BULLA BYPASS PLANNING STUDY: ALIGNMENT OPTION BB5

NET GAIN ANALYSIS AND FLORA, FAUNA AND OBEM ASSESSMENT

VicRoads

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1. EXECUTIVE SUMMARY

VicRoads engaged Brett Lane and Associates Pty Ltd (BL&A) to conduct a Flora, Fauna, Net Gain and Objective Based Evaluation Matrix (OBEM) Assessment for an approximately 650 hectare study area in and around the township of Bulla. One alignment option for the Bulla Bypass — BB5 — was assessed. This alignment option has been developed through an iterative process where minimising social, cultural and environmental impacts was the goal.

This investigation was commissioned to provide information on the extent and condition of native vegetation and fauna habitat in the study area. This report outlines any implications under various national, state and local legislation and policy.

Much of the study area occurs on private land, with the exception of the southern section near Oaklands Road and Sunbury Road where it is Commonwealth Land. The predominant land use within the study area is rural living/hobby farming on small and medium sized private allotments. Most of the original native vegetation has been cleared from the study area. Remnant native vegetation was largely confined to one large private property along Deep Creek in the north west of the study area and the Woodlands Historic Park on the eastern side of Oaklands Road.

Several remnant patches of vegetation and scattered trees occur along the banks of Deep Creek and extend up onto the large rolling hills. Open woodland dominated by River Red-gum trees (mature and recruiting) occurred along the Moonee Ponds Creek in Woodlands Historic Park.

The study area occurs within two bioregions, the Central Victorian Uplands and the Victorian Volcanic Plain. The following four ecological vegetation classes were recorded within the study area — Creekline Grassy Woodland (EVC 68), Hills Herb-rich Woodland (EVC 71), Stream Bank Shrubland (EVC 851) and Plains Woodland (EVC 803).

The current field assessment recorded 27 habitat zones, totalling 11.39 habitat hectares (39.76 hectares) and supporting 159 large/very large old trees. An additional 80 scattered trees were also recorded. The following remnant patch native vegetation and scattered trees were recorded in the study area:

- 3.15 habitat hectares (11.65 hectares) of high conservation significance Creekline Grassy Woodland (EVC 68);
- 2.56 habitat hectares (5.42 hectares) of very high conservation significance Hills Herb-rich Woodland (EVC 71);
- 0.16 habitat hectares (0.50 hectares) of high conservation significance Hills Herb-rich Woodland (EVC 71);
- 0.89 habitat hectares (3.23 hectares) of medium conservation significance Hills Herb-rich Woodland (EVC 71);
- 1.76 habitat hectares (9.94 hectares) of high conservation significance Plains Woodland (EVC 803);
- 1.32 habitat hectares (3.78 hectares) of very high conservation significance Stream Bank Shrubland (EVC 851);

- 1.54 habitat hectares (5.24 hectares) of high conservation significance Stream Bank Shrubland (EVC 851);
- 159 large/very large trees within habitat zones; and
- Six very large, 21 large, 23 medium and 30 small scattered trees.

The proposed BB5 alignment has been designed taking into account the results of BL&A's ecological assessments (BL&A 2011; 2013) and economic, social and cultural considerations.

An Objective Based Evaluation Matrix (OBEM) was also used to help assess and present the performance of the proposed alignment option based on the overall project objective: *To minimise impacts on biodiversity, including catchment values and waterways.*

In summary, with and without mitigation measures, the proposed BB5 alignment option met the overall project objective Moderately Well.

Table 1 details the impacts and implications that would pertain to the proposed BB5 alignment option.

The following implications would pertain to the current development proposal:

- A permit will be required for the proposed removal of native vegetation from the study area;
- The project will be referred to DSE for the proposed alignment;
- Ministerial approval would be required for the proposed removal of vegetation with conservation significance of *very high*;
- A Referral under the EPBC Act is required for the following proposed impacts to an EPBC Act listed value:
    - Potential impacts to Growling Grass Frog habitat;
- A Protected Flora Licence under the FFG Act would not be required for the current proposal. However, the impacts of the development on the FFG Act listed Growling Grass Frog and the listed ecological community (Victorian temperate woodland bird community) will be considered by the local planning authority during the planning permit application;
- The Growling Grass Frog listed on the DSE *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2007c) is vulnerable to impacts from the proposed development;
- A targeted Brown Toadlet survey was undertaken using best-practice methods to determine whether the species was present in areas potentially impacted upon by the proposed development. No Brown Toadlet was recorded during the targeted survey. It is possible that the species could reach the area of concern, particularly after periods of high rainfall when frogs may disperse to colonise new areas;
- Potential impacts at the Deep Creek crossing, should bridge piers be placed in or in close proximity due to the creek line causing disturbance to the ecology of the waterway and habitat connectivity; and

- There is no need to submit a Referral in relation to flora and fauna to the State Minister under the EE Act.

Table 1: Summary of the impacts of the proposed BB5 alignment option

Impacts and implications			
Vegetation Removal	Hectares removed		2.843
	Habitat Hectares removed		0.82
	Large/Very Large Old Trees removed		20
	Scattered Trees removed (size class)		1 Very Large, 2 Large, 5 Medium, 4 Small
	Conservation Significance		High – Very High
Offsets required	Remnant Patches	Net Gain Target (Hha)	1.38
	Large Trees	Protection Target	112
	Scattered Trees	Protection Target AND	13
		Recruit Target	218
		OR Recruit Only	538
Legislation	EPBC Act	Potential impacts on water quality	Yes
		Impacts on ecological community	No
		Potential impacts on Growling Grass Frog	Yes
		Number of fauna species potentially impacted by creek crossings	3
		Potential impacts on other listed flora species	No
	FFG Act	Impacts on FFG Act listed community Grey Box – Buloke Grassy Woodland?	No
		Impacts on Victorian Temperate Woodland Bird Community	Potential
		Impacts on FFG Act listed flora and fauna species	Yes
	EE Act	Referral required in relation to flora and fauna	No

Impacts and implications			
	Referral to DSE	Ministerial approval to remove vegetation	Yes
		Due to remnant patch removal	Yes
		Due to scattered tree removal	Yes
	DSE Advisory List	Impacts on DSE listed flora species	No
		Impacts on DSE listed fauna species	Potential

2. INTRODUCTION

VicRoads engaged Brett Lane and Associates Pty Ltd (BL&A) to conduct a Flora, Fauna, Net Gain and Objective Based Evaluation Matrix (OBEM) Assessment for an approximately 650 hectare study area in and around the township of Bulla. The study area that was investigated comprised one alignment option for the Bulla Bypass — BB5. This alignment option has been developed through an iterative process where minimising social, cultural and environmental impacts was the goal.

This investigation was commissioned to provide information on the extent and condition of native vegetation and fauna habitat in the study area. This report outlines any implications under various national, state and local legislation and policy, including Victoria's Native Vegetation Management Framework (DNRE 2002), referred to herein as the 'Framework'.

Specifically, the scope of the investigation included:

- Characterisation and mapping of remnant native vegetation within the study area including identification of non-indigenous species which may pose a threat to the indigenous vegetation. All vegetation types were recorded on a GPS.
- An assessment of native vegetation in accordance with Victoria's Native Vegetation Management Framework (including habitat hectare assessment and/or scattered tree assessment). This was undertaken in consultation with the Department of Sustainability and Environment (DSE).
- An assessment of the nature and quality of native fauna habitat and use of the available habitats as a wildlife corridor. All fauna habitat types were recorded on a GPS.
- An assessment of the likelihood of occurrence of threatened flora and fauna in the area.
- Compilation of flora and fauna species lists for the study area. All listed rare or threatened species identified in the study area were recorded using GPS.
- An assessment of the Deep Creek aquatic environment where it will be dissected by the alignment option BB5. Aquatic species present in this waterway were assessed. This included water quality, flow regimes, in-stream barriers and stream ecology. The habitat values of the waterway have been discussed in the context of the proposed development.
- Preparation of maps showing the results of the assessment. This includes details of the habitat hectare assessment, such as the EVC recorded, area, habitat score and habitat hectares present.
- A Net Gain Analysis of the development layout for proposed alignment BB5. Offset targets have been identified and preliminary options have been discussed with VicRoads.
- Determination of the impact of the proposed route alignment on flora and fauna (including aquatic fauna) in the route corridor and on adjacent land.

- An impact assessment of direct and indirect impacts which may occur during construction and operation of the proposed route alignment.

This report is divided into the following sections:

Section 3 describes the sources of information, including the methods used for the field survey.

Section 4 provides an overview of the characteristics of the study area.

Section 5 presents the investigation results, describing the flora and fauna and aquatic ecology of the study area.

Section 6 provides the methodologies and results of the targeted Brown Toadlet survey.

Section 7 discusses the implications of the findings under relevant Commonwealth, State and local legislation and policies.

Section 8 provides recommendations to inform the design process and assist the development of a minimum impact proposal.

This investigation was undertaken by a team from BL&A, comprising Shannon Le Bel (Botanist), Rachel Omodei (Botanist), Bill Wallach (Botanist), Curtis Doughty (Zoologist), Peter Lansley (Zoologist), Khalid Al Dabbagh (Zoologist), Teisha Sloane (Zoologist), Lachlan Marshall (Ecologist), Davide Coppolino (Senior Botanist), Brett Macdonald (Senior Ecologist) and Alan Brennan (Senior Ecologist & Project Manager). A team from Streamline Research, comprising John McGuckin and Dave Lucas, undertook the aquatic ecology assessment.

3. SOURCES OF INFORMATION

3.1. Existing information

Existing information used for this investigation is described below. Note that 'study area' refers to an area that can be described in approximate terms as being bounded by Melbourne Airport to the south, Woodlands Historic Park to the east, the OMR corridor to north and Jacksons Creek to the west.

Existing information has been obtained from a wider area, termed the 'search region' defined for this assessment as an area with radius ten kilometres from the approximate centre point of the study area of coordinates: latitude 37˚ 37' 41" S and longitude 144˚ 48' 03" E. This provided an indication of threatened species and communities that have the potential to occur in the study area.

The following reports, planning scheme and development plans relating to the study area were reviewed:

- BL&A, Outer Metropolitan Ring Link to Melbourne Airport and Bulla Bypass – Desktop Assessment of Flora and Fauna, Report No. 10155 (1.1) February 2011 (BL&A 2011); and
- BL&A, Melbourne Airport link to Outer Metropolitan Ring & Bulla Bypass Planning Study - Flora, fauna & Net gain Assessment, Report No. 11138 (1.6), May 2013 (BL&A 2013).

3.1.1. Flora

A list of the flora species recorded in the search region was obtained from the Viridans Flora Information System (FIS), a database administered by the Department of Sustainability and Environment (DSE) (Viridans Biological Databases 2011a). This database search listed all plant species, including rare and threatened plants found in the search region. The Victorian Biodiversity Atlas Flora records were also reviewed. Plant taxonomy used throughout this report follows the FIS standards.

The likelihood of suitable habitat in the study area for nationally threatened flora species was ascertained through a search of the online *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (DSEWPC 2011) using the same search region.

3.1.2. Ecological Vegetation Classes

Pre-1750 (pre-European settlement) vegetation mapping was reviewed to determine the type of native vegetation likely to occur in the study area. Information on Ecological Vegetation Classes was obtained from published EVC benchmarks. These sources included:

- Relevant EVC benchmarks for the Victorian Volcanic Plain and Central Victorian Uplands bioregions[1] (DSE 2011a).

[1] A bioregion is defined as "a geographic region that captures the patterns of ecological characteristics in the landscape, providing a natural framework for recognising and responding to

- Biodiversity Interactive Maps (DSE 2011b).

The likelihood of EPBC Act threatened ecological communities in the study area was ascertained through a search of the online *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (DSEWPC 2011) using the search region outlined above.

3.1.3. Fauna

A list of the fauna species recorded in the search region was obtained from the Atlas of Victorian Wildlife (AVW), a database administered by DSE (Viridans Biological Databases 2011b). The Victorian Biodiversity Atlas Fauna records were also reviewed. Fauna taxonomy used throughout this report follows the AVW nomenclature.

An aquatic ecology assessment was undertaken by Streamline Research Pty. Ltd. within the study area. This report can be viewed in Appendix 3. The results and implications of the aquatic assessment are summarised and included in this report.

The presence or likelihood of occurrence in the study area of nationally threatened fauna species was obtained through the EPBC Act Protected Matters Search Tool (DSEWPC 2011).

3.2. Field methodology

The field assessment was conducted on the 5th, 6th, 7th, 11th, 13th and 26th October 2011 along with 19th January 2012. During this assessment, all properties within the study area were inspected initially by vehicle and areas supporting remnant native vegetation and/or fauna habitat were surveyed in more detail on foot.

Sites in the study area found to support native vegetation and/or habitat for rare or threatened flora and/or fauna were mapped. Mapping was undertaken through a combination of aerial photograph interpretation and ground-truthing using a hand held GPS (accurate to approximately five metres).

3.2.1. Flora

Incidental records of flora species within vegetation types and landforms were made whilst conducting field work. Specimens requiring identification using laboratory techniques were collected.

3.2.2. Native vegetation

Native vegetation in Victoria has been defined as belonging to three categories (DNRE 2002):

- Remnant patch
- Scattered trees
- Degraded treeless vegetation

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biodiversity values". In general bioregions reflect underlying environmental features of the landscape (DNRE 1997).

A description of these is provided below with the prescribed DSE methods to assess them.

Remnant patch

Remnant patches of native vegetation comprise indigenous plant species considered part of a clearly definable EVC and are defined by the DSE as:

- An area of native vegetation, with or without trees, where at least 25% of the understorey cover is indigenous (excluding bare ground), and/or
- "A group (i.e. three or more) of trees where the tree canopy cover is at least 20%" (DSE 2007a).

Remnant patch vegetation is assessed using the habitat scoring or habitat hectare method (Parkes *et al*. 2003; DSE 2004a) whereby components of native vegetation (e.g. tree canopy, understorey and ground cover) are assessed against a DSE-issued EVC benchmark (see appendices) that described the notional pre-European condition of that EVC. The score effectively measures the percentage resemblance of the vegetation to its original condition.

The habitat hectare score assists in defining the value of remnant native vegetation for assessing its conservation significance and for calculating offsets if removal of native vegetation is approved.

Scattered trees

DSE (2007a) define scattered trees as indigenous canopy trees with a diameter at breast height (1.3 metres) (DBH) greater than ten centimetres "within an area where at least 75% of the total understorey plant cover is introduced vegetation and the overall canopy cover for a group (i.e. three or more) of trees is less than 20%".

Scattered trees are counted and their DBH measured. The size class of scattered trees is based on the large tree DBH in the relevant benchmark for the EVC to which it once belonged.

Isolated trees or shrubs that would have once comprised the canopy of particular EVCs that lack a Large Tree component, i.e. Swamp Scrub (EVC 53) and Coastal Alkaline Scrub (EVC 858), do not meet the criteria of a Scattered Tree (Lis Ashby, DSE, *pers. comm.* 06/05/11). Offsets are therefore not required for the removal of these plants under the Framework.

Degraded treeless vegetation

Degraded treeless vegetation comprises all other vegetation (DSE 2007a), either:

- "Minor treeless vegetation" which is vegetation that does not have more than 25% understorey cover that is native or does not contain any canopy trees, or
- "Modified treeless vegetation" which is 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. This may include such situations as former grasslands that have had a history of cropping, and now have an extremely modified cover consisting of a few opportunistic,

primary colonising native grass species generally amongst exotic species, with little other indigenous diversity.

Minor treeless vegetation requires no further assessment or offsets.

The determination of a patch supporting modified treeless vegetation must be confirmed by DSE. In the case where modified treeless vegetation supports habitat for a rare or threatened species, this will be treated as a remnant patch. A habitat hectare assessment will be required and the conservation significance will be based on the determination of best 50% or remaining 50% habitat. Offsets will be required for the removal of this type of vegetation.

Modified treeless vegetation which does not support habitat for a rare or threatened species requires no further assessment or offsets.

3.2.3. Fauna

The following techniques were used to detect fauna species inhabiting the study area:

- Incidental searches for mammal scats, tracks and signs (e.g. diggings, signs of feeding and nests/burrows).
- Turning over logs and other ground debris for reptiles, frogs and mammals.
- Bird observation during the day.
- General searches for reptiles and frogs; including identification of frog calls in seasonally wet areas.

Fish were assessed as part of this investigation by Streamline Research Pty. Ltd. and the assessment report can be viewed at Appendix 3. It describes methods used for the assessment. The results of the aquatic assessment have been included in this report.

Fauna habitat types were characterised in the study area and are described in Section 5.2.1. The quality of fauna habitat was assessed based on the criteria detailed below. These are based on habitat components which include including old-growth trees, fallen timber, leaf litter, surface rocks. Three quality categories were used, as described below:

High: The majority of fauna habitat components are present and habitat linkages to other remnant ecosystems in the landscape are intact.

Moderate: The majority of fauna habitat components are present but habitat linkages to other remnant ecosystems in the landscape are absent; or

The majority of habitat components are absent but habitat linkages to other remnant ecosystems in the landscape are intact.

Low: The majority of fauna habitat components are absent and habitat linkages to other remnant ecosystems in the landscape are absent.

3.3. Limitations of field assessment

Where feasible, all efforts are made to schedule flora and fauna field surveys in optimal weather conditions and times of year. Nevertheless, field surveys usually fail to record all species present for various reasons, including the seasonal

absence of some species and short survey duration. Rare or cryptic species are often missed in short surveys.

Detailed flora surveying was carried out in spring, when some annual and winter-emergent plant species may have been absent or in the senescent stage of their life-cycle and lacking essential identification characteristics. The timing of the survey and condition of vegetation was otherwise considered suitable to ascertain the extent and quality of native vegetation.

The fauna assessment was undertaken during warm and fine weather conditions. These conditions were considered suitable for detecting most species likely to occur in the study area.

As the primary purpose of the investigation was to assess the extent and quality of native vegetation and fauna habitats in the study area and any potential impacts, the review of existing information, combined with the field surveys were sufficient to complete this aspect of the assessment.

Wherever appropriate, a precautionary approach has been adopted in the discussion of implications. That is, where insufficient evidence is available on the occurrence or likelihood of occurrence of a species, it is assumed that it could be in an area of suitable habitat. The implications under legislation and policy are considered accordingly.

4. SITE DESCRIPTION

The study area for this investigation is approximately 650 hectares of private and public land within Bulla and Tullamarine (Figures 1, 2 & 3), approximately 24 kilometres north-west of Melbourne CBD.

The study area comprised undulating plains, low hills and incised creek valleys. Granite geology occurred in the north-eastern part of the study area while the southern and western parts of the area were dominated by basalt-derived soils. Deep Creek runs roughly north to south through the study area and lies within a deeply incised valley with steep sides.

Observed vegetation consisted of grassy woodlands, riparian woodlands, scattered trees, introduced pasture, escarpment shrublands, high threat weedy areas and planted trees.

The majority of the study area has been highly disturbed from its original vegetative state. However, some naturally vegetated areas did still remain including along creeks and in the Woodlands Historic Park. Connectivity occurred along the creeks including Deep Creek and Moonee Ponds Creek and also extended into Woodlands Historic Park.

The residential area of Bulla township lies east of Deep Creek. Low density residential, parkland and recreational land occurred between Bulla and Somerton Roads. The Bulla Tip and Quarry are located north of Sunbury Road to the west of Bulla township.

Land use in the study area include pasture, cropping, stone quarrying, stock grazing and residential areas. Surrounding land supports similar land uses. In addition, the runways of Melbourne Airport occur approximately five kilometres from the central point of the study area. Parts of the proposed Bulla Bypass alignments may occur within Melbourne Airport land, but occur away from the airport runways and other infrastructure.

The study area lies within the Victorian Volcanic Plain and Central Victorian Uplands bioregions and falls within the Port Phillip and Westernport catchment management region.

In the Hume Planning Scheme, the majority of the study area is zoned Green Wedge. Land zoned Public Park and Recreation Zone (PPRZ) and Public Conservation and Resource Zone (PCRZ) occur in the parkland/recreational areas. The town of Bulla is largely zoned Township Zone (TZ). The banks of Jackson and Deep Creeks in the vicinity of Bulla Township are also subject to an Environmental Significance Overlay.

