2010).

Plate 5 Macquarie Drive, Wyndham Vale: 'Rock Jumbles' provide shelter habitat for common reptile species such as Common Blue-tongue Lizard, snakes and small exotic mammals (e.g. House Mouse) (28 September 2010).

6 Legislative implications

6.1 Federal *Environment Protection and Biodiversity Conservation Act 1999*

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) pertains to matters of national environmental significance, including Ramsar Wetlands, listed threatened species and ecological communities, listed migratory species and Commonwealth Marine Areas. It applies to both public and private land.

A proponent is obliged to refer matters to the Commonwealth Environment Minister if such values may be affected by a proposed action. The Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC) decides whether there will be a significant impact and if it needs to be a 'controlled action' and require a formal assessment under the Act. The Commonwealth can intervene to modify or block an action if it deems this necessary for the protection of a species or community of national significance.

Summary:

All remnant grassland vegetation within the study area comprises part of the threatened ecological community 'Natural Temperate Grassland of the Victorian Volcanic Plain' (refer Section 4.1.3).

No EPBC listed flora species occur on-site, or are considered likely to occur within the study area.

The Striped Legless Lizard (listed as Vulnerable under the EPBC Act), Golden Sun Moth (listed as Critically Endangered under the EPBC Act) and Growling Grass Frog (listed as Vulnerable under the EPBC Act) were not recorded during the targeted surveys and are considered to have a low likelihood of regular occurrence within the study area (see Section 4.2.5).

No other fauna species listed as threatened under the EPBC Act are considered to have a moderate or higher likelihood of regular occurrence.

The study area is considered to support some habitat attributes for one species (Latham's Snipe) listed under the Migratory and Marine schedules of the EPBC Act. However, this species is considered to have a low- moderate likelihood of regular occurrence within the study area. The study area is unlikely to support a significant proportion of the population and is not considered important habitat for this species under the EPBC Act.

The study area is within 6 km of the Port Phillip (Western Shoreline) and Bellarine Peninsula Ramsar site. Provided mitigation measures are implemented to protect water quality and flow, impacts to downstream values associated with the Ramsar site are unlikely to occur.

6.2 Victorian *Flora and Fauna Guarantee Act 1988*

The *Flora and Fauna Guarantee Act 1988* (FFG Act) lists flora and fauna species and ecological communities that are recognised to be rare or threatened in Victoria. It also identifies threatening

processes and flora that require protection (e.g. Protected Flora and Loss of Hollow-bearing Trees). Protected flora include those species listed as threatened under the Act, plant taxa that belong to listed communities and plant taxa that are not threatened, but require protection for other reasons (e.g. from over-collection). A permit is required to remove protected flora from public land.

Summary:

One threatened ecological community listed under the FFG Act, 'Western (Basalt) Plains Grassland Community', occurs throughout the majority of the site. This community is synonymous with EVC 132_62 *Lighter-soils* Plains Grassland in the study area.

No threatened flora species listed under the FFG Act were recorded during the survey, or are considered likely to occur within the study area.

No threatened fauna species listed under the FFG Act were recorded during the assessment or are considered to have a moderate or higher likelihood of occurrence within the study area.

An FFG permit to remove Protected Flora will not be required for the proposed works.

6.3 Net Gain and *Planning and Environment Act 1987*

Victoria's policy on native vegetation, Victoria's Native Vegetation Management – A Framework for Action (the Framework) (DNRE 2002) requires all proposals to clear native vegetation to demonstrate the three-staged process of Net Gain:

1. Avoid adverse impacts, particularly through vegetation clearance;
2. If impacts cannot be avoided, minimise impacts by careful planning, design and management; and
3. If clearing must occur, the clearing must be offset.

A planning permit is required to remove any native vegetation and the three-step approach is an integral part of the decision making process relating to such permits.

Summary:

If remnant vegetation is proposed for removal, a permit to clear indigenous flora species will be required from Wyndham City Council.

The Net Gain assessment, which quantifies native vegetation within the proposed retarding basin site, is detailed in Section 6 below.

No Environmental Overlays apply to the study area.

6.4 Victorian *Catchment and Land Protection Act 1994*

The Catchment and Land Protection Act 1994 (CaLP Act) provides a legislative framework for the management of land including the control of declared noxious weeds and pest animals. Each

Catchment Management Authority (CMA) region within Victoria has a designated list of declared noxious weeds (i.e. control of which is enforceable).

Summary: Seven declared noxious weeds in the Port Phillip and Westernport CMA region were recorded in the study area (Appendix 1), of which six require control and one is restricted from trade.

The study area and surrounding land contains both the European Fox and Rabbit.

7 Net Gain

The Net Gain approach to protection, enhancement and revegetation of native vegetation is presented in the Department of Natural Resources and Environment (DNRE, now DSE) publication: Victoria's Native Vegetation Management: a Framework for Action (the Framework) (DNRE 2002). The Framework specifically focuses on achieving biodiversity goals on private land, in the context of modification and clearing of native vegetation, but is also applicable to public land. The implementation of Net Gain and the Framework has been incorporated into the Victorian Planning Provisions.

The Net Gain approach is summarised in the Framework as follows: "Net Gain is the outcome for native vegetation and habitat where overall gains are greater than overall losses and where individual losses are avoided where possible. The losses and gains are determined by a combined quality-quantity measure and over a specified area and period of time. Gains may be either required offsets for permitted clearing actions or as a result of landholder and Government assisted efforts that are not associated with clearing." (DNRE 2002)

Fundamental to vegetation management is that remnant vegetation is of greater ecological value and inherently more important than revegetation. Therefore, emphasis is given in the Framework and also the recently revised c. 52.17 of the Planning Provisions to avoiding or minimising losses, as reflected in the three-step approach to Net Gain:

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

7.1 Compliance to the three-step approach

Avoidance

Given the distribution of Plains Grassland vegetation within the study area, Avoidance cannot be achieved.

