ecology & heritage partners

Final Report

Flora and Fauna Assessment: Aberline to Horne Growth Corridor

Prepared for

Warrnambool City Council

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Ecology and Heritage Partners Pty Ltd

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LIST OF ACRONYMS

Acronym	Definition
AVW	Atlas of Victorian Wildlife
CaLP Act	Victorian *Catchment and Land Protection Act 1994*
CMA	Catchment Management Authority
DELWP	Victorian Department of Environment, Land, Water and Planning
DoEE	Commonwealth Department of the Environment and Energy
EE Act	*Environment Effects Act 1978*
EES	Environment Effects Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESO	Environmental Significance Overlay
EVC	Ecological Vegetation Class
FFG Act	*Flora and Fauna Guarantee Act 1988*
FIS	Flora Information System
FZ	Farming Zone
GRZ	General Residential Zone
INZ1	Industrial Zone
KMP	Kangaroo Management Plan
NES	National Environmental Significance
NVIM	Native Vegetation Information Management Tool
NVPP	Native Vegetation Precinct Plan
PCRZ	Public Conservation and Resource Zone
PMST	Protected Matters Search Tool
PPRZ	Public Park and Recreation Zone
PUZ	Public Use Zone
RDZ1	Road Zone
VBA	Victorian Biodiversity Atlas
WoNS	Weed of National Significance
WSUD	Water Sensitive Urban Design

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1 INTRODUCTION

1.1 Background

This Flora and Fauna Assessment report presents a summary of ecological values associated with the Aberline to Horne Growth Corridor (the 'study area' or 'site'), which encompasses 378 hectares of land located approximately four kilometres north-east of the Warrnambool CBD (Figure 1).

Warrnambool City Council ('Council') has identified the precinct as a significant growth area with the potential to support population growth and provide an increased diversity of housing stock. In order to guide future development, Council are in the process of developing a Structure Plan and Development Contribution Plan for the precinct. The plans will provide a blueprint for future development and investment within the precinct and will be informed by a range of technical studies, including this Flora and Fauna Assessment Report.

1.2 Scope and Objectives

The information presented in this report is based on a detailed desktop review and field surveys of accessible land within the study area undertaken in September 2017. The key objectives of this Flora and Fauna Assessment include:

- Map and describe the natural assets within and adjacent to the study area;
- Identify issues affecting natural assets within the study area that need to be considered in the Structure Plan;
- Identify opportunities to integrate and enhance natural assets with planning for open space, drainage and broader land use planning; and,
- Determine the requirement for further ecological studies during future stages of growth corridor planning.

1.3 Study Area and Surrounds

The study area covers 378 hectares of land bounded by Aberline Road to the west, Wangoom Road to the north and predominately farming properties to the east and south (Figures 1 and 2). According to the Victorian Department of Environment, Land, Water and Planning (DELWP) Native Vegetation Information Management Tool (NVIM) (DELWP 2017a), the study area occurs within the boundaries of the Glenelg Hopkins Catchment Management Authority (CMA), Victorian Volcanic Plain Bioregion and the Warrnambool City municipality.

Under the Warrnambool Planning Scheme, no planning overlays relating to ecological values occur within the study area and the following zoning applies:

- Farming Zone (FZ) (93% of the study area);
- Public Use Zone - Service and Utility (PUZ1) (6%);

- General Residential Zone (GRZ1) (<1%);
- Industrial Zone (INZ1) (<1%); and,
- Road Zone (RDZ2) (<1%).

The applied zoning is reflected by current land use, with the majority of the site comprising cleared agricultural land with scattered rural dwellings. Surrounding land use is predominately agricultural; however medium density residential development associated with Martin Place Estate, Anchor Point Village and Russell Creek Estate abuts the south-west sections of the study area.

The study area does not contain any formal conservation reserves; however the Tozer Memorial Reserve is located in the northern section of the site. This 20 hectare property was donated to the Victorian School Plantation Endowment Scheme in 1926 and is currently managed by a trust committee represented by three local schools. The site retains large tracts of the Grassy Woodland Ecological Vegetation Class (EVC) and is recognised as a significant ecological resource within the context of the surrounding landscape.

The study area does not support any significant wetlands or 'Current Wetlands' mapped by DELWP. Russell Creek dissects the northern and southern sections of the study area, meeting the Merri River approximately 3.5 kilometres west of the site. Scattered ephemeral farms dams are also present across the study area and the south-east section of the site supports two large water storage ponds managed by Wannon Water.