Figure 1: Study Area and Native Vegetation – Overview

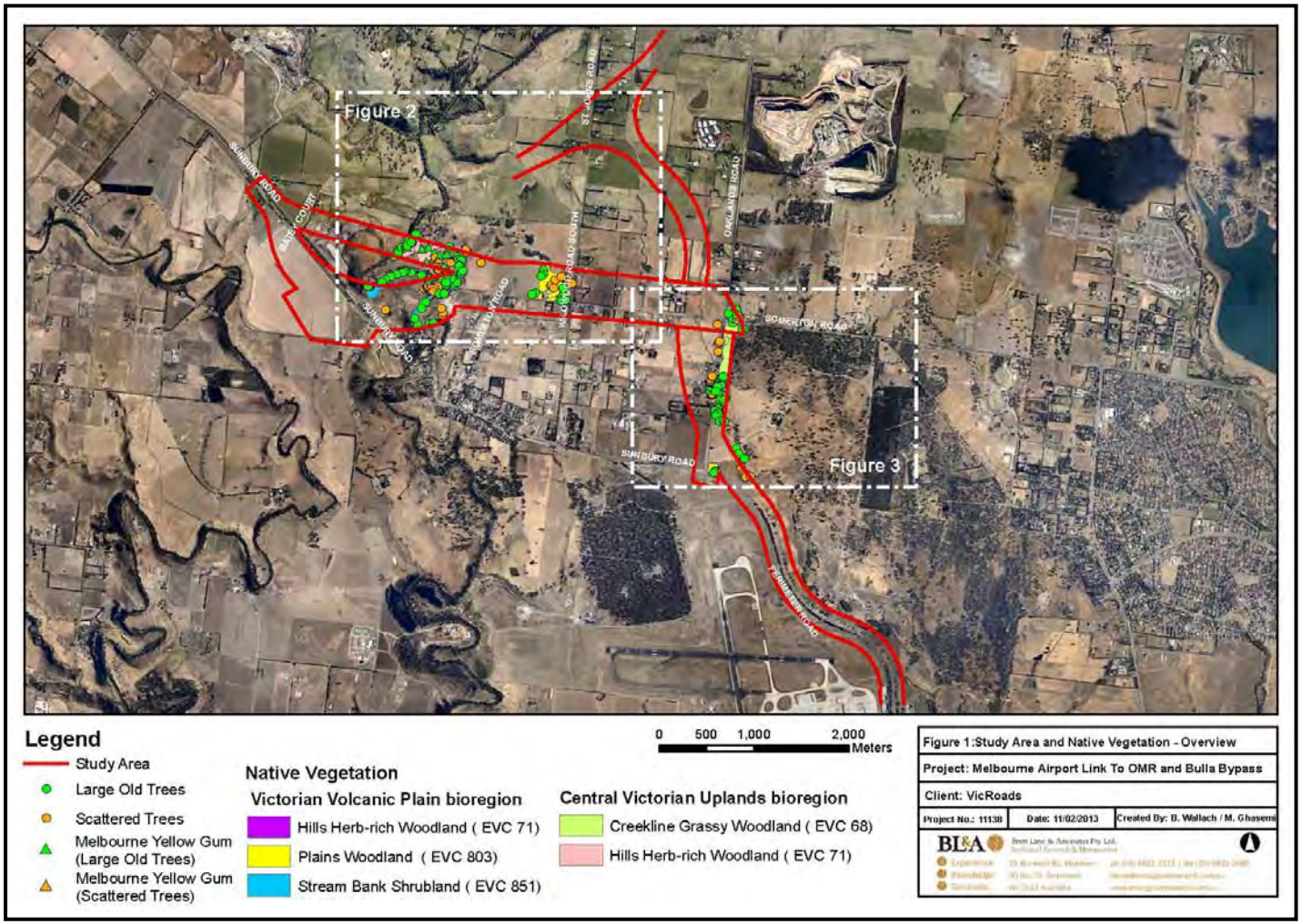


Figure 2: Study Area and Native Vegetation – Detailed West

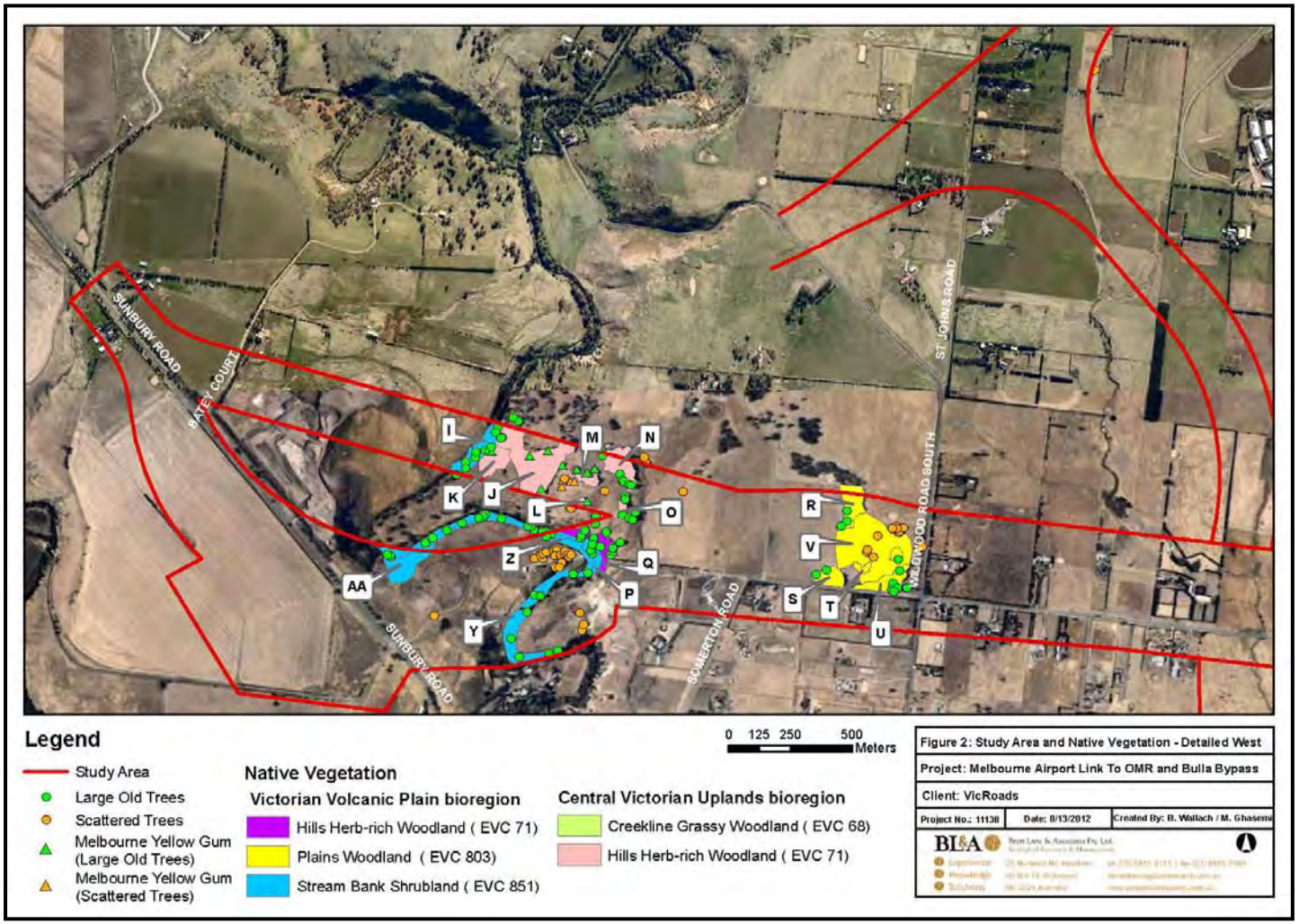
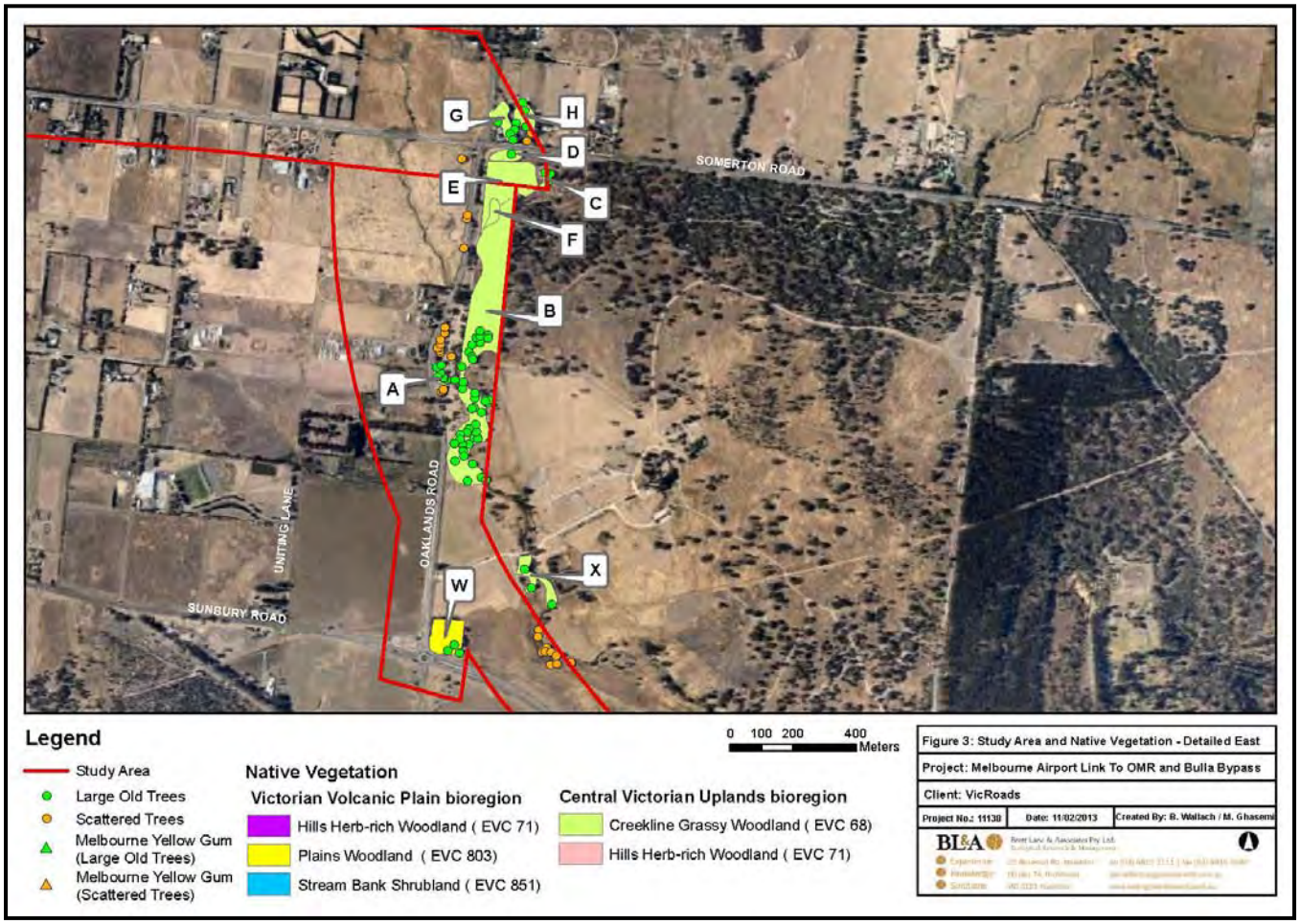


Figure 3: Study Area and Native Vegetation - Detailed East



5. ASSESSMENT RESULTS

5.1. Vegetation assessment

5.1.1. Flora species

During the field assessment 115 plant species were recorded. Of these, 56 (49%) were indigenous and 59 (51%) were introduced or non-indigenous native in origin (Appendix 1).

FIS records (Viridans Biological Databases 2011a) and the EPBC Protected Matters Search Tool (DSEWPC 2011) indicates that within the search region there are records of, or there occurs potential suitable habitat for, 51 rare or threatened flora species. Of these, 13 species were listed under the federal EPBC Act, 22 on the state *Flora and Fauna Guarantee Act 1988* (FFG Act) and 49 on DSE's Advisory List for Rare and Threatened Flora (DSE 2007b). Three rare or threatened flora species were detected during the current field survey and are listed below:

- Austral Tobacco;
- Fragrant Saltbush; and
- Melbourne Yellow-gum.

The likelihood of occurrence in the study area of threatened species listed under the FFG Act or the EPBC Act is addressed in Table 2. This analysis indicates that suitable habitat occurs on site for one listed flora species. However, as Buloke was not recorded in the study area during the current field assessment it is not considered likely to occur. Therefore, no FFG Act or the EPBC Act-listed flora species are considered likely to occur in the study area.

The following DSE-listed species were considered to potentially occur in the study area:

- Arching Flax-lily;
- Branching Groundsel; and
- Yellow Star.

Table 2: FFG Act and EPBC Act listed flora species and likelihood of occurrence

Common Name	Scientific Name	Conservation Status		Known Habitat	Likelihood of Occurrence
		EPBC	FFG		
Adamson's Blown-grass	*Lachnagrostis adamsonii*	E	f	Adamson's Blown-grass is mainly found on roadside depressions and flats, associated with drainage lines and small sluggish creeks, particularly where these sites are protected from wind by surrounding rises or by stands of tall grasses such as Phalaris aquatica, or sedges and rushes such as Juncus spp. or Gahnia spp. (DSE 2000). Associated species include Streaked Arrowgrass (Triglochin striata), Plains Saltmarsh-grass (Puccinellia stricta var. perlaxa), Australian Salt-grass (Distichlis distichophylla), Common Blown-grass (Lachnagrostis filiformis) and Beaded Glasswort (Sarcocornia quinqueflora) (Murphy 2010).	No suitable habitat - **Unlikely to occur.**
Austral Moonwort	*Botrychium australe*		f	Rare occurrences range from lowland forest to subalpine grasslands in eastern Victoria. Formal distribution extended to near Melbourne (Entwisle 1994a).	No suitable habitat - **Unlikely to occur.**
Austral Toad-flax	*Thesium australe*	V	f	Occurs on grasslands, grassy woodlands or sub-alpine grassy heathlands. Usually associated with Kangaroo Grass and Poa spp. However it will grow with other hosts, at least in the glasshouse (Scarlett *et al* 2003).	No suitable habitat - **Unlikely to occur.**
Basalt Peppercress	*Lepidium hyssopifolium*	E	f	The original habitat of Basalt Peppercress is not precisely known, but was probably eucalypt and/or *Allocasuarina* woodland with a grassy understorey, and native temperate grasslands on basalt plains (Leigh *et al*. 1984 and Tumino 2009). only known from two populations N and NE of Melbourne (Entwisle 1996a).	No suitable habitat - **Unlikely to occur.**
Brittle Greenhood	*Pterostylis truncata*		f	Open forest, often in flat open areas with shallow granite outcrops or on sheltered ridges (Jones 1994).	No suitable habitat - **Unlikely to occur.**
Buloke	*Allocasuarina luehmannii*		f	Woodlands on non-calcareous soils. Commonly grows with Grey Box (Entwisle 1996b).	Suitable habitat, but none were recorded – **Unlikely to occur.**
Button Wrinklewort	*Rutidosis leptorhynchoides*	E	f	Basaltic grasslands between Rokewood and Melbourne (Jeanes 1999).	No suitable habitat - **Unlikely to occur.**
Clover Glycine	*Glycine latrobeana*	V	f	In Victoria, occurs mainly in grasslands and grassy woodlands on basalt soils dominated by Kangaroo Grass or within intermittently flooded streamlines co-dominated by Yellow Gum and Scentbark over mixed grasses and shrubs (in the Grampians/Black Range area). The species also occurs at the Nunniong Plateau in eastern Victoria within sub-alpine woodlands around 1200 metres above sea level on red-brown clays dominated by Snow Gum over an understorey of Small-fruit Hakea, various grasses (e.g. Kangaroo Grass, tussock grasses, Bent Grass and Common Wheat-grass) and forbs. At Reef Hills State Park in north-eastern Victoria plants occur in herb-rich woodland. At Yarra Valley Parklands and Meruka Park near Melbourne, vegetation is described as Valley Grassy Forest, dominated by Yellow Box (*Eucalyptus melliodora*), with scattered Hedge Wattle (*Acacia paradoxa*). Field layer comprises wallaby grasses (*Austrodanthonia spp.*) and various forbs. Other former sites in this area occurred in Grassy Dry Forest with Red Box. (Carter & Sutter 2010; D.Coppolino pers. Obs.). It is also found rarely in heathland (Carter & Sutter 2010).	No suitable habitat - **Unlikely to occur.**
Curly Sedge	*Carex Tasmanica*	V	f	Occurs in seasonally wet, fertile, heavy basalt clay soils, usually around the margins of slightly saline drainage lines or freshwater swamps. The dominant vegetation type varies, but is often grassy/sedgy and generally lacks trees (Carter 2010a).	No suitable habitat - **Unlikely to occur.**
Large-headed Fireweed	*Senecio macrocarpus*	V	f	Occurs in a variety of habitats, including grasslands, sedgelands, shrublands and woodlands, generally on sparsely vegetated sites on sandy loam to heavy clay soils, often in depressions that are waterlogged in winter (Sinclair 2010).	No suitable habitat - **Unlikely to occur.**
Maroon Leek-orchid	*Prasophyllum frenchii*	E	f	Occurs in grassland and grassy woodland habitats, on sandy to black clay loams that are generally damp but well drained, although some sites are seasonally waterlogged. Sites include the seasonally damp transition zone on the margins of shallow freshwater marshlands (Duncan 2010)	No suitable habitat - **Unlikely to occur.**
Matted Flax-lily	*Dianella amoena*	E	f	Lowland grassland and grassy woodlands on well-drained to seasonally waterlogged fertile sandy loams to heavy cracking soils derived from sedimentary or volcanic Geology. It is widely distributed from eastern to south-western Victoria (Carter 2010b).	No suitable habitat - **Unlikely to occur.**
Pale Plover-daisy	*Leiocarpa leptolepis*		f	The only known population in Victoria occurs along a roadside which was formerly Black Box *Eucalyptus largiflorens* woodland on clay floodplain (Parsons 1987); this population is found along a roadside and the adjoining Sandilong Park Recreation Reserve approximately 4km east of Mildura (DSE 2002).	No suitable habitat - **Unlikely to occur.**
Purple Diuris	*Diuris punctata var. punctata*		f	Lowland native grasslands, grassy woodlands, heathy woodlands and open heathlands, usually on fertile, loamy soils and including periodically inundated areas (DSE 2004b).	No suitable habitat - **Unlikely to occur.**

Common Name	Scientific Name	Conservation Status		Known Habitat	Likelihood of Occurrence
		EPBC	FFG		
River Swamp Wallaby-grass	*Amphibromus fluitans*	V		Inhabits both natural and man-made water-bodies, including swamps, lagoons, billabongs and dams, and in roadside ditches predominantly in the north-central area along the Murray River between Wodonga and Echuca (Walsh 1994).	No suitable habitat - **Unlikely to occur.**
Rough Eyebright	*Euphrasia scabra*		f	Damp grassy situations, amongst shrubs, in sclerophyll forests, clearings or subalpine woodland (Barker 1999).	No suitable habitat - **Unlikely to occur.**
Small Golden Moths	*Diuris basaltica*	E	f	Grows in herb-rich native grasslands dominated by Kangaroo Grass (*Themeda triandra*) on heavy basalt soils, often with embedded basalt boulders. This vegetation is dominated by a ground layer of tussock-forming perennial grasses, with a wide variety of wildflowers and herbs growing among the tussocks (Backhouse and Lester 2010).	No suitable habitat - **Unlikely to occur.**
Small Milkwort	*Comesperma polygaloides*		f	Found in remnant native grasslands and grassy woodlands on heavy soils (Walsh 1999) on the Western Basalt Plains, dominated by Kangaroo Grass, Silver Tussock and, less commonly, wallaby grasses and spear grasses (DSE 1999)	No suitable habitat - **Unlikely to occur.**
Small Scurf-pea	*Cullen parvum*		f	The species grows in grasslands and grassy (River Red Gum) woodlands in areas with rainfall of between 450 and 700 mm (Jeanes, 1996). These sites are subject to irregular flooding, and have relatively rich soils derived from alluvium. An exception is the population near Shelford, which grows on rocky clay soils derived from basalt (DSE 2005).	No suitable habitat - **Unlikely to occur.**
Spiny Rice-flower	*Pimelea spinescens subsp. spinescens*	C	f	Grasslands or open shrublands on basalt derived soils (Entwisle 1996a). Prefers shallow depressions and drainage lines with moderate soil moisture (D.Coppolino pers. obs.).	No suitable habitat - **Unlikely to occur.**
Sunshine Diuris	*Diuris fragrantissima*	E	f	Native grasslands dominated by Kangaroo Grass, on heavy basalt soils, often with embedded basalt boulders. The sole remaining natural population at Sunshine occurs in a small (0.1 ha) remnant of Western (Basalt) Plains Grassland (Murphy *et al* 2008).	No suitable habitat - **Unlikely to occur.**
Swamp Diuris	*Diuris palustris*		f	Scattered distribution throughout western Victoria. Usually in swampy depressions in grassland or open woodland (Entwisle 1994b).	No suitable habitat - **Unlikely to occur.**
Tough Scurf-pea	*Cullen tenax*		f	Grasslands and grassy woodlands, subject to irregular flooding, with relatively rich soils derived from alluvium. *An exception is the population near Shelford, which grows from rocky clay soils derived from basalt* (DSE 2005).	No suitable habitat - **Unlikely to occur.**

C = Critically Endangered; **E** = Endangered; **V** = Vulnerable; **f** = Listed as threatened under FFG Act

5.1.2. Ecological Vegetation Classes

Pre–European EVC mapping (DSE 2011b) indicates that the study area and surrounds would have supported Plains Grassy Woodland (EVC 55), Creekline Grassy Woodland (EVC 68), Hills Herb-rich Woodland (EVC 71) and Stream Bank Shrubland (EVC 851) prior to European settlement based on modelling of factors including rainfall, aspect, soils and remaining vegetation.