Minimisation

A degree of Minimisation has been achieved by incorporating the majority of exotic vegetation into the proposed retarding basin footprint (Figure 2). Additionally, the highest quality remnant vegetation on-site (Habitat Zone 1) has been retained in its entirety.

Offsetting

All losses of Plains Grassland resulting from the proposed development must be offset (see Section 7.3).

7.2 Quantification of remnant vegetation

A quantification of remnant vegetation (Habitat Zones) occurring within the study area is provided below. No Scattered Trees were present within the study area.

7.2.1 Habitat Zones

A Habitat Zone is defined by DSE (2004) as 'a discrete area of native vegetation consisting of a single vegetation type (EVC) with an assumed similar averaged quality [that] is the base spatial unit for conducting a Habitat Hectare assessment'. Two Habitat Zones ranging from 37% to 47% of pre-European Condition were recorded in the study area, both of which were comprised of EVC 132_62 *Lighter-soils* Plains Grassland (Table 5, Figure 2, Plates 1 and 5).

Based on Habitat Score and Conservation Status, Habitat Zone 1 has a Conservation Significance of Very High and Habitat Zone 2 a Conservation Significance of High (DNRE 2002). The Conservation Significance of either Habitat Zones cannot be raised on the basis of providing the best or remaining 50% of habitat for a threatened species within the bioregion, or having 'other attributes' as outlined in Table 3.3 of PPWPCMA (2006).

7.3 Losses

The proposed construction of the retarding basin will result in the loss of 1.03 Habitat Hectares (2.8 ha) of remnant Plains Grassland vegetation (Tables 5 and 6). An additional 0.58 ha of artefactual indigenous vegetation (refer Section 4.1.1) will also be removed, though as this does not constitute 'remnant patch' vegetation, no offsetting is required for its removal.

Table 5 Wyndham Vale, Proposed Retarding Basin: Quantification and Significance of Losses in Patches of Native Vegetation

Habitat Zone			**HZ1**	**HZ2**
Bioregion			V.V.P	V.V.P
EVC #: Name			**132_62:PG**	**132_62:PG**
EVC Bioregional Conservation Status			E	E
		Max Score	**Score**	**Score**
Site Condition	Large Old Trees	10	na	na
	Canopy Cover	5	na	na
	Understorey	25	15	15
	Lack of Weeds	15	7	0
	Recruitment	10	0	0
	Organic Matter	5	5	5
	Logs	5	na	na
	Total Site Score	75	27	20
	EVC standardiser (e.g. 75/55) [1]		1.36	1.36
	Adjusted Site Score		37	27
Landscape value	Patch Size	25	10	10
	Neighbourhood			
	Distance to Core			
Habitat Score		**100**	**47**	**37**
Habitat points = #/100		**1**	**0.47**	**0.37**
Habitat Zone area (ha)		(#.#)	0.0	2.8
Habitat Hectares		(#.#)	**0.00**	**1.03**
Conservation Significance	**Conservation status x Habitat Score**		Very High	High
	Threatened Species Rating		na	na
	Other Site Attribute Rating		na	na
	Overall Conservation Significance (highest rating)		Very High	High
Net Outcome			x 2	x 1.5
Gain Target (Hha)			**0**	**1.55**
No. of Large Old Trees to be removed in each Habitat Zone			0	0
Tree protection multiplier			n/a	n/a
Large Old Trees to be protected			0	0

Table 6 Wyndham Vale, Proposed Retarding Basin: Gain targets for clearing remnant patches

							Habitat Hectares Target			Large Tree Protection Target		
Target #	Habitat Zones	Bioregion	EVC #: Name	Conservation significance	Min. habitat score for target	Other Like-for-Like reqts	Total Losses (Hha)	Net Outcome	Gain Target (Hha)	Total LOTs Lost	Protection Multiplier	LOTs to be protected
H1	HZ2	V.V.P	132_62: PG	High	28	n/a	1.03	1.5	1.55	0	0	0

7.4 Offset requirements

The gain (offset) target for the loss of 1.03 Habitat Hectares (2.8 ha) of High Conservation Significance vegetation is 1.55 Habitat Hectares (Tables 5 and 6). Typically for proposals removing vegetation of High Conservation Significance, the Framework states that: the area for achieving the gains must support the same EVC or habitat type (if Conservation Significance driven by a threatened species) or Very High Conservation Significance vegetation in the same bioregion, the vegetation must be of similar or more effective ecological and land protection function and be at least 75% of the quality in the area being lost, and revegetation is restricted to 25% of the offset.

7.5 Strategy for achieving offsets

As per information provided by the Client, the Department of Sustainability and Environment (DSE) have confirmed that as the site falls within Precinct Structure Plan 40 East, it is covered under the Melbourne Strategic Assessment. As such offsets for the removal remnant vegetation (all of which comprises EPBC-listed Natural Temperate Grassland of the Victorian Volcanic Plain) can be offset into the Western Grassland Reserve, and this can be done via a payment to DSE; as stated by DSE (August 2011) this is currently $137,500 per Habitat Hectare removed. Based on these figures the Client will meet all offset requirements through the payment of $213,125 to DSE.

8 Key Values and Assessment of Potential Impacts

The key values and potential impacts of the proposed retarding basin development are outlined below. With appropriate design and management, the proposed retarding basin has the potential to provide environmental values through increased habitat diversity for native fauna species. Mitigation measures to avoid or minimise potential impacts of the proposed development are outlined in Section 9.1.