Proposals involving the removal, destruction or lopping of native vegetation within the study area are subject to assessment under the *Permitted clearing of native vegetation - Biodiversity assessment guidelines'* (the Guidelines) (DEPI 2013). Under the Guidelines, the entire study area is classified as 'Location Risk A', the lowest risk category.

2 METHODS

2.1 Desktop Review

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

- The DELWP NVIM Tool (DELWP 2017a) and NatureKit Tool (DELWP 2017b) for:
    - Modelled data for location risk, remnant vegetation patches, scattered trees and habitat for rare or threatened species; and,
    - The extent of historic and current Ecological Vegetation Classes (EVCs).
- EVC benchmarks (DELWP 2017c) for descriptions of EVCs within the Victorian Volcanic Plain Bioregion;
- The Victorian Biodiversity Atlas (VBA) for previously documented flora and fauna records within the project locality (DELWP 2017d);
- The Flora Information System (FIS) (Viridans 2014a) and Atlas of Victorian Wildlife (AVW) (Viridans 2014b) for assistance with the distribution of flora and fauna species;
- The NatureShare Database (NatureShare 2018);
- The Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DoEE 2017);
- Relevant listings under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act), including the latest Threatened and Protected Lists (DELWP 2015a; DELWP 2015b);
- The Planning Maps Online (DELWP 2017e) and Planning Schemes Online (DELWP 2017f) to ascertain current zoning and environmental overlays in the study area;
- Other relevant environmental legislation and policies as required;
- Aerial photography of the study area; and,
- Previous ecological or other relevant assessments of the study area, including:
    - *Warrnambool City-wide Housing Strategy 2013* (Warrnambool City Council 2013);
    - *Warrnambool Open Space Strategy 2014* (Warrnambool City Council 2014);
    - *Tozer Reserve Vegetation Survey 2014* (Landtech Consulting 2014a); and,
    - *Tozer Reserve Fauna Survey 2014/15* (Landtech Consulting 2014b).

2.2 Field Assessment

A field survey was undertaken on 26th and 27th September 2017 to obtain information on flora and fauna values within the study area. The surveys focussed on all areas potentially supporting ecological values, with small residential lots and developed land excluded from the assessment. Approximately 271 hectares (72%) of the study area was accessed during the field surveys (Figure 2).

The study area was traversed, with all observed vascular flora and fauna species recorded, any significant records mapped and the overall condition of vegetation and habitats noted. EVCs were determined with reference to DELWP pre-1750 and extant EVC mapping (DELWP 2017a) and their published descriptions (DELWP 2017c).

The inspections focussed on identifying patches of native vegetation, scattered trees, protected ecological communities and potential habitat for significant flora and fauna species. With consideration to the objectives of this assessment, the fieldwork did not include targeted surveys for significant species or habitat hectare surveys.

2.3 Assessment Qualifications and Limitations

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

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

The field assessment was undertaken during an optimal season for the identification of flora and fauna species (spring); however the 'snap shot' nature of a standard biodiversity assessment meant that migratory, transitory or uncommon fauna species may have been absent from typically occupied habitats at the time of the field assessment. In addition, annual or cryptic flora species such as those that persist via underground tubers may also be absent. Targeted flora or fauna surveys and habitat hectare assessments were not undertaken, as this was beyond the preliminary scope of the project.

Nevertheless, the terrestrial flora and fauna data collected during the field assessment and information obtained from relevant desktop sources is considered adequate to provide an accurate assessment of the ecological values present within the study area.

3 EXISTING ENVIRONMENT

3.1 Vegetation

Modelling undertaken by DELWP provides an indication of the likely extent and type of native vegetation (remnant patches) present within the study area prior to European settlement and in 2005 (Table 1). The modelling suggests that only 4% of native vegetation has been retained within the study area since 1750, with large contiguous remnants mapped within the middle sections of the site.

Table 1. Modelled EVC extents within the study area

EVC	Modelled Extent (ha)	
	Pre-1750	2005
Swamp Scrub (EVC 53)	24.91	-
Plains Grassy Woodland (EVC 55)	353.37	14.53
Total	**378.28**	**14.53**

Vegetation mapping completed as part of this assessment largely confirmed the modelled paucity of native vegetation within the study area. Surveys completed across 271 hectares (72%) of the study area recorded approximately eight hectares of Plains Grassy Woodland (EVC 55_63), the majority of which comprised natural regrowth within the northern half of Tozer Memorial Reserve. Approximately 1.2 hectares of EVC 55_63 within the northern half of the reserve is considered likely to be remnant, as this area was excluded from historical plantation activities (Figure 2).