Evidence on site, including floristic composition and soil characteristics, suggested that Creekline Grassy Woodland (EVC 68) was present along Moonee Ponds Creek in the eastern half of the study area (Figures 1, 2 & 3). Hills Herb-rich Woodland (EVC 71) and Stream Bank Shrubland (EVC 851) only occurred along Deep Creek in the west of the study area. Plains Woodland (EVC 803) mainly occurs near the junction of Somerton Road and Wildwood Road in the middle of the study area. However, an isolated patch does occur on the corner of Sunbury Road and Oaklands Road

Creekline Grassy Woodland (EVC 68) has an endangered conservation status in the Central Victorian Uplands bioregion. The benchmark for this EVC describes it as "Eucalypt-dominated woodland to 15 m tall with occasional scattered shrub layer over a mostly grassy/sedgy to herbaceous ground-layer. [It] occurs on low-gradient ephemeral to intermittent drainage lines, typically on fertile colluvial/alluvial soils, on a wide range of suitably fertile geological substrates. These minor drainage lines can include a range of graminoid and herbaceous species tolerant of waterlogged soils, and are presumed to have sometimes resembled a linear wetland or system of interconnected small ponds" (Appendix 6).

Hills Herb-rich Woodland (EVC 71) has a vulnerable conservation status in the Central Victorian Uplands bioregion. The benchmark for this EVC describes it as "A dry, open eucalypt woodland to 15 m tall often with a sparse shrub layer. The understorey is dominated by a carpet of herbs and grasses. Soils are generally shallow but fertile, and outcropping rock is not uncommon. This seasonally dry environment is favourable for annual herbs, with the fertile nature of the various geologies also supporting perennial herbs. Landform can vary from relatively flat ground to ridge tops on sedimentary sandstones (along seams of mineral-rich sandstone) to undulating, rounded, granite hill landforms" (Appendix 6).

Plains Woodland (EVC 803) has an endangered conservation status in the Victorian Volcanic Plain bioregion. The benchmark for this EVC describes it as "Grassy or sedgy woodland to 15 m tall with large inter-tussock spaces potentially supporting a range of annual or geophytic herbs adapted to low summer rainfall, with low overall biomass. Mostly occurs on terrain of low relief in areas receiving <600 mm rainfall per annum. Fertile, sometimes seasonally waterlogged, mostly silty, loamy or clay topsoils, with heavy subsoils, derived largely from former Quaternary swamp deposits" (Appendix 6).

Stream Bank Shrubland (EVC 851) has an endangered conservation status in the Victorian Volcanic Plain bioregion. The benchmark for this EVC describes it as "Tall shrubland to 8 m tall above a ground layer of sedges and herbs. A sparse eucalypt overstorey to 15 m tall may sometimes be present. Occurs along rivers

and major streams where the watercourse consists of either rocky banks, a flat rocky stream bed or broad gravel banks which are often dry but are also regularly flooded by fast flowing waters" (Appendix 6).

A total of 27 remnant patches (referred to herein as habitat zones) comprising the abovementioned EVCs were identified in the study area (Table 3). Refer Figures 1, 2 & 3 for habitat zone locations.

Table 3: Description of habitat zones in the study area

Habitat Zone	EVC	Bioregional Conservation Status	Description
A	Creekline Grassy Woodland (EVC 68)	Endangered	The patch occurs within the wide road reserve of Oaklands Road and consists entirely of a River Red-gum canopy. Native flora species are virtually non-existent in the understorey. Large old trees were present.
B	Creekline Grassy Woodland (EVC 68)	Endangered	Occurring alongside Moonee Ponds Creek, this patch consisted of a River Red-gum canopy with an understorey of native shrubs (Hedge Wattle Silver Wattle and Tree Violet) and grasses (Kangaroo Grass, Common Tussock-grass, Weeping Grass, wallaby grasses and spear grasses). Many large old trees were recorded. The cover of introduced flora species was moderate, and was dominated by high threat species.
C	Creekline Grassy Woodland (EVC 68)	Endangered	A patch of only a handful of large old River Red-gum trees, with an understorey dominated by native grasses (Kangaroo Grass, wallaby grasses and spear grasses). The cover of introduced flora species was moderate, however, a majority of species were high threat.
D	Creekline Grassy Woodland (EVC 68)	Endangered	A large old River Red-gum tree, with an understorey dominated by native grasses (Supple Spear-grass, Common Tussock-grass and Weeping Grass). The cover of introduced flora species was moderate, however, a majority of species were high threat.
E	Creekline Grassy Woodland (EVC 68)	Endangered	No canopy trees occurred in this patch, but a single age cohort of River Red-gum saplings was recorded. The patch largely consisted of native grasses, including Kangaroo Grass, Supple Spear-grass and Common Tussock-grass. The cover of introduced flora species was moderate but was largely made up of the high threat weed Chilean Needle-grass.
F	Creekline Grassy Woodland (EVC 68)	Endangered	This area was dominated immature River Red-gum saplings. The understorey consisted of Weeping Grass, spear grasses and wallaby grasses. No mature trees were recorded. The cover of introduced flora species was moderate, but was largely made up of a high threat weed, Chilean Needle-grass.
G	Creekline Grassy Woodland (EVC 68)	Endangered	This patch is confined to the canopies of the large River Red-gum trees. Five of these trees are considered as large old trees. The understorey was dominated by introduced flora species.

Habitat Zone	EVC	Bioregional Conservation Status	Description
H	Creekline Grassy Woodland (EVC 68)	Endangered	This patch is confined to the canopies of the large River Red-gum trees. Three of these trees are considered as large old trees. The understorey was dominated by introduced flora species.
I	Stream Bank Shrubland (EVC 851)	Endangered	This patch occurs along both banks of Deep Creek. The canopy was dominated by mature River Red-gum trees, with several Yellow Box trees also occurring. The number of native shrub and grass species in the understorey was surprisingly high. Dominant species included Tree Violet, Drooping Sheoak, River Bottlebrush, Berry Saltbush, Supple Spear-grass, Kangaroo Grass and Common Spike-sedge. Large old trees were also present along the banks. High threat weeds were also prominent throughout the patch.
J	Hills Herb-rich Woodland (EVC 71)	Vulnerable	DSE-listed Yellow Gum and Yellow Box trees co-dominated the open canopy. The patch occurs on rocky and skeletal soils. The understorey vegetation was sparse, but dominated by native shrubs (Berry Saltbush, Drooping Cassinia, Cherry Ballart, Tree Violet, Gold-dust Wattle and DSE-listed Fragrant Saltbush), herbs (DSE-listed Austral Tobacco, Variable Groundsel, Bronze Bluebell) and grasses (Supple Spear-grass, Kangaroo Grass and wallaby grass).
K	Hills Herb-rich Woodland (EVC 71)	Vulnerable	This modified area is dominated by native shrubs and grasses, including Sweet Bursaria, Lightwood, Supple Spear-grass and wallaby grasses. No canopy trees occur. The cover of introduced flora species is low, but is dominated by high threat species.
L	Hills Herb-rich Woodland (EVC 71)	Vulnerable	A small isolated patch of three Yellow Box and DSE-listed Yellow Gum trees, one of which is a large old tree. The ground was thickly covered with native organic litter from the canopy trees. High threat weeds dominated the very sparse understorey.
M	Hills Herb-rich Woodland (EVC 71)	Vulnerable	An open DSE-listed Yellow Gum (recruiting) canopy occurred above the rocky and skeletal soils. Three large old trees were recorded. The understorey vegetation was sparse and species poor. The cover of introduced flora species was high and dominated by high threat weeds, including Apple of Sodom, Galenia and Spear Thistle.
N	Hills Herb-rich Woodland (EVC 71)	Vulnerable	An open DSE-listed Yellow Gum and Grey Box co-dominated canopy occurred above the rocky and skeletal soils. Seven large old trees were recorded. The sparse understorey consisted of DSE-listed Fragrant Saltbush and Berry Saltbush. The cover of introduced flora species was high and dominated by high threat weeds, including Apple of Sodom, Galenia and Spear Thistle.

Habitat Zone	EVC	Bioregional Conservation Status	Description
O	Hills Herb-rich Woodland (EVC 71)	Vulnerable	This degraded patch consisted of an open Grey Box canopy above a sparse understory of Berry Saltbush and Ruby Saltbush. Six large old trees were recorded. The cover of introduced flora species was high and dominated by high threat weeds, including Apple of Sodom, Galenia and Spear Thistle.
P	Stream Bank Shrubland (EVC 851)	Endangered	This patch occurs along the degraded northern bank of Deep Creek. The canopy was dominated by mature River Red-gum trees. Six large old trees were recorded. The number of native shrub species in the understorey was surprisingly high. Dominant species included Tree Violet, Drooping Sheoak, Lightwood and River Bottlebrush. Large old trees were also present. The cover of native grasses in the understorey had been outcompeted by introduced species. High threat weeds were dominant.
Q	Hills Herb-rich Woodland (EVC 71)	Vulnerable	A mixed canopy of Yellow Box, Grey Box and River Red-gum occurred on the higher northern banks of Deep Creek. Nine large old trees were recorded. Several native shrubs () and grasses () occurred in the understorey. The cover of native grasses in the understorey was reduced as a result of the dominance of introduced species. High threat weeds were dominant.
R	Plains Woodland (EVC 803)	Endangered	The understorey of this patch has been heavily degraded by stock grazing. A Grey Box canopy now exists above an understorey dominated by pasture grasses (Perennial Rye-grass and Sweet Vernal-grass) and weeds (Flatweed and Cape Weed). Three large old trees were recorded.
S	Plains Woodland (EVC 803)	Endangered	The understorey of this patch has been heavily degraded by stock grazing. A Grey Box canopy now exists above an understorey dominated by pasture grasses (Perennial Rye-grass and Sweet Vernal-grass) and weeds (Flatweed and Cape Weed). Two large old trees were recorded.
T	Plains Woodland (EVC 803)	Endangered	The understorey of this patch has been heavily degraded by stock grazing. A Grey Box canopy now exists above an understorey dominated by pasture grasses (Perennial Rye-grass and Sweet Vernal-grass) and weeds (Flatweed and Cape Weed).
U	Plains Woodland (EVC 803)	Endangered	The understorey of this patch has been heavily degraded by stock grazing. A Grey Box canopy now exists above an understorey dominated by pasture grasses (Perennial Rye-grass and Sweet Vernal-grass) and weeds (Flatweed and Cape Weed). Eight large old trees were recorded.
V	Plains Woodland (EVC 803)	Endangered	A patch of derived grassland dominated by Supple Spear-grass and Rough Spear-grass. The cover of introduced flora species was high, and was dominated by a high threat species in Chilean Needle-grass.

Habitat Zone	EVC	Bioregional Conservation Status	Description
W	Plains Woodland (EVC 803)	Endangered	A small isolated reserve of Grey Box dominated woodland. Three large old trees were recorded. A moderate cover of Gold-dust Wattle, Lightwood, DSE-listed Fragrant Saltbush, Grey Roly-poly, Nodding Saltbush and Small-leaved Clematis dominated the understorey. The cover of introduced flora species was low, but high threat weeds including Horehound, Spear Thistle and Galenia were dominant.
X	Creekline Grassy Woodland (EVC 68)	Endangered	Occurring alongside Moonee Ponds Creek, this patch consisted of a mature and recruiting River Red-gum canopy. Three large old trees were recorded. The understorey was somewhat degraded, with only common native shrubs (Hedge Wattle, Sweet Bursaria, Black Wattle and Gold-dust Wattle) and grasses (Common Tussock-grass and spear grasses) persisting. The cover of introduced flora species was moderate, and was dominated by high threat species including Sweet Vernal-grass, Black Nightshade, African Box-thorn, Artichoke Thistle and Drain Flat-sedge.
Y	Stream Bank Shrubland (EVC 851)	Endangered	This patch occurs along the bank of Deep Creek. The canopy spanned across both sides of the creek and was dominated by mature River Red-gum trees. No large old trees were recorded. The cover of native understorey shrubs (River Bottlebrush and Tree Violet) was moderate. The cover of native grasses in the understorey had been largely outcompeted by introduced species. High threat weeds were also prominent throughout the patch.
Z	Stream Bank Shrubland (EVC 851)	Endangered	This patch occurs along the degraded southern bank of Deep Creek. The canopy was dominated by mature River Red-gum trees. The number of native shrub species in the understorey was surprisingly high. Dominant species included Tree Violet, River Bottlebrush, Sweet Bursaria, Lightwood and Silver Wattle. Large old trees were also present. The cover of native grasses in the understorey had been outcompeted by introduced species. High threat weeds were also prominent throughout the patch.
AA	Stream Bank Shrubland (EVC 851)	Endangered	No canopy component was recorded in this patch. Native shrubs and grasses occurred within an understorey that was dominated by introduced flora species including Chilean Needle-grass, African Box-thorn and African Boneseed. Dominant native species included Blackwood, Ruby Saltbush, Grey Roly-poly and Rough Spear-grass.

The habitat hectare assessment results for all habitat zones recorded in the study area are provided in Table 4, including any large and very large trees in habitat zones. Habitat Zone W met the criteria for the EPBC Act listed community Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia. No other habitat zones met the thresholds to qualify for this, or any other, EPBC

Act listed community. More detailed habitat scoring results are presented in Appendix 4 and the locations of habitat zones are shown in Figures 1, 2 & 3.

Table 4: Summary of habitat hectare assessment results in the study area

Habitat Zone	EVC	Area (ha)	Habitat Score (out of 100)	Habitat Hectare (Hha)	Conservation Significance	No. of large and very large trees in habitat zone
A	Creekline Grassy Woodland (EVC 68)	0.13	25	0.03	High	7
B		7.11	30	2.13	High	41
C		0.15	44	0.07	High	3
D		0.31	29	0.09	High	1
E		2.00	20	0.40	High	0
F		0.26	20	0.05	High	0
G		0.55	24	0.13	High	5
H		0.49	18	0.09	High	3
I	Stream Bank Shrubland (EVC 851)	1.40	44	0.62	Very High	11
J	Hills Herb-rich Woodland (EVC 71)	4.12	52	2.14	Very High	8
K		1.03	29	0.30	Medium	0
L		0.09	29	0.03	Very High	1
M		0.45	25	0.11	Very High	3
N		1.66	27	0.45	Very High	7
O		0.50	32	0.16	High	6
P	Stream Bank Shrubland (EVC 851)	0.73	42	0.31	Very High	6
Q	Hills Herb-rich Woodland (EVC 71)	1.30	32	0.42	Very High	9
R	Plains Woodland (EVC 803)	1.27	22	0.28	High	3
S		0.76	20	0.15	High	2
T		0.22	14	0.03	High	0
U		1.35	29	0.39	High	8
V		5.25	12	0.63	High	0
W*		1.09	26	0.28	High	3
X	Creekline Grassy Woodland (EVC 68)	0.65	24	0.16	High	3
Y	Stream Bank Shrubland (EVC 851)	1.65	24	0.40	Very High	5
Z		3.71	35	1.30	High	25
AA		1.53	16	0.24	High	0
Totals		**39.76**		**11.39**		**160**

***** = constitutes the EPBC Act listed community Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.

The conservation significance of habitat zones is based on the bioregional conservation status of the EVCs, habitat score of the vegetation, any significant site attributes and the results of the best / remaining 50% habitat assessment, presented in Appendix 7.

The assessment for best / remaining 50% of habitat has been undertaken for each Victorian listed flora and fauna species that has been recorded or is likely to occur in each habitat zone (DSE 2007a).

5.1.3. Scattered trees

Scattered trees recorded in the study area would have once comprised the canopy component of several EVCs across both the Central Victorian Uplands and Victorian Volcanic Plain Bioregions. A total of 80 scattered trees occurred in the

study area (Figures 1, 2 & 3), of which seven were very large, 20 were large, 23 were medium and 30 were small compared to the benchmark large tree diameter at breast height (DBH) for Plains Grassy Woodland (EVC 55_61) of 80 centimetres, Creekline Grassy Woodland (EVC 68) of 80 centimetres, Hills Herb-rich Woodland (EVC 71) of 70 centimetres, Plains Woodland (EVC 803) of 70 centimetres and Stream Bank Shrubland (EVC 851) of 70 (Appendix 6). Scattered trees are listed in Appendix 5 and summarised in Table 5.

Table 5: Summary of scattered trees in the study area

Size Class	Representative EVC	Bioregion	DBH range (cm)	Conservation Significance	Number of trees
Very Large	Creekline Grassy Woodland (EVC 68)	Central Victorian Uplands	120 or greater	High	3
Very Large	Hills Herb-rich Woodland (EVC 71)	Victorian Volcanic Plain	105 or greater	Medium	3
Large	Stream Bank Shrubland (EVC 851)	Victorian Volcanic Plain	105 or greater	High	1
Large	Creekline Grassy Woodland (EVC 68)	Central Victorian Uplands	80 to 119	High	5
Large	Hills Herb-rich Woodland (EVC 71)	Central Victorian Uplands	70 to 104	Medium	6
Large	Hills Herb-rich Woodland (EVC 71)	Victorian Volcanic Plain	70 to 104	Medium	2
Large	Plains Woodland (EVC 803)	Victorian Volcanic Plain	70 to 104	High	6
Large	Stream Bank Shrubland (EVC 851)	Victorian Volcanic Plain	70 to 104	High	1
Medium	Creekline Grassy Woodland (EVC 68)	Central Victorian Uplands	60 to 79	High	5
Medium	Hills Herb-rich Woodland (EVC 71)	Central Victorian Uplands	53 to 69	Medium	4
Medium	Plains Grassy Woodland (EVC 55_61)	Victorian Volcanic Plain	60 to 79	High	1
Medium	Hills Herb-rich Woodland (EVC 71)	Victorian Volcanic Plain	53 to 69	Medium	8
Medium	Plains Woodland	Victorian	53 to 69	High	5

Size Class	Representative EVC	Bioregion	DBH range (cm)	Conservation Significance	Number of trees
	(EVC 803)	Volcanic Plain			
Small	Creekline Grassy Woodland (EVC 68)	Central Victorian Uplands	20 to 59	Low	16
Small	Hills Herb-rich Woodland (EVC 71)	Central Victorian Uplands	17 to 52	Low	4
Small	Plains Grassy Woodland (EVC 55_61)	Victorian Volcanic Plain	20 to 59	Low	1
Small	Hills Herb-rich Woodland (EVC 71)	Victorian Volcanic Plain	17 to 52	Low	7
Small	Plains Woodland (EVC 803)	Victorian Volcanic Plain	17 to 52	Low	1
Small	Stream Bank Shrubland (EVC 851)	Victorian Volcanic Plain	17 to 52	Low	1
Total					**80**

Very large, large and medium scattered trees in the study area are assigned a high to low conservation significance based on the bioregional conservation status of the EVC to which they once belonged, as presented in Table 5. Small scattered trees are defined as having low conservation significance according to the Framework. A best/remaining habitat assessment was undertaken for scattered trees recorded in the study area listed on DSE's Advisory List (Appendix 7). This assessment resulted in an increase to the conservation significance of some trees.

5.1.4. Degraded treeless vegetation

No forms of Degraded Treeless Vegetation were identified within the study area during the current assessment.

5.2. Fauna

5.2.1. Habitat assessment

The study area supports the following habitat types:

- Grassy Woodland;
- Scattered Trees;
- Rocky Escarpment;
- Aquatic habitat;
- Planted Trees and
- Pasture/Crop.

Grassy Woodland: There were three different grassy woodland habitats described below.

River Red-gum woodland: The River Red-gum dominated grassy woodland occurred at Woodlands Historic Park and along the banks of Deep Creek. Some of the trees in these two areas were very large and contained hollows that provide nesting and sheltering opportunities for birds and mammals. The majority of the understorey had been disturbed and was dominated by the introduced Chilean Needle-grass however there were some areas of native tussock grass including Kangaroo Grass, wallaby grass and spear grass. Some areas had a shrub layer consisting of Gold-dust Wattle. Coarse woody debris was in abundance providing sheltering opportunities for ground dwelling mammals, reptiles and frogs.

This habitat type extended throughout the Woodlands Historic Park and along Deep Creek which connected to other areas of similar habitat further upstream and downstream. Overall is considered to be high habitat quality for native fauna.

Grey Box woodland: This habitat type was located in the centre of the study area along Somerton Rd. There were some large old trees in this woodland that contained hollows and provide habitat for birds and mammals. The understorey had been disturbed and was dominated by introduced pasture grasses, shrubs were absent. This area was used for cattle grazing and many Eastern Grey Kangaroos utilise the pasture. Fallen logs had been collected and leaf litter was present.

The study area is connected to other woodland habitats in the area. Overall this habitat type is considered to be moderate to high habitat quality for native fauna.

Yellow Gum woodland: This habitat type was located on the high part of the escarpment along the Deep Creek ravine. This habitat type had some dead standing trees that contained hollows. Woodland bird species were present in this habitat. Lacked a middle storey vegetation layer and had a mixture of exotic and native grasses as an understorey, Coarse woody debris, stumps, rocks and leaf litter were present.

There was connectivity along Deep Creek to other woodland habitats. Overall this habitat type is considered to be high habitat quality for native fauna.

Scattered Trees: There were a few scattered trees throughout the study area, with the majority of them being River Red-gum or Grey Box. Some of these trees were

large old trees containing hollows which provide suitable habitat for hollow nesting birds and hollow dependant mammals such as possums and bats. Fallen branches were present and these trees were generally isolated. Overall these trees are considered to be moderate habitat quality for native fauna.