8.1 Key values of the study area

The key values identified within the study area are:

Flora

- The majority of the study area comprises EVC 132_62 *Lighter-soils* Plains Grassland of predominantly High Conservation Significance (a small area is of Very High Conservation Significance).
- All EVC 132_62 *Lighter-soils* Plains Grassland on the site also comprises
    - the threatened ecological community 'Natural Temperate Grassland of the Victorian Volcanic Plain' as listed under the federal *Environmental Protection and Biodiversity Conservation Act 1999*; and
    - the threatened ecological community 'Western (Basalt) Plains Grassland Community' as listed under the Victorian *Flora and Fauna Guarantee Act 1988*.

Fauna

- The grassy vegetation provides habitat for common reptile species (e.g. Common blue-tongue Lizard) and grassland birds (e.g. Stubble Quail).
- The degraded and ephemeral drainage line and dam provide habitat for a variety of common water dependent species such as frogs (e.g. Spotted Marsh Frog) and birds (e.g. Pacific Black Duck).

8.2 Potential Impacts

Within urban waterways, stormwater run-off is the major contributor to increased flow events, nutrient influxes, pollutants and litter accumulation. A key treatment in stormwater management is constructed wetlands and bio-retention ponds, which provide for the removal of nitrogen, phosphorus, suspended solids and heavy metals from the stormwater. The State Environment Protection Policy (SEPP) for the Water's of Victoria sets out base statutory requirements for the quality of stormwater run-off, with the Best Practice Environmental Management Guidelines for

Urban Stormwater describing levels of stormwater treatment necessary to comply with the SEPP requirements.

The capture and retention of stormwater within the proposed retarding basin may have a number of potential impacts on key values identified both within and surrounding the study area including:

- Loss of EVC 132_62 *Lighter-soils* Plains Grassland;
- Potential changes to hydrology (e.g. prolonged and frequent inundation flooding events) both on-site and downstream, particularly if the hydraulic capacity of the retarding basin is exceeded;
- Prolonged and frequent inundation may impact on the flora species composition (advantaging weed species);
- Loss of all existing fauna habitat within the study area. For example, grassland provides habitat for common reptile species (e.g. Common Blue-tongue Lizard) and grassland birds such as Stubble Quail;
- Movement of equipment and machinery on-site may increase the invasion by environmental weeds. Furthermore, flooding events may transport weed propagules into or out of the study area;
- Litter accumulation within the proposed retarding basin and immediate downstream environs may impact negatively on fauna species, particularly waterbirds that may consume or become entangled in plastics and other material;
- A potential decrease in water quality during construction works flowing downstream into the Werribee West Drain and entering Lollypop Creek and eventually Port Phillip Bay resulting in reduced vegetation quality and aquatic fauna diversity. Note: The water flowing downstream should show significant improvements in quality post-construction, once treatment measures and actions have been established; and
- Death or injury to common fauna species during construction activities.

9 Recommendations

9.1 Summary of key recommendations

The following preliminary recommendations are made to protect on-site and off-site environmental values and should be incorporated into the draft design of the retarding basin. These recommendations are separated into, pre-construction, construction and post-construction stages, that will be further refined once the final design has been selected. Preliminary recommendations for mitigation of both on-site and off-site impacts include:

Pre-Construction

- Where possible, retain remnant vegetation;
- The wetlands should be designed in accordance with Melbourne Waters key principles for Water Sensitive Urban Design (WSUD) as stated in the Urban Stormwater - Best Practice Environmental Management Guidelines (Victorian Stormwater Committee 1999) and the Constructed Wetland Systems – Design Guidelines for Developers (Melbourne Water 2005) principles;
- The retarding basin should be designed so that the daily flows (e.g. the velocity and depth of flow) do not alter natural flows in downstream environs (e.g. water will flow into Lollypop Creek);
- A combination of wetlands and bio retention ponds can be used to ensure that appropriate water filtration systems are installed and absorb the influx of nutrients (e.g. a wetland system);
- Further measures to minimise impacts resulting from nutrient, pollution and litter accumulation within and downstream of the study area include:
    - The construction of an upstream sediment basin to capture and filter sediment from run-off.
    - Incorporate sediment control measures (e.g. sediment control fences and other filtration devices) in accordance with best management practice and designed in accordance with water sensitive urban design principals outlined in Wong et al. (1999), CSIRO (1999), Melbourne Water (2002), and EPA guidelines: "Construction Techniques for Sediment Control" (EPA Publication No. 275, 1991) and "Environmental Guidelines for Major Construction Sites" (EPA 1996);
    - The incorporation of litter traps (e.g. a 'trash' screen should be placed over the outlet structure to prevent blockages and improve water quality downstream).
- Development of a wetland design that may attract and increase habitat diversity by providing a source of near permanent water and other resources for a variety of fauna species including: threatened fauna species (e.g. potential habitat for Growling Grass

Frog); migratory or nomadic birds (e.g. Latham's Snipe); and common water dependent species (e.g. frogs and water birds).

- The wetlands should simulate natural wetlands through their physical characteristics such as:
  - Shape, depth and edge gradients;
  - Water retention times (e.g. construction of pools with permanent water and others more ephemeral [non-permanent]);
  - The use of locally indigenous flora species for revegetation including, shallow marsh areas: emergent and fringing vegetation (rushes and sedges) and deep water areas: submergent and floating vegetation (water ribbons, pond weed).
  - Refuge areas such as logs, rocks around the margins and plant suitable aquatic and terrestrial vegetation.
  - Refuge areas for water dependent birds;
  - Provide logs, rocks around the margins; and
  - Sensitive placement of maintenance tracks.