The remaining assessed portions of the study area were identified as being either developed or supporting non-remnant vegetation (i.e. planted and/or direct seeded indigenous and non-indigenous species, grassland/ pasture dominated by introduced species or crops) (Section 3.1.2).

Specific details relating to the observed EVC and other vegetation/ habitat types are provided below.

3.1.1 Plains Grassy Woodland

Detailed vegetation surveys completed within the northern half of Tozer Memorial Reserve between 2012 and 2014 (Landtech Consulting 2014a) identified that the majority of the eight hectare area is dominated by naturally regenerating Plains Grassy Woodland (EVC 55_63). The regeneration follows the removal pine plantations in 1996 and the cessation of grazing in 2004. The 2012-2014 surveys confirmed that Plains Grassy Woodland within northern half of the reserve is represented by six distinct habitat zones, classified according to similarities in structure and condition (Table 2, Figure 2 and Plates 1 and 2). An area of approximately 1.2 hectares within the northern half of the reserve was excluded from past plantation activities (Figure 2). Plains Grassy Woodland within this area is of higher quality and is considered likely to be remnant.

The survey findings suggest that species diversity increases in areas previously supporting pine plantations, which is potentially driven by reduced nutrient loads (in comparison to adjoining grazed land) and burning events. Fire is also attributed to areas supporting limited flora diversity, particularly within Habitat Zones 5 and 6 where monoculture stands of Black Wattle *Acacia mearnsii* are dominant.

Table 2. Plains Grassy Woodland within the northern half of Tozer Memorial Reserve

Habitat Zone	Condition Score[1]	Description[2]
1	0.37	Habitat zone 1 includes areas adjoining Wangoom Road which contains predominantly exotic pasture grass species. Zone 1 also includes a variety of native species mostly non-indigenous to EVC 55_63, planted at various times over the last decade. A number of significant species were surveyed within this zone and like other zones PGW tree and understorey shrub elements are absent from this area producing mid-range diversity scores. Pastures grasses dominate this zone due to invasion from surrounding agricultural landscapes and a relatively high soil moisture status. Woody weeds such as Blackberry *Rubus fruticosus L. agg*. and Gorse *Ulex europaeus* are persisting in this area whilst overall weed impact in this zone has resulted from soil disturbance. The zone exhibits the most open Black Wattle cover ratio which further contributes to the intense growth of pasture grass species such as Phalaris *Phalaris aquatica*, Sweet Vernal Grass *Anthoxanthum odoratum*, Paspalum *Paspalum dilatatum* and Yorkshire Fog Grass *Holcus lanatus*. Sparaxis *Sparaxis bulbifera* is an issue in this zone invading from roadside areas and slashing practices.
2	0.54	Habitat zone 2 contains many elements of EVC 55_63; however it still lacks tree and understorey tree and shrub elements indicative of this EVC type. It exhibits high diversity scores mainly within the ground stratum species and high condition scores. It also makes up the largest habitat zone within the northern part of the reserve and includes an open understorey tree (Black Wattle) cover structure. The zone however contains persistent and competing pasture grass and woody weed species which if not managed have the potential to degrade this higher condition and diverse zone.
3	0.34	Habitat zone 3 persists in areas to the east of the northern section of the reserve. This zone exists in areas with increased drainage, surface rocks, and lower soil moisture values. It would appear to also have lower soil nutrient status contributing to the reduction in pasture grass species whilst exhibiting increased native grass species such as *Rytidosperma* and *Austrostipa* sp. This zone like all other zones surveyed lacks PGW tree and understory shrub layer elements however contains open Black Wattle canopy spacing. The dominance of Black Wattle in many parts of this zone further contributes to its low condition and diversity scores.
4	0.59	Along with Habitat zone 2, zone 4 exhibits high diversity and condition scores with significant ground stratum species found within this area. Exotic pasture grasses and woody weeds such as Blackberry and Gorse were surveyed in this area which also includes areas of varying soil moisture due to localised land form. This zone includes an open cover of Black Wattle allowing sufficient light to promote ground stratum development. Plains Grassy Woodland tree and understorey shrub elements are also lacking in this zone.
5	0.35	Habitat zone 5 contains areas of Black Wattle cover dominance which vastly reduces the diversity and condition scores within this zone. Reduced ground stratum indigenous species cover is evident in this area (dominance of Kangaroo Grass *Themeda triandra*) with Black Wattle dominance related to possible burning of Pine tree trash, initiating mass seed store germination.
6	0.22	Habitat zone 6 exhibits in most areas almost complete dominance of Black Wattle and overhead cover levels between 50 and 75%. This zone as with zone 5 has low diversity and condition scores and in most areas lacks any ground cover apart from bryophyte development. This zone would also have been influenced by past management practices and the increased soil disturbance and fire when Pine trees were removed from the area. As with zone 5 this area lacks Plains Grassy Woodland tree, shrub and ground stratum species.