Rocky Escarpment: This habitat type was located along the Deep Creek ravine. It was dominated by Yellow Box and River Red-Gum. It contained large old trees with hollows and provided nesting opportunities for raptors in the tree branches. There were fallen trees and branches along with the abundance of surface and embedded rocks which provided excellent conditions for reptiles. Native tussock grasses were present including spear grass and wallaby grass. This habitat type did expand along the Deep Creek escarpment. Overall this habitat type is considered to be high habitat quality for native fauna.

Aquatic Habitat: There were two different aquatic habitats at the study area including creeklines and farm dams.

Creekline habitats: There are two creekline habitats at the study area including Deep Creek and Moonee Ponds Creek. These creeks are lined with River Red-gum and have fringing, emergent and aquatic vegetation along the creek. The Deep Creek is a slow flowing creek, where as the Moonee Ponds Creek is an ephemeral creek and is sometimes slow flowing, stagnant or dry. At the time of the current survey it was slow flowing. These creeks provide suitable habitat for water birds, mammals, reptiles and frogs and are well connected. Overall this habitat type is considered to be high habitat quality for native fauna.

Farm Dams: These habitat types are constructed wetlands that were generally poorly vegetated. It provides habitat for common waterbirds and watering points for large mammals and seed eating birds (cockatoos and pigeons). These dams are isolated and are considered to be low to moderate habitat quality for native fauna.

Planted Trees: Many trees have been planted along road reserves and fence lines. They are dominated by non-indigenous eucalypt species including Sugar Gum and Yate and also by introduced pine trees. Overall these habitat types are considered to be low habitat quality for native fauna.

Pasture & Crop: These habitat types were dominated by introduced pasture grasses and many areas were dominated by Chilean Needle-grass. These areas were utilised for grazing purposes and are used primarily by feral animals and common occurring animals. Overall this habitat type is considered to be low habitat quality for native fauna.

5.2.2. Fauna species

The review of existing information and current field survey indicated that 231 fauna species may occur within the study area, including 156 bird (11 introduced), 30 mammal (seven introduced), 20 reptile, 11 frog and 14 fish species (Appendix 2).

During the field assessments 100 fauna species were recorded. This included 72 bird (eight introduced), 12 mammal (four introduced), five reptile, five frog and six fish species (two introduced) (Appendix 2).

5.2.3. Listed threatened fauna species

The review of existing information and current field survey indicate that within the search region 39 rare or threatened fauna species (28 bird, five mammal, three reptile, two frog and one invertebrate) listed on the EPBC Act, FFG Act and/or the DSE advisory list (DSE 2007c) may occur within the study area. Their likelihood of occurrence within the study area is assessed and presented in Table 6. Species that are likely to occur are highlighted.

Table 6 indicates whether any of the listed rare or threatened species are also listed as migratory species under the EPBC Act.

Table 6: Threatened fauna identified as occurring or potentially occurring in the study area

Common Name	Scientific Name	Conservation Status			Habitat	Number of Records	Year of Last Record	Likelihood of occurrence
		EPBC	FFG	DSE				
Birds								
Australasian Bittern	*Botaurus poiciloptilus*	EN	L	EN	Usually inhabits permanent freshwater wetlands with tall dense vegetation, particularly those dominated by sedges, rush, reeds or cutting grass (Marchant and Higgins 1990).			No suitable habitat – **unlikely to occur**
Australasian Shoveler	*Anas rhynchotis*			VU	Large and deep freshwater wetlands with abundant aquatic flora. Less often, brackish or saline waters including inshore estuarine waters. Sometimes on farm dams (Marchant and Higgins 1990).	2	2000	Suitable habitat occurs - **may occur occasionally on farm dams** however this is not considered core habitat for this species
Australian Painted Snipe	*Rostratula australis*	VU, M (CAMBA)	L	CE	Shallow freshwater or brackish swamps, usually inland and often ephemeral, with emergent vegetation such as River Red Gum and Lignum and muddy margins. Uncommon summer visitors to Victoria (Garnett and Crowley 2000).			No suitable habitat – **unlikely to occur**
Australian Pratincole	*Stiltia isabella*			NT	Open plains, sparsely wooded plains and tussock grasslands, usually in arid and semi-arid zones (Higgins and Davies 1996).	1	1982	No suitable habitat – **unlikely to occur**
Black Falcon	*Falco subniger*			VU	Inhabits woodlands, open country and terrestrial wetlands in arid and semi-arid zones. Mainly occurs over open plains and undulating land with large tracts of low vegetation. It is more commonly found in north western Victoria and is only occasionally found in southern Victoria. It is a highly mobile species, moving in response to food availability and seasonal conditions (Marchant and Higgins 1993).	1	1999	Suitable habitat present in grasslands - **may occur occasionally** in grassland habitats
Black-chinned Honeyeater	*Melithreptus gularis*			NT	Open box-ironbark forests and woodlands. Usually found in Red or Mugga Ironbarks, Grey Box, Yellow Gum and Yellow Box. Especially mature tall trees along gullies, low-lying flats and lower slopes. Characteristic box-ironbark species, widespread but moderately common. The species is gregarious, usually seen in groups of 3–10 birds (Higgins *et al.* 2001; Tzaros 2005).	5	1991	Suitable habitat in woodland habitat - **potential to occur**
Black-eared Cuckoo	*Chrysococcyx osculans*			NT	Open woodlands and open shrublands often those dominated by eucalypts or often in saltbush or bluebush shrublands. In Victoria it usually occurs north of the divide. (Higgins 1999).	2	2000	Suitable habitat in woodland habitat - **potential to occur**
Blue-billed Duck	*Oxyura australis*		L	EN	Terrestrial freshwater and brackish wetlands, preferring deep permanent, well vegetated water bodies. Secretive birds, usually feeding in open water or beside tall dense vegetation (Marchant and Higgins 1990).	1	2000	No suitable habitat – **unlikely to occur**
Brown Quail	*Coturnix ypsilophora*			NT	Prefers tall ground vegetation, such as grass, ferns and shrubs over damp or swampy ground. Also occurs in grasslands, cereal crops, stubble, leafy crops, heath, bracken and stands of vegetation fringing freshwater wetlands. In Victoria it is widespread and could be locally common in suitable habitats (Marchant and Higgins 1993).	2	1995	Suitable habitat in riparian habitat along creek lines - **potential to occur**
Brown Treecreeper	*Climacteris picumnus victoriae*			NT	Woodlands dominated by eucalyptus, especially Stringybarks or other rough-barked eucalypts usually with open grassy understorey, some dead trees and fallen timber (Higgins *et al.* 2001).	12	1991	Suitable habitat in woodland habitat - **potential to occur**
Caspian Tern	*Hydroprogne caspia*	M (JAMBA, CAMBA)	L	NT	Sheltered coastal embayments, including harbours, lagoons, inlets, estuaries and river deltas, usually with sandy or muddy margins. A small breeding population of Caspian Terns occurs on Mud Islands, which is one of three breeding colonies in Victoria (Higgins and Davies 1996).	1	2007	No suitable habitat – **unlikely to occur**
Diamond Dove	*Geopelia cuneata*		L	NT	Mostly arid and semi-arid grassland savannah, often of spinifex and in low open woodlands with grassy understorey; also often in open riparian woodlands (Higgins and Davies 1996).	1	1999	Although there is suitable habitat for this species in the woodland habitat, the range of this species does not usually extend this far south. **Unlikely to regularly occur**
Diamond Firetail	*Stagonopleura guttata*		L	VU	Commonly found in open forests and woodlands often with sparse grassy understorey also occurs along watercourses and in farmland areas. Widespread but scattered. Populations have declined in Victoria since the 1950's (Higgins *et al.* 2006).	6	1990	Suitable habitat in woodland habitat - **potential to occur**
Eastern Great Egret	*Ardea modesta*	M (JAMBA, CAMBA)	L	VU	Variety of wetlands including estuaries and intertidal mudflats; various permanent and ephemeral freshwater, brackish and saline wetlands; shallows of deep permanent lakes (Marchant and Higgins 1990).	5	2002	Suitable habitat in farm dams - **may occasionally occur** in study area however farm dams are not considered core habitat for this species

Common Name	Scientific Name	Conservation Status			Habitat	Number of Records	Year of Last Record	Likelihood of occurrence
		EPBC	FFG	DSE				
Fairy Tern	*Sterna nereis*	VU	L	EN	Sheltered coasts, on mainland and inshore and offshore islands. Occurs in embayments, such as harbours, inlets, bays, estuaries and lagoons and on ocean beaches. Also on coastal lakes and salt ponds. In Victoria the species is most common between Westernport and Port Phillip Bays, West to Aireys Inlet (Higgins and Davies 1996).			No suitable habitat – **unlikely to occur**
Freckled Duck	*Stictonetta naevosa*		L	EN	Terrestrial wetlands, it prefers fresh, densely vegetated waters, particularly floodwater swamps and creeks vegetated with lignum or cane grass. During dry seasons or droughts it moves away from ephemeral breeding swamps and occupy large permanent waters (Marchant and Higgins 1990).	1	2007	No suitable habitat – **unlikely to occur**
Hardhead	*Aythya australis*			VU	Inhabits large, deep waters where vegetation is abundant, particularly deep swamps and lakes, pools and creeks. It also occurs on freshwater meadows, seasonal swamps with abundant aquatic flora, reed swamps, wooded lakes and swamps, rice fields, and sewage ponds (Marchant and Higgins 1990).	5	1991	Suitable habitat in farm dams and Deep Creek - **may occasionally occur** in study area however farm dams are not considered core habitat for this species
Lewin's Rail	*Lewinia pectoralis*		L	VU	Occurs in a variety of densely vegetated wetland habitats, fresh or saline and usually with areas of standing water. It requires shallow water areas to forage in. Occur mainly in southern parts of Victoria (Marchant and Higgins 1993).	1	1991	No suitable habitat – **unlikely to occur**
Little Egret	*Egretta garzetta*		L	EN	It occurs in a range of coastal and terrestrial wetlands, including freshwater wetlands with vegetation such as *Typha* and requires trees for roosting and nesting (Marchant and Higgins 1990).	1	1986	No suitable habitat – **unlikely to occur**
Musk Duck	*Biziura lobata*			VU	This species inhabits terrestrial wetlands, estuarine habitats and sheltered inland waters. Almost entirely aquatic, preferring deep water of large swamps, lakes and estuaries, where conditions are stable and aquatic flora abundant (Marchant and Higgins 1990).	4	2000	No suitable habitat – **unlikely to occur**
Nankeen Night Heron	*Nycticorax caledonicus*			NT	Inhabits littoral and estuarine habitats and terrestrial wetlands. Mainly nocturnal foraging over soft or firm substrates in still or slow-moving shallow water, on exposed shores, banks and flats of wetlands, or swampy vegetation. Often occurs where sheltered by tall emergent or ground vegetation and near trees used for roosting (Marchant and Higgins 1990).	7	2000	Suitable habitat present along the creek lines - **may occur in Deep Creek and Moonee Ponds Creek**
Pied Cormorant	*Phalacrocorax varius*			NT	Occurs in marine and coastal habitats. They require trees in which to nest, such as dead eucalypts or melaleucas and also occurs in the Murray-Darling Basin and other large lakes. The breeding population in Port Phillip Bay is the largest and most regular breeding colony in Victoria and one of the largest in Australia (Marchant and Higgins 1990).	3	1995	No suitable habitat – **unlikely to occur**
Plains-wanderer	*Pedionomus torquatus*	VU	L	CE	This species inhabits native grasslands with sparse cover, preferring grasslands that include Wallaby Grass and Spear grass. In Victoria no recent records in south east, sporadic reports from Keilor–Werribee Plains. Widespread in small areas in the mallee, most common in northern Victoria between Bendigo and Swan Hill (Marchant and Higgins 1993).	2	1949	No suitable habitat – **unlikely to occur**
Regent Honeyeater	*Xanthomyza phrygia*	EN, M (JAMBA)	L	CE	Mainly occurs in dry scrlerophyll forests and box-ironbark woodlands with copious flowering eucalypts and/or mistletoes, usually near rivers and creeks on inland slopes of the Great Dividing Range. It can also occur in small remnant patches or isolated clumps of mature flowering trees in farmland, coastal or urban areas. Occur in northern and central Victorian box-ironbark forests. It is now considered extinct in western Victoria (Higgins *et al*. 2001).			Suitable habitat present in woodland habitats however these habitats are not extensive and are not considered to be core habitat for the species - **unlikely to regularly occur**
Royal Spoonbill	*Platalea regia*			VU	This species occurs in terrestrial wetlands, sheltered marine habitats and wet grasslands. Foraging limited to shallow waters, often among aquatic or emergent vegetation or submerged logs that shelter prey and favour coastal habitats (Marchant and Higgins 1990).	2	1987	Suitable habitat in farm dams - **may occasionally occur** in study area however farm dams are not considered core habitat for this species
Speckled Warbler	*Pyrrholaemus sagittatus*		L	VU	Inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations. It is also found in River Red Gum woodlands. The species is uncommon, populations have declined since the 1980s (Higgins and Peter 2002; Tzaros 2005).	7	1990	No suitable habitat – **unlikely to occur**

Common Name	Scientific Name	Conservation Status			Habitat	Number of Records	Year of Last Record	Likelihood of occurrence
		EPBC	FFG	DSE				
Spotted Harrier	*Circus assimilis*			NT	It prefers open woodlands that do not obstruct low flight and natural and exotic grasslands in arid and semi arid areas. It is more common in Victoria along the Murray River and occurs sporadically in southern Victoria (Higgins and Davies 1996).	3	1991	Suitable habitat present in grasslands - **may occur occasionally** in grassland habitats
Swift Parrot	*Lathamus discolor*	EN	L	EN	This species prefers a narrow range of eucalypts in Victoria, including White Box, Red Ironbark and Yellow Gum as well as River Red Gum when this species supports abundant 'lerp'. It breeds in Tasmania and migrates to the mainland of Australia for the autumn, winter and early spring months. It lives mostly north of the Great Dividing Range, passing through two areas of Victoria on migration: the Port Phillip district and Gippsland (Emison *et al.* 1987; Higgins 1999; Kennedy and Tzaros 2005).	6	2000	Suitable habitat occurs in the woodland habitats particularly in the Yellow Gum woodland - **may occasionally occur**
Mammals								
Eastern Barred Bandicoot	*Perameles gunnii*	EN	L	CE	Originally volcanic plain native grasslands, nowadays farmland, parkland and suburban gardens (Menkhorst 1995).	13	2003	This species was released into Woodlands Historic Park as a captive breeding program however it was unsuccessful and no bandicoots remain – **no longer occurs**
Fat-tailed Dunnart	*Sminthopsis crassicaudata*			NT	Native grasslands associated with rocky areas, rough pastures and the edges of stubble paddocks (Menkhorst 1995).	2	1989	No suitable habitat – **unlikely to occur**
Grey-headed Flying-Fox	*Pteropus poliocephalus*	VU	L	VU	Roosts in riverine habitat in Melbourne and forages widely in flowering eucalypts and fruit trees (Menkhorst 1995).			This species has a roosting site along the Yarra River in Fairfield and will forage up to 50 km from its roosting site in flowering scattered trees and woodlands – **likely to occur**
New Holland Mouse	*Pseudomys novaehollandiae*	VU	L	VU	Coastal heath and scrub, heathy woodland, open forest and vegetated sand-dunes (Menkhorst 1995).			no suitable habitat – **unlikely to occur**
Spot-tailed Quoll	*Dasyurus maculatus*	EN	L	EN	Rainforest, wet and dry forest, coastal heath and scrub and River Red-gum woodlands along inland rivers (Menkhorst 1995).			no suitable habitat – **unlikely to occur**
Reptiles								
Bearded Dragon	*Pogona barbata*			DD	Woodlands and dry sclerophyll forests; widespread in areas of population occurrence (Wilson and Swan 2003).	1	1988	Suitable habitat in Woodlands Historic Park - **may occur in small numbers**
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	EN	L	CE	The species is confined to native tussock grassland on basalt plains north and west of Melbourne, has not been confirmed in Victoria since the 1960's (Robertson and Cooper 2000).	1	1990	No suitable habitat – **unlikely to occur**
Striped Legless Lizard	*Delma impar*	VU	L	EN	Tussock grasslands on the volcanic plains often associated with scattered rocks and cracked soils (Cogger 2000).	4	2001	No suitable habitat – **unlikely to occur**
Frogs								
Brown Toadlet	*Pseudophryne bibronii*		L	EN	Wet and dry forest, grassy areas besides small creeks, alpine grasslands and mossy bogs (Cogger 2000).	14	1990	Suitable habitat along creeklines in woodland habitats - **potential to occur**

Common Name	Scientific Name	Conservation Status			Habitat	Number of Records	Year of Last Record	Likelihood of occurrence
		EPBC	FFG	DSE				
Growling Grass Frog	*Litoria raniformis*	VU	L	EN	Permanent, still or slow flowing water with fringing and emergent vegetation in streams, swamps, lagoons and artificial wetlands such as farm dams and abandoned quarries (Clemann and Gillespie 2004).	40	2009	Suitable habitat along creeklines - **likely to occur and assumed to occur**
Fish								
Australian Grayling	Prototroctes maraena	VU	L	VU	Large and small coastal streams and rivers with cool, clear waters with a gravel substrate and altering pools and riffles (Cadwallader and Backhouse 1983).			Has been recorded downstream from the study area - **potential to occur**
Dwarf Galaxias	*Galaxiella pusilla*	VU	L	VU	Vegetated margins of still water, ditches, swamps and backwaters of creeks, both ephemeral and permanent (Allen *et al.* 2002).			Has not been recorded in the catchment - **unlikely to occur**
Yarra Pygmy Perch	*Nannoperca obscura*	VU	L	NT	Streams and small lakes, prefers flowing water with abundant aquatic vegetation (Allen *et al.* 2002).			Has been recorded upstream from the study area - **potential to occur**
Invertebrates								
Golden Sun Moth	*Synemon plana*	CE	L	CE	Areas that are, or have been native grasslands or grassy woodlands. It is known to inhabit degraded grasslands with introduced grasses being dominant, with a preference for the native wallaby grass being present (DEWHA 2009).	116	2008	No suitable habitat – **unlikely to occur**

CE = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **NT** = Lower risk, near threatened; **DD** = data deficient; **L** = Listed as threatened under FFG Act; **M** = Listed migratory species; **(JAMBA)** = Japan-Australia Migratory Bird Agreement; **(CAMBA)** = China-Australia Migratory Bird Agreement; **(ROKAMBA)** = Republic of Korea- Australia Migratory Bird Agreement; **(Bonn)** = Bonn Convention

Birds

Based on the assessment in Table 6, 13 listed threatened bird species were considered likely to occur in the study area. The vulnerability of these species to potential impacts from the proposed development is discussed below.

- Australasian Shoveler and Hardhead

  (DSE: vulnerable)

  These two ducks have the potential to occur in farm dams in the study area. Farm dams are not their core habitat and they prefer to reside in grassy wetland, swamps and lakes. If these two species do occur in the study area, they would only occur occasionally. The removal of any farm dams in the study area will not impact on these two species as there are other farm dams nearby that they can utilise.

- Black Falcon and Spotted Harrier

  (DSE: vulnerable and near threatened respectively)

  These two raptors are grassland specialists that utilise open areas for hunting their prey. They are extremely nomadic and move in response to food. These two species may occur occasionally in the open areas. The proposed development is not considered to have an impact on these two species.

- Black-chinned Honeyeater, Black–eared Cuckoo and Brown Treecreeper

  (DSE: near threatened)

  These three bird species occur in woodland habitats. Any removal of woodland habitat has the potential to remove potential habitat for these two species. As woodland habitat is limited in the region, any removal of woodlands has the potential to impact on these three species.

- Brown Quail

  (DSE: near threatened)

  Two records of this species occur from the AVW dated in 1986 and 1985, the closest was three kilometres to the north east. This species has the potential to occur along the creek line habitats in the study area. If the creekline habitats are left undisturbed, then impacts to this species will be minimal.

- Diamond Firetail

  (FFG Act: listed, DSE: vulnerable)

  There were six records of the Diamond Firetail from the AVW dated from 1988 and 1990. These records were scattered around the search region the closest was from the township of Bulla. This species occurs in grassy woodland habitats. Removal of this habitat type has the potential to impact on this species.

- Eastern Great Egret

  (EPBC Act: migratory, FFG Act: listed, DSE: vulnerable)

  This species has the potential to occur on the farm dams in the study area. This species prefers to reside in grassy wetlands and swamps. Farm dams are

not the core habitat of this species. If this species does occur in the study area, it would only occur occasionally. The removal of any farm dams in the study area will not impact on this species as there are other farm dams nearby it can utilise.

- Nankeen Night Heron

  (DSE: near threatened)

  This species occurs in wetlands and along watercourses. It has potential to occur along the two creeks in the study area. If the two creeks are undisturbed then impacts on this species will be minimal.

- Royal Spoonbill

  (DSE: vulnerable)

  This species has the potential to occur on the farm dams in the study area. This species prefers to reside in grassy wetlands and swamps. Farm dams are not the core habitat of this species. If this species does occur in the study area, it would only occur occasionally. The removal of any farm dams in the study area will not impact on this species as there are other farm dams nearby it can utilise.