- Note: Further information regarding habitat augmentation (e.g. provision of habitat for fauna) and revegetation can be provided once a detailed design of the retarding basin is available.

Construction

- Use appropriate high visibility fencing to delineate the remnant vegetation being retained from the construction zone (provide signs showing 'No-Go Zones');
- Create designated access points and tracks through non remnant vegetation when undertaking construction on-site. Appropriate fencing and No-Go signage should be used to define access restrictions and avoid accidental access/damage to vegetation that is to be retained;
- Implement sediment control measures (e.g. sediment control fences and other filtration devices) in accordance with best management practice and designed in accordance with water sensitive urban design principals outlined in Wong et al. (1999), CSIRO (1999), Melbourne Water (2002), and EPA guidelines: "Construction Techniques for Sediment Control" (EPA Publication No. 275, 1991) and "Environmental Guidelines for Major Construction Sites" (EPA 1996);
- During construction, do not store fill, excavated materials, fuels and oils near the drainage line or on remnant vegetation that is to be retained;

- Restore the site surrounding the development zone as soon as possible after construction with locally indigenous flora species of local provenance;
- Develop appropriate weed management and hygiene protocols that are applied during and post-construction; and
- Avoid works during heavy rainfall periods.

Post-construction

- Restore the site surrounding the development zone as soon as possible after construction with locally indigenous flora species of local provenance;
- Revegetation of embankments and other areas should utilise plant species of indigenous local provenance that can tolerate mowing and assist embankment structural durability from erosion and drought; and
- Sampling programs for water quality monitoring should follow existing Melbourne Water and Environment Protection Agency guidelines. If monitoring detects harmful levels of particular water quality attributes, remedial action should be undertaken in consultation with EPA, DSE and Council.

9.2 Further work required

The following recommendations are made for further work within the study area:

- Preparation of an Environmental Management Plan/Construction Management Plan to address the potential impacts and management strategies to be implemented pre-construction, during and post-construction (e.g. best management practices for urban run-off and water quality control).

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11 References

ABZECO (2009). Targeted Seasonally Appropriate Survey for Golden Sun Moth & Striped Legless Lizard, 445-479 McGrath Road, Wyndham Vale. (Applied Botany, Zoology and Ecological Consulting: Eltham).

ABZECO (2010). Flora, Fauna Habitat and Net Gain Assessment, 445-479 McGrath Road, Wyndham Vale. (Applied Botany, Zoology and Ecological Consulting: Eltham).

Anstis, M. (2002). 'Tadpoles of South-eastern Australia: A Guide with Keys'. (Reed New Holland, NSW.)

Bainbridge, B., Davern, A. and Crawford, D. (2006). Vegetation Description in Golden Sun Moth Habitat in Epping/Wollert and Campbellfield. Report prepared for Port Phillip and Westernport Catchment Management Authority (Merri Creek Management Committee: Brunswick).

Biosis Research (2008) Targeted survey of Golden Sun Moth in the Melbourne Area. Report prepared for FKP property Group. Author: D. Gilmore (Biosis Research, Port Melbourne, Victoria).

Birds Australia (2003). 'Draft working list of birds of Australia and Australian territories'. (Birds Australia: Hawthorn East).

Bureau of Meteorology (2011). Climate statistics for Australia locations; Laverton RAAF. (Commonwealth of Australia, Bureau of Meteorology, Melbourne).

Churchill, S. (1998). 'Australian Bats'. (Reed New Holland: Sydney).

Coulson, G. (1990). Conservation biology of the Striped Legless Lizard (*Delma impar*). An initial investigation. Arthur Rylah Institute for Environmental Research Technical Report (106): 1-40.

Coulson, G (1995). Management directions for the Striped Legless Lizard (*Delma impar*) in the Australian Capital Territory. Technical Report 12. Wildlife Research Unit, ACT Parks & Conservation Service.

Cogger, H.G., Cameron, E.E., Sadlier, R.A. and Eggler, P. (1993). The Action Plan for Australian Reptiles. (Australian Nature Conservation Agency: Canberra).

Cook, L. and Edwards, E.D. (1993). Population Biology of Endangered Moth *Synemon plana* 1992-93, York Park, Barton. Report prepared for the National Capital Planning Authority (CSIRO Division of Entomology: Canberra).

CSIRO (1999). Urban stormwater: best practice environmental management guidelines. (Victoria Stormwater Committee, CSIRO, Melbourne).

DEWHA (2008). Policy Statement 3.8: Natural Temperate Grassland of the Victorian Volcanic Plain. (Department of the Environment, Water, Heritage and the Arts: Canberra.)

DEWHA (2009). Background paper to EPBC Act Policy Statement 3.12 – Nationally Threatened Species and Ecological Communities. Significant Impact Guidelines for the Critically

Endangered Golden Sun Moth (*Synemon plana*). The Department of the Environment, Water, Heritage and the Arts.

DEWHA (in prep.) EPBC Act Policy Statement 3. X – Significant Impact Guidelines for 36 Migratory Shorebird Species. Australian Government, Department of the Environment, Water, Heritage and the Arts.

DNRE (2002). Victoria's Native Vegetation Management: A Framework for Action. (Department of Sustainability and Environment [formerly Natural Resources and Environment]: East Melbourne).

DPCD (2011). Victoria's online planning schemes. URL: http://www.dse.vic.gov.au/planningschemes/ (Department of Planning and Community Development: Melbourne).