- Swift Parrot

  (EPBC Act: endangered and migratory, FFG Act: listed, DSE: endangered)

  This species feeds on a variety of eucalypts including Yellow Gum, Grey Box, River Red Gum and Sugar Gum, all of which are in the study area. This species may pass through the area occasionally on its migration and feed from the eucalypts. Removal of these eucalypts would result in removal of potential Swift Parrot habitat.

Migratory Birds

The review of existing information identified 11 listed migratory bird species within the search region. Of these, six were considered likely to occur in the study area based on the availability of suitable habitat.

Potential impacts to migratory species likely to occur in the study area are discussed below.

- Fork-tailed Swift and White-throated Needletail

  (EPBC Act: migratory)

  These two species are summer visitors and spend most of their lives on the wing. They may fly over the study area occasionally. The proposed development will not impact on these two species.

- Eastern Great Egret

  (EPBC Act: migratory, FFG Act: listed, DSE: vulnerable)

  This species has been considered above.

- Cattle Egret

  (EPBC Act: migratory)

This species will quite often forage in exotic pastures and crops. There is potential for this species to occur at the study area however the proposed development is unlikely to have an impact on this species.

- Latham's Snipe

  (EPBC Act: migratory, DSE: near threatened)

  This species has the potential to occur in grassy depressions and drainage lines in the study area. This is not considered core habitat for the species and the proposed development is considered unlikely to cause a significant impact on this species.

- Swift Parrot

  (EPBC Act: endangered and migratory, FFG Act: listed, DSE: endangered)

  This species has been considered above.

Mammals

Based on the assessment in Table 6, one listed mammal species was considered likely to occur in the study area. The vulnerability of this species to potential impacts from the proposed development is discussed below.

- Grey-headed Flying-Fox

  (EPBC Act: vulnerable, FFG Act: listed, DSE: vulnerable)

  The Grey-headed Flying-Fox has a roosting site along the Yarra River at Fairfield. This species can fly up to 50 kilometres away from their breeding site. The study area is within that foraging range therefore this species has the potential to forage in the flowering eucalypts at the study area. However the study area is not considered to be core habitat for the species and therefore the proposed development is considered unlikely to have a significant impact on the species.

Reptiles

Based on the assessment in Table 6, one listed reptile species was considered likely to occur in the study area. The vulnerability of this species to potential impacts from the proposed development is discussed below.

- Bearded Dragon

  (DSE: data deficient)

  This species has suitable habitat in the grassy woodland habitats. There is one record of this species from the AVW in 1988 taken from the Organ Pipes National Park. This species may still reside in the area, however, probably in small numbers. It more commonly occurs in dry/arid areas. The proposed development is considered unlikely to have a significant impact on this species.

Frogs

Based on the assessment in Table 6, two listed frog species were considered likely to occur in the study area due to the presence of suitable habitat (Figure 4).

The vulnerability of these species to potential impacts from the proposed development is discussed below.

- **Brown Toadlet**

  (FFG Act: listed, DSE: endangered)

  There are five records of Brown Toadlet from the AVW post 1980. One of those records was taken from Woodlands Historic Park and another from Deep Creek near the township of Bulla. There is potential for this species to occur in the woodland habitats at the study area.

  A targeted survey for this species has been undertaken to clarify its status within the study area. The results of the targeted survey are reported in section 6.

- **Growling Grass Frog**

  (EPBC Act: vulnerable, FFG Act: listed, DSE: endangered)

  There are 39 records of Growling Gras Frog from the AVW within the search region. This species is known to occur in the Moonee Ponds Creek. The proposed development has the potential to remove or disturb Growling Grass Frog habitat and thus have a significant impact on the species.

Fish

Based on the assessment in Table 6 and undertaken by Streamline Research Pty. Ltd. (Appendix 3), two listed fish species were considered as having potential to occur in the study area. The vulnerability of these species to potential impacts from the proposed development is discussed below.

- **Australian Grayling**

  (EPBC Act: vulnerable, FFG Act: listed, DSE: vulnerable)

  The Australian Grayling has not been recorded upstream of the Jacksons Creek junction, which is approximately five kilometres to the south of Bulla. A population was not recorded during the current investigation though flooding events in 2010/11 could have potentially moved these species into the study area. If the Bulla bypass does traverse over Deep Creek, creek crossings need to be constructed in a manner which does not impede water movement and to ensure that no obstruction to fish passage occurs and ensure that the hydrological regime of the creek is retained.

- **Yarra Pygmy Perch**

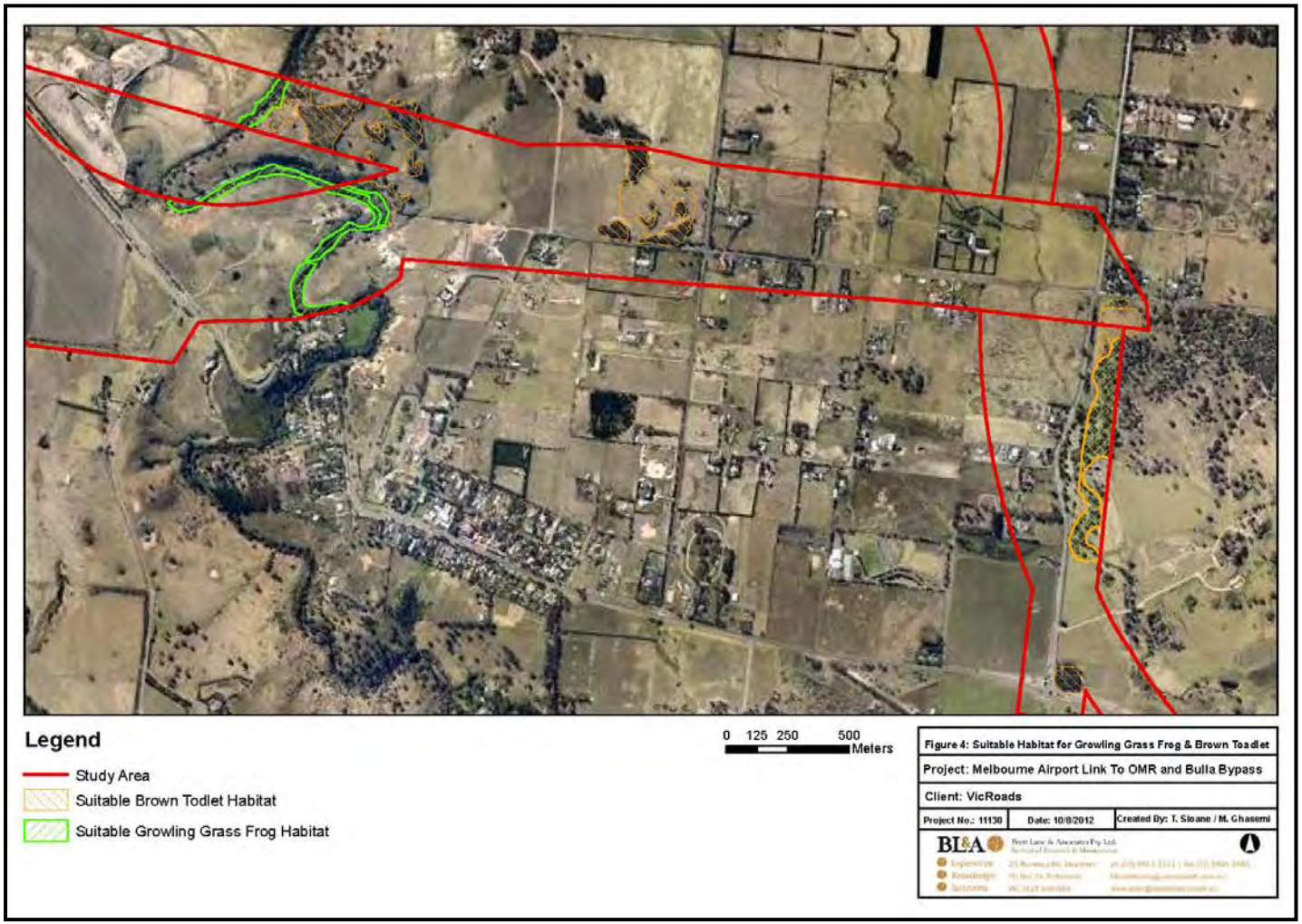
  (EPBC Act: vulnerable, FFG Act: listed, DSE: near threatened)

  The Yarra Pygmy Perch has only been recorded in Deep Creek about 20 kilometres north of Bulla near Romsey and Lancefield. Although there is no known record of this species within the study area, floodwaters in 2010/11 could have potentially moved these species into the study area. If a crossing is required at Deep Creek a bridge is recommended to ensure that the natural flow regime of Deep Creek can be maintained and that unrestricted aquatic fauna passage can occur.

Invertebrates

Based on the assessment in Table 6, no listed invertebrate species were considered likely to occur in the study area. There are no potential impacts from the proposed development on threatened invertebrates.

Figure 4: Suitable habitat for Growling Grass Frog and Brown Toadlet



6. BROWN TOADLET TARGETED SURVEY

6.1. Introduction

This section describes the methods, results and conclusions of the targeted Brown Toadlet survey which was conducted in woodland habitats within both the BB5 alignment options. This investigation was commissioned to provide information on the extent and condition of Brown Toadlet habitat and identified any existing populations in the study area.

6.2. Species Biology

6.2.1. Description

The Brown Toadlet (*Pseudophryne bibronii*) is small and dark which often has darker flecks and sometimes with reddish spots. It often has a pale vertical mark on the tip of its nose and a yellow or orange patch on the base of each arm. Underneath the body is marbled with white and black and the skin is scattered with smooth or slightly granular warts below and low warts above (Cogger 2000).

6.2.2. Habitat

The Brown Toadlet breeds in congregations in inundated grassy areas beside creeks, gutters, drainage lines and alike. When not breeding, it will disperse and occur under rocks and logs in woodlands and forests. It also occurs in alpine grasslands and mossy bogs (Cogger 2000).

6.2.3. Distribution

The species is widely distributed through south-eastern Queensland, the eastern half of New South Wales, throughout Victoria, south-eastern South Australia and Tasmania (Figure 5).

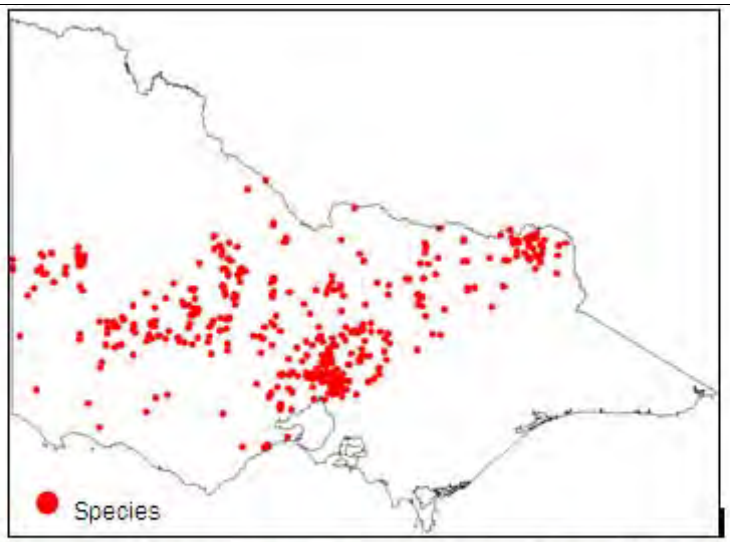


Figure 5: Distribution of Brown Toadlet in Victoria (Source: Viridians 2011b)

6.2.4. *Threats*

A number of current threats can be attributed to the decline throughout much of this species former range in Victoria including: habitat alteration through undesirable grazing intensities previous mining activities and residential developments which has lead to the loss and/or modification of suitable breeding habitat.

6.2.5. *Legislative protection*

The Brown Toadlet is listed as endangered in Victoria (DSE 2007b) and is also listed as threatened under the Victorian FFG Act.

6.3. Methods

6.3.1. *Existing information*

Existing information regarding Brown Toadlet has been obtained from the Victorian fauna records from the Atlas of Victorian Wildlife (AVW), a database administered by DSE (Viridans Biological Databases 2011b). This search listed all Brown Toadlet found within a ten kilometre search region the approximate centre point of the study area, coordinates: latitude 37˚ 37' 41" S and longitude 144˚ 48' 03" E.

6.3.2. *Habitat assessment*

The exact area covered by this investigation will be limited to habitat within the study area potentially impacted by the alignment options BB5 as follows:

- Creekline Grassy Woodland EVC 68 (River Red-gum Woodland) located in the east of the study area
- Plains Woodland EVC 803 (Grey Box Woodland) located centrally within the study area and
- Hills Herb-rich Woodland EVC 71 (Gum/Box Woodland) located in the southwest of the study area.

Habitats were assessed for their suitability for the Brown Toadlet.

6.3.3. *Targeted Survey*

The Brown Toadlet survey was undertaken using methods consistent with the DSE Biodiversity Precinct Planning Kit, including call playback and spotlighting.

To determine the occurrence of the Brown Toadlet in the study area, a targeted survey was undertaken over three night visits on 14th, 21st and 25th June 2012. Prior to commencing surveying, the woodland habitat in the study area was examined for suitability. The three survey locations are provided in Figure 6.

The survey was conducted at night during cool and moist weather conditions. The Brown Toadlet is more likely to be active and calling under these conditions, making detection more likely. Table 7 presents the weather conditions at each survey site for the three surveys.

Table 7: Weather conditions during the targeted survey

Date	Site #	Time - start	Time - finish	Temperature	Humidity	Wind
14/06/2012	1	18:15	19:00	13°C	73%	Gentle northerly
	2	17:15	18:00	13.9°C	72%	
21/06/2012	1	20:06	20:57	9.9°C	77%	light north-westerly breeze
	2	18:34	19:19	8.6°C	87%	
	3	17:35	18:00	9.2°C	74%	
25/06/2012	1	19:25	20:10	10.2°C	63%	Gentle southerly
	2	18:25	19:10	10.5°C	66%	
	3	17:25	18:08	11.8°C	64%	

Field surveys took place between 17:00 (twilight, almost dark) and 20:00 Australian Eastern Daylight time (AEDT). On first arrival at a site, five minutes was spent in suitable habitat listening for frog calls and all frog species heard calling were noted. After five minutes listening time, the call of the Brown Toadlet was played through a megaphone in an effort to elicit the response of this species.

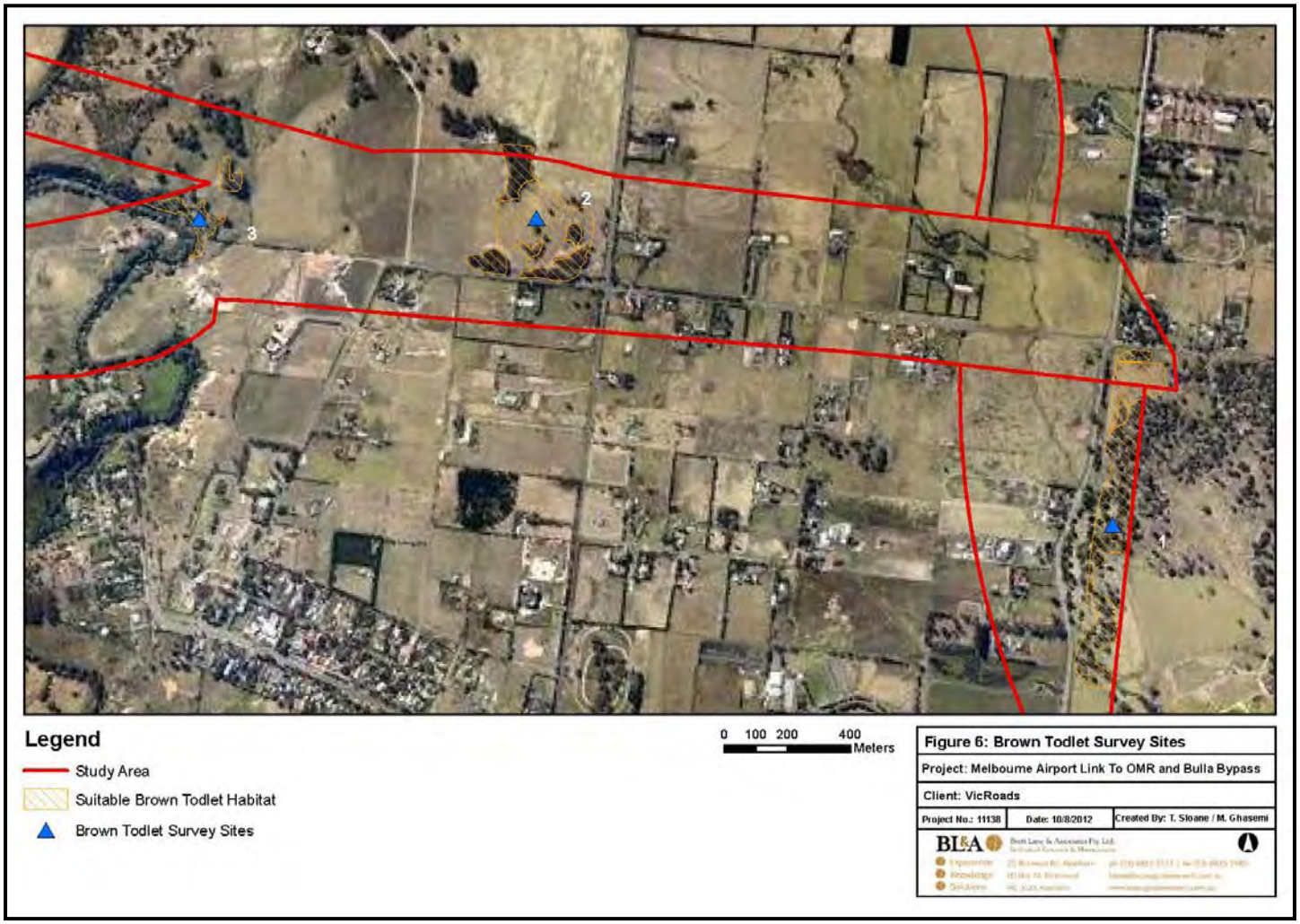
Following call playback and listening time, each site was systematically searched for frogs with a spotlight and visual inspection of dams, woodland and associated wet depressions. Call recognition and limited active searching (turning surface debris) was also conducted. The number of frogs seen or heard during the search time was recorded.

6.3.4. Limitations of field assessment

The timing, duration and weather conditions of the Brown Toadlet survey were considered suitable for identifying the presence of the species within the study area. The Brown Toadlet is most active from March to July. Therefore the survey conditions were deemed suitable to identify the presence of a population at the site. Noise interference was a limiting factor during the surveys. Sites 1 and 2 were underneath the flight path of commercial aeroplanes taking off from Melbourne Airport, Tullamarine. Site 3 comprised of a creek, and rushing water added to noise disturbance making it difficult to hear frogs calling.

Wherever appropriate, a precautionary approach has been adopted in the discussion of implications. That is, where insufficient evidence is available on the occurrence or likelihood of occurrence of a species, it is assumed that it could be in an area of suitable habitat. The implications under legislation and policy are considered accordingly.

Figure 6: Location of Brown Toadlet survey sites



6.4. Results

6.4.1. Existing information

The AVW holds 14 records of Brown Toadlet within ten kilometres of the study area. However, only five of these records were recorded in the past 30 years, in 1989 and 1990. The locations of these records and others in the wider area are illustrated in Figure 7. The most recent record was in 1990 (see Appendix 8).

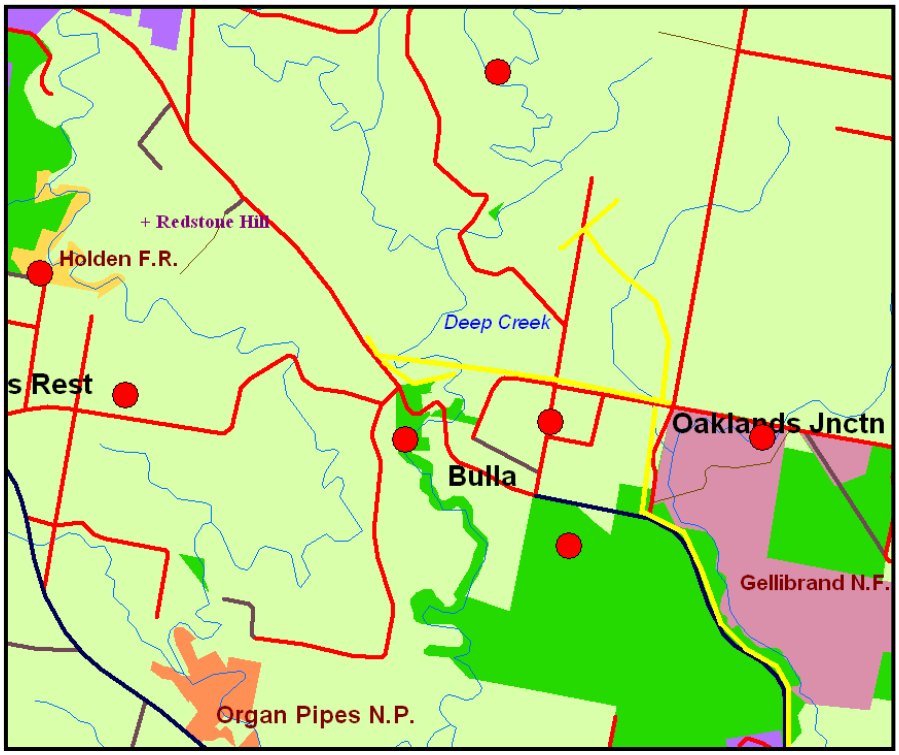


Figure 7: Map of existing records from the AVW (Viridians 2011b).

The yellow lines show the approximate location of the study area. The red dots represent the location of the Brown Toadlet records up to 10 kilometres from the centre of the study area.

6.4.2. Habitat Assessment

The habitats located in the study area supported low to moderate quality Brown Toadlet habitat. Below is a description of each survey site and its suitability as Brown Toadlet habitat (refer to Figure 6).

Survey Site 1

Survey site one encompassed the north-western section of Woodlands Historic Park. The ground cover was grassy and damp with some areas of leaf litter beneath eucalypts. Areas of wet depressions were connected to the creek that provided dispersal routes for frogs. Rush and other native aquatic vegetation along with woody debris were abundant at this site (Figure 8). Considering its level of connectivity and availability of original habitat elements, this habitat has been assessed as being of high quality for Brown Toadlet.

Figure 8: Survey Site 1

Survey Site 2

Site two comprised a dam located in the corner of Somerton and Wildwood Road South which provided aquatic habitat for frogs (Figure 9). Surrounding the dam was a patch of woodland that provided suitable ground coverage of leaf litter and woody debris. Despite its close proximity to roads, many species of frogs were observed from this site. This habitat was considered moderate quality for Brown Toadlet.

Figure 9: Survey Site 2

Survey Site 3

Site three is located on Deep Creek in a minor valley. A steep gradient exists between the top of the habitat zone and the creek line. River Red-gums dominate

the canopy along the riparian edge whilst Yellow and Grey Box species dominate the upper slopes of the habitat patch/project area. Evidence exists indicating the private land manager has conducted indigenous revegetation during the past 5 years to improve habitat. Weed and introduced species dominate the shrub and understory layers particularly Willow, Soursob, African Box-thorn, Cocksfoot, Serrated Tussock and other pastoral grasses. Some rocky areas and dead wood exist on site although below benchmark levels. Most of this habitat has been over grown by exotic flora species. This habitat was considered low quality for Brown Toadlet.

6.4.3. *Survey results*

This section describes the results of the current survey. Numbers in the tables below are the sum of all individual frogs recorded from surveys each night.

6.4.4. *Call Playback*

Table 8 presents the results for the number of frog calls heard during the ten minute call playback and listening time at each site.

Table 8: Number of frog calls heard during the call playback survey

Date	Site	Species			
		Common Froglet	Spotted Marsh Frog	Southern Brown Tree Frog	Whistling Tree Frog
14/06/2012	1	30	-	-	-
	2	8	-	4	-
21/06/2012	1	5	-	-	-
	2	4	-	4	1
	3	-	-	-	-
25/06/2012	1	45	-	-	-
	2	5	-	4	
	3	-	-	-	-

The results show that the Common Froglet (*Crinia signifera*) was the most widely distributed frog at the study area, occurring at sites 1 and 2 using the call play-back method. The Southern Brown Tree Frog (*Litoria ewingii*) was the second most abundant frog heard calling throughout the study area.

No Brown Toadlet was heard responding to call-playback.

6.4.5. *Spotlighting and active searches*

Table 9 presents the results of spotlighting survey.

Table 9: Number of frog calls heard during the spotlighting and active search

Date	Site	Species			
		Common Froglet	Spotted Marsh Frog	Southern Brown Tree Frog	Whistling Tree Frog
14/06/2012	1	-	-	-	-
	2	-	-	-	-
21/06/2012	1	1	1	-	-
	2	-	4	-	1
	3	-	-	-	-
25/06/2012	1	150	-	-	-
	2	1	3	-	1
	3	-	-	-	-

The Common Froglet was most abundant at site 1, which was assessed as being of higher quality habitat. Figure 10 shows two Common Froglet seen at site 1. Furthermore, the adjacent creek was observed as being a breeding and dispersal route throughout the Woodlands Historic Park. Spotted Marsh Frog and Whistling Tree Frog were observed at site 2.

Figure 10: Common Froglet seen at site 1

The Brown Toadlet was not recorded during spotlighting and active searching.

7. IMPACTS AND REGULATORY IMPLICATIONS

7.1. Proposed development

VicRoads had previously considered eight potential alignment options for the proposed Melbourne Airport Link, Oaklands Road Duplication & Bulla Bypass project. These are detailed in BL&A Reports 11138 (1.6) and 11138 (3.0). Through an iterative process, these options were considered with regard to project costs and social, environmental and cultural impacts. This resulted in the current proposed alignment — BB5 — designated the preferred alignment. This preferred alignment involves construction of a highway section between Oaklands Road in the east and Sunbury Road in the west, to form a northern bypass of the township of Bulla. It also involves the construction of two bridge spans: an approximately 500 metre section spanning the Deep Creek valley and an approximately 80 metre section spanning a small gully to the north-east of Deep Creek. The bridge spanning Deep Creek will dissect it at an oblique angle.

7.2. Impacts of the proposed BB5 alignment

This section of the proposed Bulla bypass would result in the removal of native vegetation as follows:

- 0.02 Habitat Hectares (0.009 hectares) of high conservation significance Creekline Grassy Woodland (EVC 68) from habitat zones D and G. This includes the removal of one large/very large old tree from Habitat Zone G.
- 0.10 Habitat Hectares (0.306 hectares) of high conservation significance Hills Herb-rich Woodland (EVC 71) from Habitat Zone O. This includes the removal of four large/very large old trees.
- 0.09 Habitat Hectares (0.210 hectares) of very high conservation significance Stream Bank Shrubland (EVC 851) from Habitat Zone P. This includes the removal of five large/very large old trees.
- 0.17 Habitat Hectares (0.539 hectares) of very high conservation significance Hills Herb-rich Woodland (EVC 71) from Habitat Zone Q. This includes the removal of three large/very large old trees.
- 0.33 Habitat Hectares (1.40 hectares) of high conservation significance Plains Woodland (EVC 803) from Habitat Zones S, U and V. This includes the removal of seven large/very large old trees from Habitat Zones U and S.
- 0.11 Habitat Hectares (0.302 hectares) of high conservation significance Stream Bank Shrubland (EVC 851) from Habitat Zone Z.
- The removal of 12 scattered trees, 3 of which are large or very large.

The areas of native vegetation and scattered trees that would be impacted by the proposed development are shown in Figure 11.

7.3. Objective Based Evaluation Matrix

An Objective Based Evaluation Matrix (OBEM) was used to help assess and present the performance of the proposed BB5 alignment option based on the impacts on biodiversity set out in Section 7.2. An overall project objective was provided by VicRoads. This overall project objective was as follows:

- To minimise impacts on biodiversity, including catchment values / waterways

A series of suitable project sub-objectives were determined in conjunction with VicRoads. The sub-objectives were as follows:

- Minimise impacts on listed threatened flora species;
- Minimise impacts on listed threatened fauna species;
- Minimise impacts on vegetation communities;
- Minimise impacts on Large Old Trees, Very Large Old trees and scattered trees; and
- Minimise isolating and/or fragmenting habitat in a landscape context.

A detailed matrix was developed that assessed the proposed BB5 alignment option against each of the above five project sub-objectives for specific ecological matters (e.g. flora species, fauna species, vegetation communities, etc.). This matrix is provided in Appendix 9. Based on the extent to which each specific ecological matter met its relevant sub-objective, all ecological matters were then assigned a score of 1 to 5, based on the following criteria:

- *Very Well* (i.e. best practice, strong level of compliance, major positive impact) — *5 points*;
- *Well* (i.e. improved practice, good policy compliance, positive impact) — *4 points*;
- *Moderately Well* (i.e. partial policy compliance, no distinct positive or negative impact) — *3 points*;
- *Poor* (i.e. policy non-compliance and negative impact) — *2 points*; and
- *Very Poor* (i.e. major policy non-compliance and major negative impact) — *1 point*.

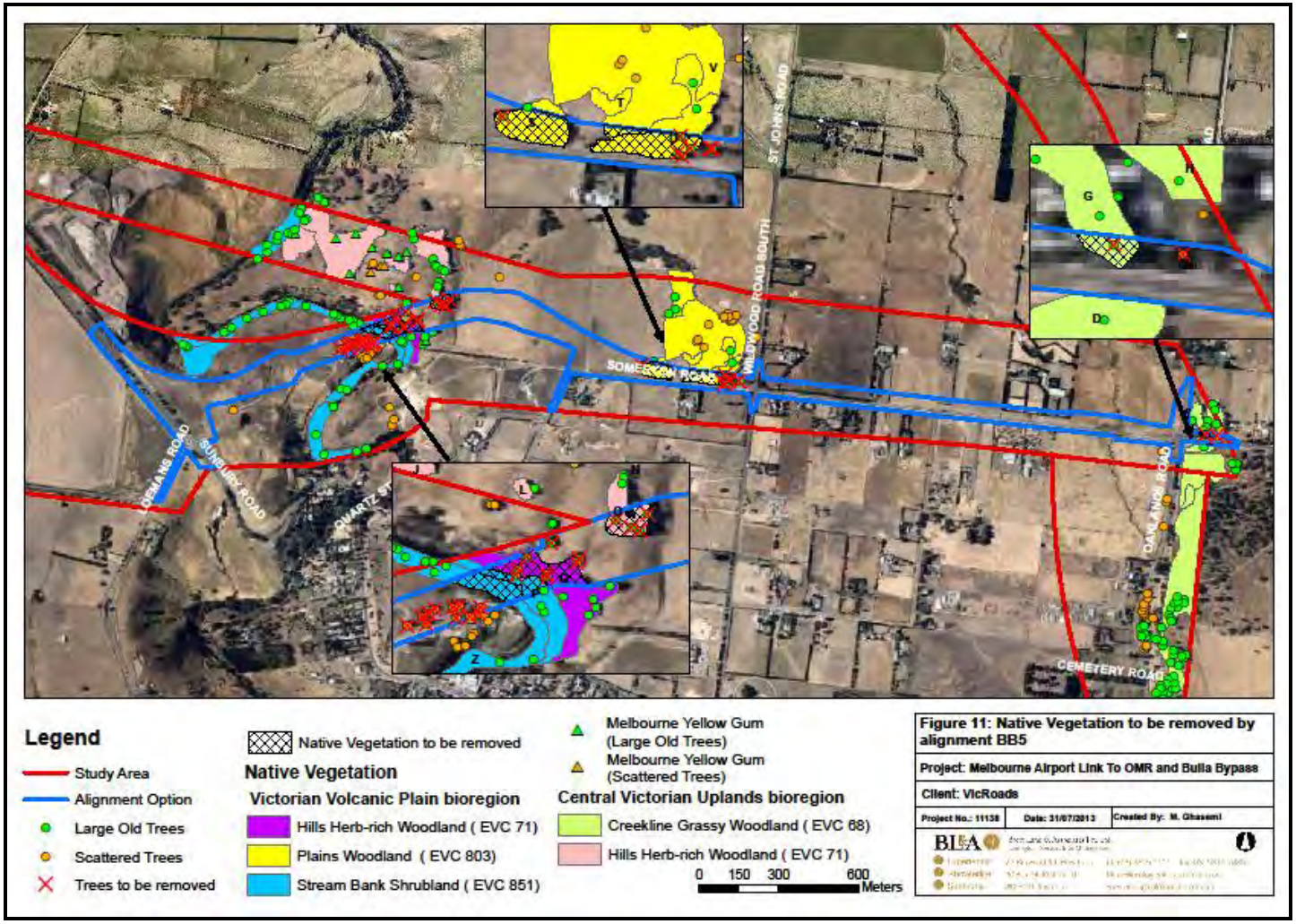
The scores for each ecological matter were then averaged to produce an overall score for each sub-objective (i.e. matter A = *Poor* (Score of 2) and matter B = *Well* (score of 4); therefore overall sub-objective score = 3 (*Moderately Well)*). These overall scores for each of the five sub-objectives of the project were then averaged to produce an overall score for the proposed BB5 alignment option against the overall project objective.

The results of the OBEM assessment for the proposed BB5 alignment option are presented in Table 10. In summary, with and without mitigation measures, the proposed alignment met the project objective Moderately Well.

Table 10: Extent to which the proposed BB5 alignment option meets the project sub-objectives and overall project objective.

Sub-objective	Mitigation	Extent to which alignment option meets project sub-objectives
Minimise impacts on listed threatened flora species	without	Very Well
	with	Very Well
Minimise impacts on listed threatened fauna species	without	Poor
	with	Moderately Well
Minimise impacts on vegetation communities	without	Well
	with	Well
Minimise impacts on Large, Very Large & Scattered Trees	without	Poor
	with	Poor
Minimise isolating and/or fragmenting habitat in a landscape context	without	Moderately Well
	with	Moderately Well
Project Objective	**Mitigation**	**Extent to which alignment option meets overall project objective**
To minimise impacts on biodiversity, including catchment values & waterways	without	Moderately Well
	with	Moderately Well

Figure 11: Native vegetation to be removed by the proposed BB5 alignment option



7.4. Planning controls

7.4.1. State provisions

Destruction, lopping or removal of native vegetation on allotments of 0.4 hectares or more requires a planning permit under Clause 52.17 of all Victorian Planning Schemes. This includes the removal of dead trees with a DBH of 40 centimetres or greater, native degraded treeless vegetation and/or any individual scattered native plants.

Before issuing a planning permit, Responsible Authorities are obligated to refer to Clause 12.01 (Biodiversity) in the Planning Scheme. This refers in turn to Victoria's Native Vegetation Management Framework – a Framework for Action, discussed in the following section.

7.4.2. Local provisions

The study area is subject to several overlays in the Hume Planning Scheme, one of which is relevant to this assessment. The purpose and implications of this relevant overlay is discussed in this section.

Environmental Significance Overlay (ESO1)

This overlay applies to the steep escarpments that occur along Deep Creek near the Bulla Township.

Purpose:

The overlay covers a number of waterways within the Hume City Council that are considered to have significant visual and geological features of the rural landscape and which serve important ecological, drainage and recreational functions. This overlay aims to protect and enhance the health and vitality of these aquatic ecosystems.

Implications:

The proposed works will require a planning permit if any native vegetation is proposed to be removed within the ESO1. A planning permit would also be required if any degradation is expected along Deep Creek. Specific construction control measures should however be put in place to avoid any impact on this aquatic ecosystem.

The proposed BB5 alignment option is likely to require a planning permit under ESO1 for impacting on native vegetation within areas subject to the overlay and any possible degradation along Deep Creek.

7.5. Native Vegetation Management Framework

7.5.1. How the Framework operates

Any proposal to remove native vegetation from the study area must demonstrate that the three-step approach of 'Net Gain' outlined in the Framework has been applied. This approach is hierarchical and includes the following steps:

- Step 1: As a priority, ***avoid*** adverse impacts on native vegetation, particularly through clearance;

If the removal of native vegetation cannot be avoided:

- Step 2: ***Minimise*** impacts through appropriate consideration in the planning process and expert input to project design or management; and
- Step 3: Identify appropriate ***offset*** options.

A combination of project design and offsetting should aim to achieve a net gain in the area and quality of native vegetation across Victoria.

Responses to planning permit applications to remove native vegetation vary depending on the conservation significance of the vegetation proposed for removal. Conservation significance determines both the likelihood of approval and, importantly, the scale of the required offset. This is summarised Table 11.

Table 11: Likely response to applications for removal of intact native vegetation

Framework conservation significance	Likely response to application for clearing	Likely offset requirements
VERY HIGH	Clearing not permitted unless exceptional circumstances apply. Offset Management Plan to be submitted with application.	Substantial Net Gain At least 2 X calculated loss in habitat hectares plus a large tree protection and replacement offset if any large trees are removed
HIGH	Clearing generally not permitted	Net Gain At least 1.5 X calculated loss in habitat hectares plus a large tree protection and replacement offset if any large trees are removed
MEDIUM	Clearing generally not permitted	Equivalent Gain At least 1 X calculated loss in habitat hectares plus a large tree protection and replacement offset if any large trees are removed
LOW	Clearing may be permitted but only as part of an appropriate sustainable use response	Equivalent Gain At least 1 X calculated loss in habitat hectares

Offset targets are directly related to the habitat hectare value of the removed vegetation. They can comprise indigenous vegetation retained for conservation purposes within the study area, or vegetation elsewhere, secured on a case-by-case basis by the proponent or through the DSE Bush Broker scheme.

Clause 66.02 of the planning scheme determines the role of the DSE in the assessment of indigenous vegetation removal planning permit applications. If an application is referred to the DSE then the Responsible Authority must follow that department's recommendation in relation to that permit application. The criteria presented in Table 12 indicate when the DSE becomes a referral authority.

Table 12: Application referral criteria

Applications will be referred to the Department of Sustainability and Environment under the following circumstances:
Scattered Trees ▪ To remove or destroy more than 15 native trees if each tree has a trunk diameter of less than 40 centimetres at a height of 1.3 metres above ground level (DBH = diameter at 1.3 metres above ground). ▪ To remove or destroy more than 5 native trees if each tree has a trunk diameter of 40 centimetres or more at a height of 1.3 metres above ground level.
Remnant Patch Vegetation (may include trees) ▪ To remove or destroy native vegetation which is in an Ecological Vegetation Class that has a Bioregional Conservation Status of Endangered, Vulnerable or Rare if the area to be cleared is more than 0.5 hectare. ▪ To remove or destroy native vegetation which is in an Ecological Vegetation Class that has a Bioregional Conservation Status of Depleted or Least Concern if the area to be cleared is more than 1 hectare.

The criterion described above has been considered for the proposed BB5 alignment option, and the need for a referral to DSE is discussed below.

This alignment would trigger a referral to DSE due to the proposed removal of more than 0.5 hectares from Habitat Zones D, G, O, P, Q, S, U, V and Z. All these habitat zones have a Bioregional Conservation Status of either Endangered or Vulnerable.

As such, the current proposal would trigger a referral to DSE.

7.5.2. Offset targets for removal from habitat zones

Offsets for the removal of native vegetation from habitat zones are directly related to the habitat hectare value of the removed vegetation. These may include the permanent protection (e.g. Section 173 agreement under the *Planning and Environment Act 1987*) for conservation purposes of other existing remnant vegetation. Offsets may be located within the study area or offsite. The offset site must be actively managed to achieve a gain for a period of 10 years and subsequently maintained in perpetuity. Offsite offsets may be identified on a case-by-case basis by the proponent or through the DSE Bush Broker scheme.

Offsets must be of a like-for-like nature as outlined in the Framework. Like-for-like requirements are summarised in Table 13.

Table 13: Like-for-like requirements for offsetting removal of remnant patch native vegetation

Like-for-like criteria	Conservation significance	
	Very high	High
Type of vegetation that may be used for offsets	Same EVC	Same EVC OR *very high* conservation significance vegetation within the same bioregion
Minimum quality of the existing vegetation proposed as the basis of an offset	90% of the quality in the area being lost	75% of the quality in the area being lost
Maximum proportion of the offset target (in Habitat Hectares) that may be achieved through revegetation	10%	25%

Offset targets for removal from habitat zones in the proposed BB5 alignment option are presented in Table 14.

Table 14: Offset targets for removal from habitat zones for the proposed BB5 alignment option

Habitat Hectares Target							Large Tree Target				
								Protect		Recruit^	
Habitat Zone	Conservation Significance	EVC	Area of Removal (ha)	Total Loss (Hha)	Net Gain Multiplier*	Net Gain Target (Hha)	Total Losses	Multiplier*	Target (trees)	Multiplier*	Target (plants)
D	High	Creekline Grassy Woodland (EVC 68)	0.001	0.00	X 1.5	0.00	0	N/A			
G			0.089	0.02	x 1.5	0.03	1	X 4	4	X 20	20
O	High	Hills Herb-rich Woodland (EVC 71)	0.306	0.10	x 1.5	0.15	4	X 4	16	X 20	80
P	Very High	Stream Bank Shrubland (EVC 851)	0.210	0.09	x 2	0.18	5	X 8	40	X 40	200
Q	Very High	Hills Herb-rich Woodland (EVC 71)	0.539	0.17	x 2	0.34	3	X 8	24	X 40	120
S	High	Plains Woodland (EVC 803)	0.650	0.13	x 1.5	0.20	1	X 4	4	X 20	20
U			0.647	0.19	x 1.5	0.29	6	X 4	24	X 20	120
V			0.099	0.01	x 1.5	0.02	0	N/A			
Z	High	Stream Bank Shrubland (EVC 851)	0.302	0.11	x 1.5	0.17	0	N/A			
Totals			**2.843**	**0.82**		**1.38**	**20**		**112**		**560**

***** = These multipliers relate to Table 6 of the Framework and may be varied by the Regional Vegetation Plans; **^** = 15% of plants recruited must be canopy trees; Note that DSE acknowledge that the secure protection of 1 tree will result in the natural recruitment of 5 new plants.

The process of calculating offsets is highly complex. The area required to achieve the offset targets presented above, is based on vegetation quality within the offset site and the proposed management, tenure and security. Previous experience has demonstrated that the following amount of suitable native vegetation may be required to achieve the offset target per the proposed BB5 alignment option:

- Approximately 6.9 hectares (EQUATION: Gain Target (1.38 hha) x 5 = 6.9)

These estimates are based on a potential 20% improvement of the offset site. It should be noted that this is an approximation only. The potential for an offset site to achieve the required offset targets can only be calculated once the final offset site has been identified.