DSE (2004a). EVC/Bioregional Benchmark for Vegetation Quality Assessment; Victorian Volcanic Plain bioregion, EVC 132_61: Heavier-soils Plains Grassland. (Department of Sustainability and Environment: East Melbourne).

DSE (2004b). Vegetation Quality Assessment Manual – Guidelines for Applying the Habitat Hectares Scoring Method, Version 1.3. (Department of Sustainability and Environment: East Melbourne.)

DSE (2005a). Advisory list of rare or threatened plants in Victoria – 2005. (Department of Sustainability and Environment: East Melbourne).

DSE (2005b). Sites of Biodiversity Significance (BioSites) and Ecological Vegetation Classes (EVCs): Port Phillip and Western Prot Region. Maps and Reports on CD-ROM. (Department of Sustainability and Environment: East Melbourne.)

DSE (2007a). Advisory List of threatened Vertebrate Fauna in Victoria - 2007. (Department of Sustainability and Environment: East Melbourne).

DSE (2007b). Guide for assessment of referred planning permit applications. (Department of Sustainability and Environment: East Melbourne).

DSE (2009a). Flora Information System. Database. (Arthur Rylah Institute: Heidelberg.)

DSE (2009b). Victorian Fauna Display database. (DSE/Viridians Biological Databases: Brighton East, Victoria).

DSE (2009c). Advisory list of threatened invertebrate fauna in Victoria – 2009. (Department of Sustainability and Environment: East Melbourne)

DSE (2010a). Biodiversity Interactive Map 2.0. URL: http://mapshare2.dse.vic.gov.au/MapShare2EXT/imf.jsp?site=bim (Department of Sustainability and Environment: East Melbourne).

DSE (2010b). Ecological Vegetation Class (EVC) Benchmarks for each Bioregion. URL: http://www.dse.vic.gov.au/dse/nrence.nsf/LinkView/43FE7DF24A1447D9CA256EE6007EA8788062D358172E420C4A256DEA0012F71C (Department of Sustainability and Environment: East Melbourne).

DSE (2010c). Native Vegetation Offsets, Fact Sheet 2 – Conservation Significance and Like for Like. (Department of Sustainability and Environment: East Melbourne.)

DSEWPC (2011). EPBC Act Protected Matters Search Tool. URL: http://www.environment.gov.au/erin/ert/epbc/index.html (Department of Sustainability, Environment, Water, Population and Communities: Canberra).

Ecology Australia (2010) Golden Sun Moth Targeted Surveys - Mt Ridley Road, Craigieburn. Christina Renowden – Ecology Australia, Fairfield Victoria.

Emison, W.B., Beardsell, C.M., Norman, F.I., Loyn R.H. (1987). 'Atlas of Australian Birds.' (Department of Conservation, Forests and Lands for the Royal Australasian Ornithologists Union: Melbourne).

Endersby, I and Koehler, S. (2006). Golden Sun Moth *Synemon plana*: Discovery of new populations around Melbourne. Victorian Naturalist 123 (6)

EPA Guidelines (1991). Construction Techniques for Sediment Pollution Control. (Environment Protection Authority, Southbank).

EPA Guidelines (1996). Environment Guidelines for Major Construction Sites Best Practice Environmental Management (Environment Protection Authority, Southbank).

EPA Guidelines (2008). Maintaining Water Sensitive Urban Design Elements. (Environment Protection Authority, Southbank).

Garnet S.T. and Crowley, G.M. (2000). The action plan for Australian birds 2000. (Environment Australia, Canberra).

GHD (2007). Melbourne Water Lollypop Creek Drainage Scheme Pre-Design Phase Desktop Review of Ecological Values. (GHD: Melbourne).

Gibson, L. (2008). Surveys of Golden Sun Moth (*Synemon plana*) populations at Cooper Street and Derrimut Grasslands. Unpublished report for Parks Victoria (Parks Victoria, Melbourne).

Gibson, L. and New, T. (2007). Problems in studying populations of the Golden Sun-moth, *Synemon plana* (Lepidoptera: Castniidae), in south eastern Australia. Journal of Insect Conservation 11; 309-313.

Gilmore, D. (2007). Targeted survey of the Golden Sun Moth in the Melbourne Area. Report prepared for FKP by Biosis Research. (Biosis Pty Ltd: Port Melbourne).

Gilmore, D., Koehler, S., O'Dwyer, C. and Moore, W. (2008). Golden Sun Moth *Synemon plana* (Lepidoptera: Castniidae): results of a broad survey of populations around Melbourne. The Victorian Naturalist 125 (2); 39-46.

Higgins, P.J. (1999) Handbook of Australian, New Zealand and Antarctic Birds. Volume 4 Parrots to Dollarbird. Oxford University Press, Melbourne.

Higgins, P.J., Davies, S.J..J.F. (1996) Handbook of Australian New Zealand and Antarctic Birds. Volume 3 Snipe to Pigeons. Oxford University Press, Melbourne.

Maxwell S., Burbidge A.A. and Morris K (Eds) 1996. 'The Action Plan for Australian Marsupials and Monotremes'. Report prepared for the Australian Marsupials and Monotremes Specialist Group IUCN Survival Commission. Environment Australia, Endangered Species Program, Project No 500.

Melbourne Water (2002). Melbourne Water Drainage Manual, www.melbournewater.com.au

Melbourne Water (2005) Constructed Wetland Systems – Design Guidelines for Developers (V 3.) Melbourne Water.

NPWS 2001. Atlas of NSW Wildlife. (NPWS, Hurstville).

O'Dwyer, C.O., and Attiwill, P.M. (2000) Restoration of a native grassland as habitat for the Golden Sun Moth *Synemon plana* Walker (Lepidoptera: Castniidae) at Mount Piper, Australia. Restoration Ecology 8; 170-174.