These offset targets will most likely be able to be achieved at an appropriate third party offset site. This would need to be identified through discussions with the DSE BushBroker coordinator.

Additional offset targets for removal of large and very large trees from habitat zones (except from habitat zones of low conservation significance) apply to any such approved removal under the Framework and the Port Phillip and Westernport Native Vegetation Plan (PPWCMA 2006) and are presented in Table 14. These offsets contain both a protection and recruitment component, whereby a prescribed number of existing trees must be protected for conservation purposes, and a prescribed number of new indigenous plants must be successfully recruited through planting and/or assisted natural regeneration. Large tree offsets can also be obtained through the DSE BushBroker coordinator.

7.5.3. Offset targets for removal of scattered trees

Any approved removal of scattered trees will attract an offset target comprising protection and recruitment components, whereby a prescribed number of trees of the same size class must be protected and recruitment (planting or assisted regeneration) of indigenous plants undertaken. The scale of the offset is determined by the size class of the trees proposed to be removed. Alternatively, in the event that the protection of existing trees is considered not to be feasible, a 'recruit only' offset for tree removal may apply, subject to negotiation with the Responsible Authority.

Offset targets for approved removal of scattered trees from the proposed BB5 alignment option, as determined by the Framework and the Port Phillip and Westernport Native Vegetation Plan (PPWCMA 2006), are presented in Table 15.

Table 15: Offset targets for scattered tree removal for the proposed BB5 alignment option

Size Class	Conservation Significance	No. trees to be removed	Protect and Recruit Option				Recruit Only option#
			Protect (no. trees)^		Recruit (no. plants)^		
			Multiplier*	Offset total	Multiplier*	Offset total	
Very large	Medium	1	4	4	20	20	140
Large	Medium	2	2	4	15	30	130
Medium	Medium	5	1	5	15	75	175
Small	Low	4	N/A	N/A	Variable	93	93
Totals		**12**		**13**		**218**	**538**

***** = These multipliers relate to Table 6 of the Framework and may be varied by the Regional Vegetation Plans; **^** = The protection of a very large, large or medium tree, either scattered or within a patch, is assumed to result in the generation of five recruits (DSE 2007); **#** = This is the least preferred option, and is only intended to make up shortfalls in protect and recruit targets. Subject to DSE/Responsible Authority approval.

7.6. EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* contains a list of threatened species and ecological communities that are considered to be of national conservation significance. Any impacts on these species considered significant requires the approval of the Australian Minister for the Environment. If there is a possibility of a significant impact on nationally threatened species or communities or listed migratory species, a Referral under the EPBC Act should be considered. The Minister will decide after 20 business days whether the project will be a 'controlled action' under the EPBC Act, in which case it cannot be undertaken without the approval of the Minister. This approval depends on a further assessment and approval process.

7.6.1. Threatened ecological communities

One EPBC Act listed ecological community, Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia, was recorded within Habitat Zone W in the study area. No other listed communities were recorded or considered likely to occur in the study area. This ecological community will not be impacted by the proposed BB5 alignment option.

7.6.2. Threatened flora species

No EPBC Act listed flora species were recorded and none were considered likely to occur in the study area. The proposed BB5 alignment option will not impact on any EPBC Act listed flora species.

7.6.3. Threatened fauna species

No EPBC Act listed fauna species were recorded but three were considered likely to occur — Growling Grass Frog, Grey-headed Flying-fox and Swift Parrot. The Growling Grass Frog is known from the Moonee Ponds Creek. No targeted surveys for this highly mobile species were undertaken as surveys may not record the species. Instead, a precautionary approach has been taken whereby it is assumed that Growling Grass Frog is present in the study area along the Moonee Ponds Creek and Deep Creek (Figures 1, 2 & 3).

Growling Grass Frog could potentially be impacted by the crossing of Deep Creek under the proposed BB5 alignment option.

7.6.4. Key Threatening Processes under the EPBC Act

The following Key Threatening Process is considered relevant for the project:

- Land clearance.

7.6.5. Implications

The proposed BB5 alignment option crosses Deep Creek, although at this stage it is uncertain what the proximity of the piers to Deep Creek will be. Therefore there may be potential impacts on the Growling Grass Frog, through removal of habitat and potential impacts to water quality along Deep Creek.

7.7. FFG Act

The Victorian *Flora and Fauna Guarantee Act 1988* lists threatened flora and fauna species to provide for their protection and management. The FFG Act has limited direct application to private land. However, Clause 15.09 of the Planning Scheme makes reference to this Act. The local planning authority is likely to consider impacts on FFG Act-listed species and communities when deciding on planning permit applications.

The removal of threatened species or communities, or protected flora under the FFG Act from public land requires a licence under the Act. This licence is obtained from the Department of Sustainability and Environment.

7.7.1. Threatened ecological communities

One FFG Act listed ecological community (Grey box – Buloke Grassy Woodland) was recorded in Habitat Zone W, on Commonwealth Land. This ecological community will not be impacted by the proposed BB5 alignment option.

Additionally, one community (the Victorian temperate woodland bird community) was considered likely to occur. This community was only identified on private land. The impacts of the development will be considered by the local planning authority during the planning permit application.

7.7.2. Threatened/protected flora species

No FFG Act listed flora species were recorded and none were considered likely to occur in the study area.

No protected flora values under the FFG Act were recorded on public land within the study area.

The proposed BB5 alignment option will not impact on any FFG Act listed flora species or protected flora values.

7.7.3. Threatened fauna species

No FFG Act listed fauna species were recorded and six were considered likely to occur.

Growling Grass Frog could potentially be impacted by the crossing of Deep Creek under the proposed BB5 alignment option.

7.7.4. Key Threatening Processes under the FFG Act

The following Key Threatening Processes are considered relevant for the project:

- Alteration to the natural flow regimes of rivers and streams.
- Alteration to the natural temperature regimes of rivers and streams.
- Degradation of native riparian vegetation along Victorian rivers and streams.
- Habitat fragmentation as a threatening process for fauna in Victoria.
- Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis.
- Invasion of native vegetation by “environmental weeds”.

- Prevention of passage of aquatic biota as a result of the presence of instream structures.

Mitigation measures in Section 8.2 identify specific actions required to manage these key threatening processes.

7.7.5. Implications

A Protected Flora Licence under the FFG Act would not be required for the current proposal.

The impacts of the development on one FFG Act listed bird community on private land will be considered by the local planning authority during the planning permit application.

7.8. EE Act

The "Ministerial Guidelines for Assessment of Environmental Effects under the *Environment Effects Act 1978"* (DSE 2006), identifies the following criteria related to flora and fauna which assist in determining whether a Referral to the State Minister for Planning is required:

- Potential clearing of ten hectares or more of native vegetation from an area with endangered EVC, or vegetation that is or is likely to be, of very high conservation significance according to Victoria's Native Vegetation Management Framework, except where authorised under an approved Forest Management Plan or Fire Protection Plan;
- Potential long-term loss of a significant proportion (1 to 5% depending upon conservation status of species concerned) of known remaining habitat or population of a threatened species in Victoria;
- Potential long-term change to a wetland's ecological character, where that wetland is Ramsar listed, or listed in 'A Directory of Important Wetlands in Australia';
- Potential major effects upon the biodiversity of aquatic ecosystems over the long term;
- Potential significant effects on matters listed under the *Flora and Fauna Guarantee Act 1988*.

One or a combination of these criteria may trigger a requirement for a Referral to the Victorian Minister for Planning who will determine if an EES is required.

A Referral to the state Minister for Planning in relation to flora and fauna is therefore not required.

7.9. DSE advisory lists

Rare and threatened species advisory lists administered by the Department of Sustainability and Environment include flora and fauna species known to be rare or threatened throughout the state. Although the advisory list has no statutory status, the Responsible Authority will consider impacts on any species on the list when assessing a planning application.

The proposed development will not impact on any flora species from the DSE *Advisory List of Rare and Threatened Plants in Victoria* (DSE 2007b) recorded in the study area.

The following fauna species listed on the DSE *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2007c) are vulnerable to impacts from the proposed development.

- Growling Grass Frog.

Suitable habitat for this species has been mapped and can be viewed in Figure 4. These habitats are to be avoided where possible.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1. Conclusions

The following implications would pertain to the current development proposal — alignment BB5:

- A permit will be required for the proposed removal of native vegetation from the study area;
- The project will be referred to DSE for the proposed alignment;
- Ministerial approval would be required for the proposed removal of vegetation with conservation significance of *very high*;
- A Referral under the EPBC Act is required for the following proposed impacts to an EPBC Act listed value:
    - Potential impacts to Growling Grass Frog habitat;
- A Protected Flora Licence under the FFG Act would not be required for the current proposal. However, the impacts of the development on the FFG Act listed Growling Grass Frog and the listed ecological community (Victorian temperate woodland bird community) will be considered by the local planning authority during the planning permit application;
- The Growling Grass Frog listed on the DSE *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2007c) is vulnerable to impacts from the proposed development;
- A targeted Brown Toadlet survey was undertaken using best-practice methods to determine whether the species was present in areas potentially impacted upon by the proposed development. No Brown Toadlet was recorded during the targeted survey. It is possible that the species could reach the area of concern, particularly after periods of high rainfall when frogs may disperse to colonise new areas;
- Potential impacts at the Deep Creek crossing, should bridge piers be placed in or in close proximity due to the creek line causing disturbance to the ecology of the waterway and habitat connectivity; and
- There is no need to submit a Referral in relation to flora and fauna to the State Minister under the EE Act.

8.2. Mitigation Recommendations

Consideration should be given to including the mitigation measures described below in the project:

Pre-construction:

- Avoid disturbing the intact native vegetation and scattered trees where feasible.
- Avoid removal of large, hollow-bearing indigenous trees where feasible.
- Avoid removing suitable habitat for the Growling Grass Frog and Brown Toadlet.
- In accordance with the *Catchment and Land Protection Act 1994*, the noxious weed species listed below, which were recorded in the study area, must be controlled using precision methods that minimise off-target kills (e.g. spot spraying). This method of control will be implemented throughout the project.
    - African Boneseed
    - African Box-thorn
    - Hawthorn
    - Horehound
    - Spear Thistle and
    - Sweet Briar.
- Avoid impacts upon Deep Creek.
    - A water sensitive road design to filter contaminates from entering Deep Creek should be implemented
    - Ensure there are no barriers constructed in Deep Creek that will prevent movement and connectivity of fauna.
- The proposed development should be designed in a way that does not alter the site's hydrology in areas that support native vegetation or act as tributaries to Deep Creek.
- The recommended mitigation measures outlined below are from the aquatic assessment undertaken by Streamline Research Pty. Ltd. (Appendix 3) and states that all aquatic habitat remains intact and that water and pollutant runoff to waterways is prevented if Bulla Bypass is to cross Deep Creek. The following is a list of mitigation measures from the aquatic assessment:
    - All stream crossings need to be constructed in a manner which does not impede water movement and to ensure that no obstruction to fish passage occurs;
    - Best practice environmental protection measures need to be in accordance with the VicRoads Environment Strategy 2005-2015 (VicRoads, 2005), VicRoads Environmental Management Guidelines (2006); and

- A minimal footprint should be used for construction activities. No-go zones could be applied both during construction and after completion of the works. Temporary barriers must be erected around the perimeter of construction areas, and around sites of native vegetation adjacent to the construction zone, prior to construction activities commencing and for the duration of construction works. The barriers will prevent access by construction personnel to Deep Creek and the floodplain habitat.

- Construction contractors should be inducted into an environmental management program for construction works; and
- All environmental controls should be checked for compliance on a regular basis.

Construction phase:

- Environmentally sensitive areas should be securely fenced at one metre from the perimeter and appropriately signed. All machinery and earthworks are to be excluded from these areas.
- Any tree pruning should be undertaken by an experienced arborist to prevent disease or unnecessary damage to the tree or disturbance to understorey vegetation during tree trimming.
- Any stockpiling will occur outside of environmentally sensitive areas.
- All machinery should enter and exit works sites along defined routes that do not impact on native vegetation or cause soil disturbance and weed spread.
- All machinery brought on site should be weed and pathogen free. This is important for environmental and agricultural protection. Soil borne pathogens such as Cinnamon Fungus and livestock diseases can be easily transported by machinery.
- All machinery wash down, lay down and personnel rest areas should be defined (fenced) and located in disturbed areas.
- Sediment and hazardous wastes should be prevented from entering Deep Creek. As a precaution against flooding, the storage of fill, excavated material, fuels and oils should not be stockpiled near Deep Creek.
- Sedimentation and erosion controls must be implemented during construction in accordance with Victorian Environment Protection Authority (EPA) guidelines including Environmental Guidelines for Major Construction Sites (1996) and Construction Techniques for Sediment Pollution Control (1991).
- Sedimentation control measures must remain in place until the completion of the works. Sediment fences should be installed to prevent unnecessary erosion and sedimentation to the creek. Sediment and erosion control plans should be developed.
- Where an erosion hazard is identified, erosion control activities should include:
  - The use of sediment fences down slope of exposed soil and stockpiles.
  - Bunding of stockpiles.

  - Minimisation of the area of disturbed soil at any one time. Sediment and hazardous wastes should be prevented from entering Deep Creek. As a precaution against flooding, the storage of fill, excavated material, fuels and oils should not be stockpiled near Deep Creek.

- The adoption of best practise drainage management and incorporation of water sensitive road design (Wong et al., 2000) should be incorporated into the works. VicRoads should ensure that there would be no drainage/runoff from the new road directly into Deep Creek. Construction of swale drains /wetlands should be provided to catch and treat excess water runoff before entering into the Moonee Ponds Creek. This would create more habitat for Growling Grass Frog and help to mitigate any potential impacts to the species.
- The movement of construction vehicles in the vicinity of Deep Creek should be minimised. Passage of vehicles should occur within the smallest amount of easement possible.
- Monitoring following an incident that may impact on aquatic fauna will comprise appropriate sampling to confirm the extent of the disturbance to aquatic habitat. For spillages, post incident monitoring (water quality) will be repeated at daily intervals until the contaminant is no longer considered to be a threat. Monitoring should be performed by a suitably qualified aquatic biologist.

Post-construction phase:

- Weed control, by an experienced bush regenerator, is to be carried out in bushland or wetland areas disturbed after construction so as to control any weed outbreaks.
- A suitable buffer area along Deep Creek and its tributaries should be revegetated with appropriate indigenous plants of local genetic provenance. This measure is aimed at minimising any potential long-term adverse impacts that the proposed development may have on the health and functionality of these watercourses.
- The use of local indigenous plant species, of local genetic provenance, should be considered in the landscaping of any development on the site. Locally indigenous species generally have low water-use requirements, high survival rates and provide habitat to local fauna species. The site provides a large reservoir for seed collection within wetland and forested areas.

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Appendix 1: Flora species recorded in the study area and threatened species known (or with the potential) to occur in the search region

Origin	Common Name	Scientific Name	Family Name	Conservation Status			Recorded
				EPBC	FFG	DSE	
	Adamson's Blown-grass	Lachnagrostis adamsonii	Poaceae	E	f	v	
*	African Boneseed	Chrysanthemoides monilifera subsp. monilifera	Asteraceae				X
*	African Box-thorn	Lycium ferocissimum	Solanaceae				X
*	Agapanthus	Agapanthus praecox subsp. orientalis	Alliaceae				X
*	Apple of Sodom	Solanum linnaeanum	Solanaceae				X
	Arching Flax-lily	Dianella sp. aff. longifolia (Benambra)	Hemerocallidaceae			v	
*	Artichoke Thistle	Cynara cardunculus	Asteraceae				X
	Austral Crane's-bill	Geranium solanderi var. solanderi s.s.	Geraniaceae			v	
	Austral Moonwort	Botrychium australe	Ophioglossaceae		f	v	
	Austral Toad-flax	Thesium australe	Santalaceae	V	f	v	
	Austral Tobacco	Nicotiana suaveolens	Solanaceae			r	X
	Austral Trefoil	Lotus australis var. australis	Fabaceae			k	
	Basalt Peppercress	Lepidium hyssopifolium	Brassicaceae	E	f	e	
	Basalt Podolepis	Podolepis sp. 1	Asteraceae			e	
	Berry Saltbush	Atriplex semibaccata	Chenopodiaceae				X
*	Big Heron's-bill	Erodium botrys	Geraniaceae				X
*	Black Nightshade	Solanum nigrum s.s.	Solanaceae				X
	Black Roly-poly	Sclerolaena muricata var. muricata	Chenopodiaceae			k	
	Black-anther Flax-lily	Dianella revoluta s.l.	Hemerocallidaceae				X
*	Blackberry	Rubus fruticosus spp. agg.	Rosaceae				X
	Blackwood	Acacia melanoxylon	Mimosaceae				X
	Branching Groundsel	Senecio cunninghamii var. cunninghamii	Asteraceae			r	
	Bristly Wallaby-grass	Rytidosperma setaceum	Poaceae				X
	Brittle Greenhood	Pterostylis truncata	Orchidaceae		f	e	
	Bronze Bluebell	Wahlenbergia luteola	Campanulaceae				X
	Brown-back Wallaby-grass	Rytidosperma duttonianum	Poaceae				X
*	Brown-top Bent	Agrostis capillaris	Poaceae				X
	Buloke	Allocasuarina luehmannii	Casuarinaceae		f		
	Button Wrinklewort	Rutidosis leptorhynchoides	Asteraceae	E	f	e	
*	Cape Weed	Arctotheca calendula	Asteraceae				X
	Cherry Ballart	Exocarpos cupressiformis	Santalaceae				X
*	Chickweed	Stellaria media	Caryophyllaceae				X
*	Chilean Needle-grass	Nassella neesiana	Poaceae				X
*	Clover	Trifolium spp.	Fabaceae				X
	Clover Glycine	Glycine latrobeana	Fabaceae	V	f	v	
	Coarse Dodder-laurel	Cassytha melantha	Lauraceae				X
*	Cocksfoot	Dactylis glomerata	Poaceae				X
*	Common Centaury	Centaurium erythraea	Gentianaceae				X
	Common Cudweed	Euchiton involucratus s.l.	Asteraceae				X
	Common Grass-sedge	Carex breviculmis	Cyperaceae				X
*	Common Heron's-bill	Erodium cicutarium	Geraniaceae				X
*	Common Onion-grass	Romulea rosea var. australis s.s.	Iridaceae				X
	Common Reed	Phragmites australis	Poaceae				X
	Common Spike-sedge	Eleocharis acuta	Cyperaceae				X
	Common Tussock-grass	Poa labillardierei	Poaceae				X
*	Common Vetch	Vicia sativa	Fabaceae				X
	Common Wallaby-grass	Rytidosperma caespitosum	Poaceae				X

Origin	Common Name	Scientific Name	Family Name	Conservation Status			Recorded
				EPBC	FFG	DSE	
*	Couch	Cynodon dactylon var. dactylon	Poaceae				X
	Curly Sedge	Carex Tasmanica	Cyperaceae	V	f	v	
	Curved Rice-flower	Pimelea curviflora s.l.	Thymelaeaceae				X
*	Cut-leaf Crane's-bill	Geranium dissectum	Geraniaceae				X
*	Drain Flat-sedge	Cyperus eragrostis	Cyperaceae				X
	Drooping Cassinia	Cassinia arcuata	Asteraceae				X
	Drooping Sheoak	Allocasuarina verticillata	Casuarinaceae				X
*	Fennel	Foeniculum vulgare	Apiaceae				X
	Flat Spike-sedge	Eleocharis plana	Cyperaceae			v	
	Floodplain Fireweed	Senecio campylocarpus	Asteraceae			r	
	Fragrant Saltbush	Rhagodia parabolica	Chenopodiaceae			r	X
*	Galenia	Galenia pubescens var. pubescens	Aizoaceae				X
*	Garden Dandelion	Taraxacum officinale spp. agg.	Asteraceae				X
#	Giant Honey-myrtle	Melaleuca armillaris subsp. armillaris	Myrtaceae			r	
	Gold-dust Wattle	Acacia acinacea s.l.	Mimosaceae				X
*	Golden Thistle	Scolymus hispanicus	Asteraceae				X
*	Gorse	Ulex europaeus	Fabaceae				X
	Grassland Wood-sorrel	Oxalis perennans	Oxalidaceae				X
	Grey Box	Eucalyptus microcarpa	Myrtaceae				X
	Grey Roly-poly	Sclerolaena muricata var. villosa	Chenopodiaceae				X
	Grey Spike-sedge	Eleocharis macbarronii	Cyperaceae			k	
*	Hawthorn	Crataegus monogyna	Rosaceae				X
	Hedge Wattle	Acacia paradoxa	Mimosaceae				X
*	Horehound	Marrubium vulgare	Lamiaceae				X
	Inland Pigface	Carpobrotus modestus	Aizoaceae				X
	Kangaroo Apple	Solanum aviculare	Solanaceae				X
	Kangaroo Grass	Themeda triandra	Poaceae				X
	Kidney-weed	Dichondra repens	Convolvulaceae				X
	Kneed Spear-grass	Austrostipa bigeniculata	Poaceae				X
*	Large Quaking-grass	Briza maxima	Poaceae				X
*	Large-flower Wood-sorrel	Oxalis purpurea	Oxalidaceae				X
	Large-headed Fireweed	Senecio macrocarpus	Asteraceae	V	f	e	
	Leafless Bluebush	Maireana aphylla	Chenopodiaceae			k	
	Lightwood	Acacia implexa	Mimosaceae				X
	Maroon Leek-orchid	Prasophyllum frenchii	Orchidaceae	E	f	e	
	Matted Flax-lily	Dianella amoena	Hemerocallidaceae	E	f	e	
	Melbourne Yellow-gum	Eucalyptus leucoxylon subsp. connata	Myrtaceae			v	X
*	Mirror Bush	Coprosma repens	Rubiaceae				X
*	Montpellier Broom	Genista monspessulana	Fabaceae				X
	Native Peppercress	Lepidium pseudohyssopifolium	Brassicaceae			k	
	Nodding Saltbush	Einadia nutans subsp. nutans	Chenopodiaceae				X
	Pale Plover-daisy	Leiocarpa leptolepis	Asteraceae		f	e	
	Pale Rush	Juncus pallidus	Juncaceae				X
	Pale Swamp Everlasting	Helichrysum aff. rutidolepis (Lowland Swamps)	Asteraceae			v	
*	Panic Veldt-grass	Ehrharta erecta var. erecta	Poaceae				X
*	Paterson's Curse	Echium plantagineum	Boraginaceae				X
*	Pepper Tree	Schinus molle	Anacardiaceae				X
*	Perennial Rye-grass	Lolium perenne	Poaceae				X
*	Pimpernel	Anagallis arvensis	Primulaceae				X

Origin	Common Name	Scientific Name	Family Name	Conservation Status			Recorded
				EPBC	FFG	DSE	
	Plains Joyweed	Alternanthera sp. 1 (Plains)	Amaranthaceae			k	
	Plains Yam-daisy	Microseris scapigera s.s.	Asteraceae			v	
*	Prairie Grass	Bromus catharticus	Poaceae				X
*	Prickly Pear	Opuntia spp.	Cactaceae				X
	Prickly Starwort	Stellaria pungens	Caryophyllaceae				X
	Purple Diuris	Diuris punctata var. punctata	Orchidaceae		f	v	
*	Radiata Pine	Pinus radiata	Pinaceae				X
*	Red-ink Weed	Phytolacca octandra	Phytolaccaceae				X
	Red-leg Grass	Bothriochloa macra	Poaceae				X
*	Ribwort	Plantago lanceolata	Veronicaceae				X
	River Bottlebrush	Callistemon sieberi	Myrtaceae				X
	River Red-gum	Eucalyptus camaldulensis	Myrtaceae				X
	River Swamp Wallaby-grass	Amphibromus fluitans	Poaceae	V			
	Rough Eyebright	Euphrasia scabra	Orobanchaceae		f	e	
*	Rough Sow-thistle	Sonchus asper s.l.	Asteraceae				X
	Rough Spear-grass	Austrostipa scabra subsp. falcata	Poaceae				X
	Rough-grain Love-grass	Eragrostis trachycarpa	Poaceae			r	
	Ruby Saltbush	Enchylaena tomentosa var. tomentosa	Chenopodiaceae				X
	Rye Beetle-grass	Tripogon loliiformis	Poaceae			r	
#	Sallow Wattle	Acacia longifolia subsp. longifolia	Mimosaceae				X
*	Serrated Tussock	Nassella trichotoma	Poaceae				X
	Short-bristle Wallaby-grass	Rytidosperma setaceum var. brevisetum	Poaceae			r	
	Sieber Crassula	Crassula sieberiana s.l.	Crassulaceae				X
	Silver Wattle	Acacia dealbata	Mimosaceae				X
	Slender Bindweed	Convolvulus angustissimus subsp. omnigracilis	Convolvulaceae			k	
	Slender Clematis	Clematis decipiens	Ranunculaceae			k	
	Slender Dock	Rumex brownii	Polygonaceae				X
	Slender Tick-trefoil	Desmodium varians	Fabaceae			k	
	Small Golden Moths	Diuris basaltica	Orchidaceae	E	f	v	
	Small Milkwort	Comesperma polygaloides	Polygalaceae		f	v	
*	Small Nettle	Urtica urens	Urticaceae				X
	Small Scurf-pea	Cullen parvum	Fabaceae		f	e	
	Small-leaved Clematis	Clematis microphylla s.l.	Ranunculaceae				X
	Smooth Solenogyne	Solenogyne dominii	Asteraceae				X
#	Snowy Mint-bush	Prostanthera nivea var. nivea	Lamiaceae			r	
*	Soursob	Oxalis pes-caprae	Oxalidaceae				X
*	Spear Thistle	Cirsium vulgare	Asteraceae				X
	Spiny Rice-flower	Pimelea spinescens	Thymelaeaceae		f	e	
	Spiny Rice-flower	Pimelea spinescens subsp. spinescens	Thymelaeaceae	C	f	e	
	Spiny-headed Mat-rush	Lomandra longifolia	Xanthorrhoeaceae				X
#	Spotted Gum	Corymbia maculata	Myrtaceae			v	
*	Sugar Gum	Eucalyptus cladocalyx	Myrtaceae				X
	Sunshine Diuris	Diuris fragrantissima	Orchidaceae	E	f	e	
	Supple Spear-grass	Austrostipa mollis	Poaceae				X
	Swamp Diuris	Diuris palustris	Orchidaceae		f	v	
*	Swamp Water-starwort	Callitriche palustris var. palustris	Veronicaceae			k	
*	Sweet Briar	Rosa rubiginosa	Rosaceae				X
	Sweet Bursaria	Bursaria spinosa	Pittosporaceae				X
*	Sweet Vernal-grass	Anthoxanthum odoratum	Poaceae				X

Origin	Common Name	Scientific Name	Family Name	Conservation Status			Recorded
				EPBC	FFG	DSE	
	Tall Bluebell	Wahlenbergia stricta subsp. stricta	Campanulaceae				X
*	Toowoomba Canary-grass	Phalaris aquatica	Poaceae				X
	Tough Scurf-pea	Cullen tenax	Fabaceae		f	e	
	Tree Violet	Melicytus dentatus s.l.	Violaceae				X
*	Turnip	Brassica spp.	Brassicaceae				X
*	Twiggy Turnip	Brassica fruticulosa	Brassicaceae				X
	Variable Groundsel	Senecio pinnatifolius	Asteraceae				X
	Variable Sword-sedge	Lepidosperma laterale	Cyperaceae				X
*	Variegated Thistle	Silybum marianum	Asteraceae				X
	Veined Spear-grass	Austrostipa rudis	Poaceae				X
*	Velvety Pink	Petrorhagia dubia	Caryophyllaceae				X
	Wallaby Grass	Rytidosperma spp.	Poaceae				X
	Water Ribbons	Triglochin procera s.l.	Juncaginaceae				X
	Weeping Grass	Microlaena stipoides var. stipoides	Poaceae				X
*	White Clover	Trifolium repens var. repens	Fabaceae				X
*	Wild Oat	Avena fatua	Poaceae				X
	Yellow Box	Eucalyptus melliodora	Myrtaceae				X
	Yellow Star	Hypoxis vaginata var. brevistigmata	Hypoxidaceae			k	
*	Yorkshire Fog	Holcus lanatus	Poaceae				X

***** = introduced species; **#** = native species occurring outside of natural range; **L** =listed as threatened; **EPBC** = status under EPBC Act; **DSE** = status under DSE's Advisory List; **C** = critically endangered; **E, e** = endangered; **V, v** = vulnerable; **R, r** = rare; **k** = insufficiently known

Appendix 2: Vertebrate terrestrial and aquatic fauna species that occur or are likely to occur in the study area

Common Name	Scientific Name	Recorded	EPBC	FFG	DSE
Birds					
Australasian Grebe	*Tachybaptus novaehollandiae*	X			
Australasian Pipit	*Anthus novaeseelandiae*				
Australasian Shoveler	*Anas rhynchotis*				VU
Australian Hobby	*Falco longipennis*				
Australian Magpie	*Gymnorhina tibicen*	X			
Australian Owlet-nightjar	*Aegotheles cristatus*				
Australian Raven	*Corvus coronoides*				
Australian Shelduck	*Tadorna tadornoides*				
Australian Spotted Crake	*Porzana fluminea*				
Australian White Ibis	*Threskiornis molucca*	X			
Australian Wood Duck	*Chenonetta jubata*	X			
Black Falcon	*Falco subniger*				VU
Black Kite	*Milvus migrans*				
Black Swan	*Cygnus atratus*				
Black-chinned Honeyeater	*Melithreptus gularis*				NT
Black-eared Cuckoo	*Chrysococcyx osculans*				NT
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X			
Black-fronted Dotterel	*Elseyornis melanops*	X			
Black-shouldered Kite	*Elanus axillaris*	X			
Brown Falcon	*Falco berigora*	X			
Brown Goshawk	*Accipiter fasciatus*	X			
Brown Quail	*Coturnix ypsilophora*				NT
Brown Songlark	*Cincloramphus cruralis*				
Brown Thornbill	*Acanthiza pusilla*	X			
Brown-headed Honeyeater	*Melithreptus brevirostris*	X			
Buff-rumped Thornbill	*Acanthiza reguloides*				
Cattle Egret	*Ardea ibis*				
Chestnut Teal	*Anas castanea*				
Clamorous Reed Warbler	*Acrocephalus stentoreus*				
Collared Sparrowhawk	*Accipiter cirrhocephalus*	X			
Common Blackbird	*Turdus merula*	X			*
Common Bronzewing	*Phaps chalcoptera*				
Common Myna	*Acridotheres tristis*	X			*
Common Starling	*Sturnus vulgaris*	X			*
Crested Pigeon	*Ocyphaps lophotes*	X			
Crested Shrike-tit	*Falcunculus frontatus*				
Crimson Rosella	*Platycercus elegans elegans*	X			
Darter	*Anhinga novaehollandiae*				
Diamond Firetail	*Stagonopleura guttata*			L	VU
Dusky Moorhen	*Gallinula tenebrosa*	X			
Dusky Woodswallow	*Artamus cyanopterus*	X			
Eastern Great Egret	*Ardea modesta*			L	VU
Eastern Rosella	*Platycercus eximius*	X			
Eastern Spinebill	*Acanthorhynchus tenuirostris*				
Eurasian Coot	*Fulica atra*				
Eurasian Tree Sparrow	*Passer montanus*				*
European Goldfinch	*Carduelis carduelis*	X			*
European Greenfinch	*Carduelis chloris*	X			*
European Skylark	*Alauda arvensis*	X			*
Fairy Martin	*Hirundo ariel*	X			
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	X			
Flame Robin	*Petroica phoenicea*				
Fork-tailed Swift	*Apus pacificus*				
Galah	*Eolophus roseicapilla*	X			
Gang-gang Cockatoo	*Callocephalon fimbriatum*				
Golden Whistler	*Pachycephala pectoralis*				
Golden-headed Cisticola	*Cisticola exilis*	X			
Great Cormorant	*Phalacrocorax carbo*				
Grey Butcherbird	*Cracticus torquatus*				
Grey Currawong	*Strepera versicolor*				
Grey Fantail	*Rhipidura albiscarpa*	X			
Grey Shrike-thrush	*Colluricincla harmonica*	X			
Grey Teal	*Anas gracilis*	X			
Hardhead	*Aythya australis*				VU

Common Name	Scientific Name	Recorded	EPBC	FFG	DSE
Hoary-headed Grebe	*Poliocephalus poliocephalus*				
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	X			
Horsfield's Bushlark	*Mirafra javanica*				
House Sparrow	*Passer domesticus*	X			*
Jacky Winter	*Microeca fascinans*				
Laughing Kookaburra	*Dacelo novaeguineae*	X			
Lewin's Rail	*Lewinia pectoralis*			L	VU
Little Black Cormorant	*Phalacrocorax sulcirostris*				
Little Corella	*Cacatua sanguinea*	X			
Little Eagle	*Hieraaetus morphnoides*	X			
Little Grassbird	*Megalurus gramineus*				
Little Lorikeet	*Glossopsitta pusilla*				
Little Pied Cormorant	*Microcarbo melanoleucos*	X			
Little Raven	*Corvus mellori*	X			
Little Wattlebird	*Anthochaera chrysoptera*				
Long-billed Corella	*Cacatua tenuirostris*	X			
Magpie-lark	*Grallina cyanoleuca*	X			
Masked Lapwing	*Vanellus miles*	X			
Mistletoebird	*Dicaeum hirundinaceum*				
Musk Lorikeet	*Glossopsitta concinna*				
Nankeen Kestrel	*Falco cenchroides*				
Nankeen Night Heron	*Nycticorax caledonicus*				NT
New Holland Honeyeater	*Phylidonyris novaehollandiae*	X			
Noisy Miner	*Manorina melanocephala*	X			
Olive-backed Oriole	*Oriolus sagittatus*				
Pacific Barn Owl	*Tyto javanica*	X			
Pacific Black Duck	*Anas superciliosa*	X			
Pallid Cuckoo	*Cuculus pallidus*	X			
Peregrine Falcon	*Falco peregrinus*				
Pied Currawong	*Strepera graculina*				
Purple Swamphen	*Porphyrio porphyrio*				
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	X			
Rainbow Bee-eater	*Merops ornatus*				
Rainbow Lorikeet	*Trichoglossus haematodus*	X			
Red Wattlebird	*Anthochaera carunculata*	X			
Red-browed Finch	*Neochmia temporalis*	X			
Red-capped Robin	*Petroica goodenovii*				
Red-rumped Parrot	*Psephotus haematonotus*	X			
Restless Flycatcher	*Myiagra inquieta*				
Rock Dove	*Columba livia*	X			*
Royal Spoonbill	*Platalea regia*				VU
Rufous Fantail	*Rhipidura rufifrons*				
Rufous Songlark	*Cincloramphus mathewsi*	X			
Rufous Whistler	*Pachycephala rufiventris*				
Sacred Kingfisher	*Todiramphus sanctus*				
Scarlet Robin	*Petroica boodang*				
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	X			
Silvereye	*Zosterops lateralis*	X			
Singing Honeyeater	*Lichenostomus virescens*				
Song Thrush	*Turdus philomelos*				*
Southern Boobook	*Ninox novaeseelandiae*				
Southern Whiteface	*Aphelocephala leucopsis*				
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*				
Spotless Crake	*Porzana tabuensis*				
Spotted Harrier	*Circus assimilis*				NT
Spotted Pardalote	*Pardalotus punctatus*	X			
Spotted Turtle-Dove	*Streptopelia chinensis*				*
Straw-necked Ibis	*Threskiornis spinicollis*	X			
Striated Fieldwren	*Calamanthus fuliginosus*				
Striated Pardalote	*Pardalotus striatus*	X			
Striated Thornbill	*Acanthiza lineata*				
Stubble Quail	*Coturnix pectoralis*				
Sulphur-crested Cockatoo	*Cacatua galerita*	X			
Superb Fairy-wren	*Malurus cyaneus*	X			
Swamp Harrier	*Circus approximans*				
Swift Parrot	*Lathamus discolor*		EN	L	EN

Common Name	Scientific Name	Recorded	EPBC	FFG	DSE
Tawny Frogmouth	*Podargus strigoides*				
Tree Martin	*Hirundo nigricans*	X			
Varied Sittella	*Daphoenositta chrysoptera*	X			
Wedge-tailed Eagle	*Aquila audax*	X			
Weebill	*Smicrornis brevirostris*				
Welcome Swallow	*Hirundo neoxena*	X			
Whistling Kite	*Haliastur sphenurus*	X			
White-browed Scrubwren	*Sericornis frontalis*				
White-browed Woodswallow	*Artamus superciliosus*				
White-eared Honeyeater	*Lichenostomus leucotis*				
White-faced Heron	*Egretta novaehollandiae*	X			
White-fronted Chat	*Epthianura albifrons*				
White-naped Honeyeater	*Melithreptus lunatus*				
White-necked Heron	*Ardea pacifica*	X			
White-plumed Honeyeater	*Lichenostomus penicillatus*	X			
White-throated Needletail	*Hirundapus caudacutus*				
White-throated Treecreeper	*Cormobates leucophaeus*				
White-winged Triller	*Lalage sueurii*	X			
Willie Wagtail	*Rhipidura leucophrys*	X			
Yellow Thornbill	*Acanthiza nana*				
Yellow-billed Spoonbill	*Platalea flavipes*	X			
Yellow-faced Honeyeater	*Lichenostomus chrysops*	X			
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	X			
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*				
Yellow-tufted Honeyeater	*Lichenostomus melanops*				
Zebra Finch	*Taeniopygia guttata*				
Mammals					
Black Rat	*Rattus rattus*				*
Black Wallaby	*Wallabia bicolor*	X			
Brown Rat	*Rattus norvegicus*				*
Cat	*Felis catus*				*
Chocolate Wattled Bat	*Chalinolobus morio*				
Common Brushtail Possum	*Trichosurus vulpecula*	X			
Common Ringtail Possum	*Pseudocheirus peregrinus*	X			
Dingo/Dog (feral)	*Canis lupus*				
Eastern Grey Kangaroo	*Macropus giganteus*	X			
European Hare	*Lepus europeaus*	X			*
European Rabbit	*Oryctolagus cuniculus*	X			*
Freetail Bat (eastern form)	*Mormopterus sp. EG*				
Gould's Long-eared Bat	*Nyctophilus gouldi*				
Gould's Wattled Bat	*Chalinolobus gouldii*				
House Mouse	*Mus musculus*	X			*
Inland Broad-nosed Bat	*Scotorepens balstoni*				
Koala	*Phascolarctos cinereus*				
Large Forest Bat	*Vespadelus darlingtoni*				
Lesser Long-eared Bat	*Nyctophilus geoffroyi*				
Little Forest Bat	*Vespadelus vulturnus*				
Platypus	*Ornithorhynchus anatinus*	X			
Red Fox	*Vulpes vulpes*	X			*
Short-beaked Echidna	*Tachyglossus aculeatus*	X			
Southern Forest Bat	*Vespadelus regulus*				
Southern Freetail Bat (long penis)	*Mormopterus sp. 1*				
Sugar Glider	*Petaurus breviceps*				
Swamp Rat	*Rattus lutreolus*	X			
Water Rat	*Hydromys chrysogaster*	X			
White-striped Freetail Bat	*Tadarida australis*				
Reptiles					
Bearded Dragon	*Pogona barbata*				DD
Black Rock Skink	*Egernia saxatilis intermedia*				
Bougainville's Skink	*Lerista bougainvillii*	X			
Common Blue-tongued Lizard	*Tiliqua scincoides*	X			
Common Long-necked Turtle	*Chelodina longicollis*				
Cunningham's Skink	*Egernia cunninghami*				
Eastern Brown Snake	*Pseudonaja textilis*				
Eastern Small-eyed Snake	*Rhinoplocephalus nigrescens*				
Eastern Three-lined Skink	*Bassiana duperreyi*				

Common Name	Scientific Name	Recorded	EPBC	FFG	DSE
Garden Skink	*Lampropholis guichenoti*	X			
Large Striped Skink	*Ctenotus robustus*				
Little Whip Snake	*Suta flagellum*				
Lowland Copperhead	*Austrelaps superbus*				
Marbled Gecko	*Christinus marmoratus*				
Red-bellied Black Snake	*Pseudechis porphyriacus*				
Southern Water Skink	*Eulamprus tympanum tympanum*	X			
Tiger Snake	*Notechis scutatus*				
Tree Dragon	*Amphibolurus muricatus*	X			
Tussock Skink	*Pseudemoia pagenstecheri*				
White's Skink	*Egernia whitii*				
Frogs					
Brown Toadlet	*Pseudophryne bibronii*			L	EN
Common Froglet	*Crinia signifera*	X			
Common Spadefoot Toad	*Neobatrachus sudelli*				
Growling Grass Frog	*Litoria raniformis*		VU	L	EN
Lesueur's Frog	*Litoria lesueuri*				
Peron's Tree Frog	*Litoria peronii*				
Southern Brown Tree Frog	*Litoria ewingii*	X			
Southern Bullfrog	*Limnodynastes dumerilii*	X			
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	X			
Striped Marsh Frog	*Limnodynastes peronii*				
WhistlingTree Frog	*Litoria verreauxii verreauxii*	X			
Fish					
Australian Smelt	*Retropinna semoni*				
Brown Trout	*Salmo trutta*				*
Common Carp	*Cyprinus carpio*				*
Common Galaxias	*Galaxias maculatus*	X			
Eastern Gambusia	*Gambusia holbrooki*				*
Flat-headed Gudgeon	*Philypnodon grandiceps*	X			
Goldfish	*Carassius auratus*				*
Mountain Galaxias	*Galaxias olidus*	X			
Oriental Weatherloach	*Misgurnus anguillicaudatus*				*
Redfin Perch	*Perca fluviatilis*	X			*
Short-finned Eel	*Anguilla australis*	X			
Southern Pigmy Perch	*Nannoperca australis*				
Tench	*Tinca tinca*	X			*
Tupong	*Pseudaphritis urvillii*				

DSE – Status from DSE Advisory List; **EPBC** – Status under EPBC Act; **FFG** – Status under FFG Act; **EN** – Endangered; **VU**– Vulnerable; **NT** – Lower risk near threatened; **DD** = data deficient; **L** – Listed under FFG Act; ***** = introduced species; **X** = recorded.