PPWPCMA (2006). Port Phillip and Western Port – Native Vegetation Plan. (Port Phillip and Western Port Catchment Management Authority: Frankston).

Practical Ecology (2008). Flora & Fauna Assessment and Net Gain Analysis, 445-479 McGrath Road, Wyndham Vale. (Practical Ecology: Preston).

Robertson, P., Heard, G., and Scroggie, M. (2002). The Ecology and Conservation Status of the Growling Grass Frog (*Litoria raniformis*) in the Merri Creek Corridor. Interim Report: Distribution, Abundance and Habitat Requirements. Report prepared for Department of Sustainability and Environment (Wildlife Profiles: Heidelberg.)

Smith, W.J.S. & Robertson, P. (1999). National recovery plan for the Striped Legless Lizard *Delma impar* 1999-2003. Unpublished report to Environment Australia, Canberra.

Stanger, M., Clayton, M., Schodde, R., Wombey, J. and Mason, I. (1998). 'CSIRO list of Australian vertebrates: a reference with conservation status'. (CSIRO Publishing: Collingwood).

Strahan (1995) The Mammals of Australia. Reed New Holland. Forest NSW Australia.

Triggs, B. (1996). Tracks, Scats and Other Traces - A Field guide to Australian Mammals. (Oxford University Press: Melbourne).

Tyler, M. (1997). The Action Plan for Australian Frogs. Wildlife Australia Endangered Species Program for Environment Australia, Canberra.

Victorian Storm Water Committee (1999) Urban Stormwater – Best Practice Environmental Management Guidelines. CSIRO publishing, Collingwood Victoria.

Walsh, N. G. and Stajsic, V. (2007). A Census of the Vascular Plants of Victoria. (National Herbarium of Victoria, Royal Botanic Gardens: South Yarra).

Webster, A., Fallu, R. and Preece, K. (2003). Flora and Fauna Guarantee Action Statement # 17: Striped Legless Lizard *Delma impar*. (Department of Sustainability and Environment: Victoria).

Wilson, S. and Swan, G. (2003). 'A complete guide to reptiles of Australia'. (Reed New Holland: Sydney).

Wong, T. H. F., Breen, P. F., Somes, L. G., and Lloyd, S. D. (1999). Managing urban stormwater using constructed wetlands. 98/7, (Cooperative Research Centre of Catchment Hydrology, Cooperative Research Centre for Freshwater Ecology, Melbourne).

Appendix 1 Vascular plant species recorded within the study area, Wyndham Vale, October 2010

Key:
* - Exotic plant species
C – Noxious weed listed as Regionally Controlled under the *Catchment and Land Protection Act 1994*.
R – Noxious weed listed as Restricted under the *Catchment and Land Protection Act 1994*.

	Scientific Name	Common Name	Family Name
*	*Aira elegantissima*	Delicate Hair-grass	Poaceae
*	*Arctotheca calendula*	Cape Weed	Asteraceae
	Atriplex semibaccata	Berry Saltbush	Chenopodiacea e
	Austrodanthonia duttoniana	Brown-back Wallaby-grass	Poaceae
	Austrodanthonia setacea	Bristly Wallaby-grass	Poaceae
	Austrostipa bigeniculata	Kneed Spear-grass	Poaceae
*	*Avena barbata*	Bearded Oat	Poaceae
*	*Brassica fruticulosa*	Twiggy Turnip	Brassicaceae
*	*Bromus hordeaceus subsp. hordeaceus*	Soft Brome	Poaceae
	Chloris truncata	Windmill Grass	Poaceae
*	*Cirsium vulgare* **C**	Spear Thistle	Asteraceae
	Cotula australis	Common Cotula	Asteraceae
	Crassula decumbens var. decumbens	Spreading Crassula	Crassulaceae
	Crassula tetramera	Australian Stonecrop	Crassulaceae
*	*Cynara cardunculus* **C**	Artichoke Thistle	Asteraceae
*	*Echium plantagineum* **C**	Paterson's Curse	Boraginaceae
*	*Ehrharta erecta var. erecta*	Panic Veldt-grass	Poaceae
*	*Ehrharta longiflora*	Annual Veldt-grass	Poaceae
	Einadia nutans subsp. nutans	Nodding Saltbush	Chenopodiacea e
	Enchylaena tomentosa var. tomentosa	Ruby Saltbush	Chenopodiacea e
*	*Erodium botrys*	Big Heron's-bill	Geraniaceae
*	*Foeniculum vulgare* **R**	Fennel	Apiaceae
*	*Galenia pubescens var. pubescens*	Galenia	Aizoaceae
	Haloragis heterophylla	Varied Raspwort	Haloragaceae
*	*Helminthotheca echioides*	Ox-tongue	Asteraceae
*	*Hordeum leporinum*	Barley-grass	Poaceae
*	*Hypochoeris radicata*	Flatweed	Asteraceae
*	*Leontodon taraxacoides subsp. taraxacoides*	Hairy Hawkbit	Asteraceae
*	*Lepidium africanum*	Common Peppercress	Brassicaceae
*	*Lepidium draba* **C**	Hoary Cress	Brassicaceae
*	*Lolium perenne*	Perennial Rye-grass	Poaceae
*	*Lolium rigidum*	Wimmera Rye-grass	Poaceae
*	*Lycium ferocissimum* **C**	African Box-thorn	Solanaceae

	Scientific Name	Common Name	Family Name
	Lythrum hyssopifolia	Small Loosestrife	Lythraceae
*	*Malva parviflora*	Small-flower Mallow	Malvaceae
*	*Nassella trichotoma* **C**	Serrated Tussock	Poaceae
	Oxalis exilis	Shady Wood-sorrel	Oxalidaceae
	Oxalis perennans	Grassland Wood-sorrel	Oxalidaceae
*	*Oxalis pes-caprae*	Soursob	Oxalidaceae
*	*Plantago coronopus*	Buck's-horn Plantain	Veronicaceae
*	*Plantago lanceolata*	Ribwort	Veronicaceae
*	*Rapistrum rugosum*	Giant Mustard	Brassicaceae
	Rhagodia candolleana subsp. candolleana	Seaberry Saltbush	Chenopodiacea e
*	*Romulea rosea var. australis s.s.*	Common Onion-grass	Iridaceae
	Rumex dumosus	Wiry Dock	Polygonaceae
*	*Scorzonera laciniata var. laciniata*	Scorzonera	Asteraceae
	Senecio quadridentatus	Cotton Fireweed	Asteraceae
*	*Sonchus oleraceus*	Common Sow-thistle	Asteraceae
	Tetragonia implexicoma	Bower Spinach	Aizoaceae
*	*Trifolium arvense var. arvense*	Hare's-foot Clover	Fabaceae
*	*Trifolium campestre var. campestre*	Hop Clover	Fabaceae
*	*Trifolium striatum*	Knotted Clover	Fabaceae
*	*Vicia sativa subsp. sativa*	Common Vetch	Fabaceae
	Vittadinia sp.	New Holland Daisy	Asteraceae
	Walwhalleya proluta	Rigid Panic	Poaceae

Appendix 2 Fauna species recorded within the study area (October 2010 to February 2011)

Key:

S = seen
I = indirect evidence
Mi – Migratory species under the EPBC Act 1999
M – Marine overfly species under the EPBC Act 1999
* - denotes exotic species

Common Name	Scientific Name	Status
Birds		
Stubble Quail	*Coturnix pectoralis*	M
Crested Pigeon	*Ocyphaps lophotes*	
Masked Lapwing	*Vanellus miles*	Mi
Straw-necked Ibis	*Threskiornis spinicollis*	M
Pacific Black Duck	*Anas superciliosa*	Mi
Chestnut Teal	*Anas castanea*	Mi
Swamp Harrier	*Circus approximans*	Mi,M
Australian Hobby	*Falco longipennis*	Mi
Brown Falcon	*Falco berigora*	Mi
Long-billed Corella	*Cacatua tenuirostris*	
Galah	*Eolophus roseicapilla*	
Crimson Rosella	*Platycercus elegans elegans*	
Tawny Frogmouth	*Podargus strigoides*	
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	M
Magpie-lark	*Grallina cyanoleuca*	M
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	
Red Wattlebird	*Anthochaera carunculata*	
Australian Pipit	*Anthus australis*	M
Australian Magpie	*Gymnorhina tibicen*	
Little Raven	*Corvus mellori*	M
*Spotted Turtle-Dove	*Streptopelia chinensis*	
*House Sparrow	*Passer domesticus*	
*Common Myna	*Acridotheres tristis*	
Mammals		
*House Mouse	*Mus musculus*	
*Fox	*Vulpes vulpes*	
Reptiles		
Eastern Blue-tongued Lizard	*Tiliqua scincoides*	
Frogs		
Eastern Banjo Frog	*Limnodynastes dumerilii*	
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	

Appendix 3 Threatened fauna species and species listed under the Migratory and/or Marine Overfly Schedule of the EPBC Act recorded within the DRA (DSE 2007c) or predicted to occur (DSEWPC 2011), and their Likelihood of Regular Occurrence (LRO) within the study area, Macquarie Drive, Wyndham Vale.

Key
EPBC – Environmental Protection and Biodiversity Conservation Act 1999
NAP – National Action Plan
FFG – Flora and Fauna Guarantee Act 1988
DSE – Status according to DSE (2007a): Advisory List of Threatened Vertebrate Fauna in Victoria – 2007.
CE – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; LC – Least Concern; LR-NT – Lower Risk- Near Threatened; R-IK – Rare or Insufficiently Known; R/R – Rare and Restricted; DD – Data Deficient; CD – Conservation Dependent.
L – Listed under the FFG Act 1988.
N – Nominated for listing under the FFG Act 1988
I – Ineligible for listing under the FFG Act 1988.
Mi – Migratory species under the EPBC Act 1999
M – Marine overfly species under the EPBC Act 1999
Last – Year of last record
Rec – Number of records in Fauna DRA
LRO – Likelihood of Regular Occurrence
†- Species identified in the EPBC Protected Matters Search (DSEWPC 2010) but not in the DRA (DSE 2009)

Common Name	Scientific Name	EPBC	NAP	FFG	DSE	Last	Recs	LRO
Birds								
Stubble Quail	*Coturnix pectoralis*	M				1989	1	Recorded
Brown Quail	*Coturnix ypsilophora*				NT	1989	1	Low - Moderate
Plains-wanderer	*Pedionomus torquatus*	VU	EN	L	CE	1987	2	Low-Moderate
Buff-banded Rail	*Gallirallus philippensis*	M				1989	3	Low-Moderate
Spotless Crake	*Porzana tabuensis*	M				1990	1	Low-Moderate
Purple Swamphen	*Porphyrio porphyrio*	M				2006	1	Moderate
Silver Gull	*Larus novaehollandiae*	Mi,M				1999	4	Moderate
Masked Lapwing	*Vanellus miles*	Mi				2000	11	Recorded
Banded Lapwing	*Vanellus tricolor*	Mi				1990	1	Low
Black-fronted Dotterel	*Elseyornis melanops*	Mi				1989	1	Moderate
Latham's Snipe	*Gallinago hardwickii*	Mi,M			NT	2006	4	Low-Moderate
Australian Painted Snipe	*Rostratula australis*	VU, Mi, M				#		Low
Curlew Sandpiper	*Calidris ferruginea*	Mi, M				#		Low
Double-banded Plover	*Charadrius bicinctus*	Mi, M				#		Low
Red-necked Stint	*Calidris ruficollis*	Mi, M				#		Low
Regent Honeyeater	*Anthochaera phrygia*	EN, Mi, M				#		Negligible

Satin Flycatcher	*Myiagra cyanoleuca*	Mi, M				#		Low
Sharp-tailed Sandpiper	*Calidris acuminata*	Mi, M				#		Low
White-throated Needletail	*Hirundapus caudacutus*	Mi, M				#		Low-Moderate
Australian Pratincole	*Stiltia isabella*	Mi,M			NT	1992	1	Low
Australian White Ibis	*Threskiornis molucca*	M				2000	8	High
Straw-necked Ibis	*Threskiornis spinicollis*	M				2006	12	Recorded
Royal Spoonbill	*Platalea regia*				VU	1990	3	Low
Great Egret	*Ardea alba*	Mi,M		L	VU	1990	3	Low-Moderate
Nankeen Night-Heron	*Nycticorax caledonicus hilli*	M			NT	1990	4	Low-Moderate
Australasian Bittern	*Botaurus poiciloptilus*		VU	L	EN	1989	1	Low
Australian Wood Duck	*Chenonetta jubata*	Mi				1989	4	High
Black Swan	*Cygnus atratus*	Mi				1989	2	Low
Australian Shelduck	*Tadorna tadornoides*	Mi				1989	3	Low
Pacific Black Duck	*Anas superciliosa*	Mi				2006	17	Recorded
Chestnut Teal	*Anas castanea*	Mi				2006	7	Recorded
Grey Teal	*Anas gracilis*	Mi				1989	3	Low-Moderate
Australasian Shoveler	*Anas rhynchotis*	Mi			VU	1952	2	Low
Blue-billed Duck	*Oxyura australis*	Mi		L	EN	1970	1	Low
Swamp Harrier	*Circus approximans*	Mi,M				1990	1	Moderate
Grey Goshawk	*Accipiter novaehollandiae*	Mi		N	VU	2006	2	Low-Moderate
Brown Goshawk	*Accipiter fasciatus*	Mi,M				1998	9	Low-Moderate
Little Eagle	*Hieraaetus morphnoides*	Mi				1999	4	Low-Moderate
Whistling Kite	*Haliastur sphenurus*	Mi,M				1990	2	Low-Moderate
Black Kite	*Milvus migrans*	Mi				1993	1	Low-Moderate
Black-shouldered Kite	*Elanus axillaris*	Mi				1998	5	Moderate
Australian Hobby	*Falco longipennis*	Mi				1990	1	Low-Moderate
Peregrine Falcon	*Falco peregrinus*	Mi				2006	1	Low-Moderate
Brown Falcon	*Falco berigora*	Mi				1990	5	Moderate
Nankeen Kestrel	*Falco cenchroides*	Mi,M				1990	9	Moderate

Southern Boobook	*Ninox boobook*	M				1990	1	Low
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Mi, M				#		Low
Blue-winged Parrot	*Neophema chrysostoma*	M				1990	1	Lo w
Swift Parrot	*Lathamus discolor*	EN				#		Low
Rainbow Bee-eater	*Merops ornatus*	Mi,M				1988	1	Low
Pallid Cuckoo	*Cuculus pallidus*	M				1999	1	Low-Moderate
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	M				1999	3	Recorded
Welcome Swallow	*Hirundo neoxena*	M				2006	23	High
Tree Martin	*Hirundo nigricans*	M				2006	4	Low-moderate
Fork-tailed Swift	*Apus pacificus*	Mi, M				#		Low
Rufous Fantail	*Rhipidura rufifrons*	M				1989	1	Low
Flame Robin	*Petroica phoenicea*	M				1998	8	Moderate
Magpie-lark	*Grallina cyanoleuca*	M				2006	33	Recorded
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	M				1990	5	High
Little Grassbird	*Megalurus gramineus*	Mi				1990	1	Recorded
Silvereye	*Zosterops lateralis*	M				1999	9	Moderate
Australian Pipit	*Anthus australis*	M				1990	12	Recorded
Little Raven	*Corvus mellori*	M				2006	32	Recorded
Cattle Egret	*Ardea ibis*	Mi,M				1990	5	Moderate
Mammals								
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	EN	NT	I	NT	1881	1	Negligible
Eastern Barred Bandicoot	*Perameles gunnii*	EN	CE	L	CE	1982	5	Negligible
Koala	*Phascolarctos cinereus*		NT			2005	1	Low
Grey-headed Flying-fox	*Pteropus poliocephalus*	VU				#		Low-Moderate
New Holland Mouse	*Pseudomys novaehollandiae*	VU				#		Negligible
Spot-tailed Quoll	*Dasyurus maculatus maculatus (SE mainland population)*	EN				#		Negligible
Frogs								

Growling Grass Frog	*Litoria raniformis*	VU	VU	L	EN	1990	3	Low
Reptiles								
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	EN				#		Negligible
Striped Legless Lizard	*Delma impar*	VU				#		Low
Fish								
Australian Grayling	*Prototroctes maraena*	VU				#		Low
Dwarf Galaxias	*Galaxiella pusilla*	VU				#		Low