Notes: 1) Out of a possible score of 1.00

2) Sourced from Landtech Consulting 2014a

Plate 1. Plains Grassy Woodland within the study area (Ecology and Heritage Partners Pty Ltd 27/09/2017).

Plate 2. Plains Grassy Woodland within the study area (Ecology and Heritage Partners Pty Ltd 27/09/2017).

3.1.2 Planted Native Vegetation

The study area supports planted native vegetation in the form of scattered windbreaks and approximately 12 hectares of direct-seeded and planted land within the southern half of Tozer Memorial Reserve.

Windbreaks supporting native species, both indigenous and non-indigenous to the locality, occur on private property across the site (Figure 2 and Plate 3). Native species planted within the study area include River Red Gum *Eucalyptus camaldulensis*, Swamp Gum *Eucalyptus ovata*, Messmate *Eucalyptus obliqua*, Manna Gum *Eucalyptus viminalis*, Hedge Wattle *Acacia paradoxa,* Tree Everlasting *Ozothamnus ferruginous*, Moonah *Melaleuca lanceolata*, Blackwood *Acacia melanoxylon*, and Giant Honey-myrtle *Melaleuca armillaris*. .

The southern half of Tozer Memorial Reserve has been subject to intensive grazing and soil compaction, resulting in a landscape which is more modified than the northern section of the reserve. Past disturbance within this area has limited the potential for natural regeneration, with significant revegetation efforts employed to restore the Plains Grassy Woodland EVC. Since 2006, approximately 12,800 seedlings have been hand planted within the southern half of the reserve, along with the direct seeding of approximately 8.8 hectares within this area (Landtech Consulting 2014a) (Plate 4). Revegetation and direct-seeding within the southern half of Tozer Memorial Reserve has been funded by a combination of public and corporate sources.

Plate 3. Planted native vegetation within the study area (Ecology and Heritage Partners Pty Ltd 26/09/2017).

Plate 4. Direct seeded native vegetation within the southern half of Tozer Memorial Reserve (Ecology and Heritage Partners Pty Ltd 27/09/2017).

3.1.3 Introduced Vegetation

Introduced vegetation in the study area consists of grazed pasture and non-native plantings in windrows around dwellings, sheds, and the adjoining roadsides.

Pasture is dominate across the site and was recorded to have a high cover (>80%) of exotic grass species, many of which had been direct-seeded for grazing or cropping. Scattered native grasses were present in these areas, however they did not have the required 25% cover to be considered a remnant patch under the Guidelines (DEPI 2013). Theses areas were dominated by environmental weeds such as Phalaris, Rye-grass *Lolium* spp., Onion Grass *Romulea rosea,* Paspalum*,* Cape Weed *Arctotheca calendula* and Oat *Avena* spp (Plate 5). Noxious weeds were recorded throughout pasture in the study area, and along Russell Creek, with several occurrences of Hawthorn *Crataegus monogyna* and Sweet Briar *Rosa rubiginosa* particularly prevalent. The Weeds of National Significance (WoNS) Blackberry *Rubus fruticosus* sp. agg., and African Box-thorn *Lycium ferocissimum* were also present on site in low abundance.

Non-native plantings are present across the study area, with commonly occurring species including Monteray Cypress *Cupressus macrocarpa* and Radiata Pine *Pinus radiata*. Non-Victorian native species commonly present included Sugar Gum *Eucalyptus cladocalyx*, Tuart *Eucalyptus gomphocephala*, Yate *Eucalyptus cornuta* and Southern Mahogany *Eucalyptus botryoides* (Plate 6).

Plate 5. Weed-dominated pasture within the study area (Ecology and Heritage Partners Pty Ltd 26/09/2017).

Plate 6. Planted introduced vegetation within the study area (Ecology and Heritage Partners Pty Ltd 26/09/2017).

3.2 Fauna Habitat

Key habitat resources within the study area include the remnant, regenerating and revegetated sections of Tozer Memorial Reserve, planted native and non-native vegetation across the remaining site areas, and waterbodies, including scattered farm dams, wetlands and Russell Creek.

Remnant and regenerating stands of Plains Grassy Woodland and planted native vegetation within Tozer Memorial Reserve are known to support a diversity of fauna species (Landtech Consulting 2014b) (Section 3.3). While this vegetation is too young to contain hollows, a range of habitat features are present within the reserve including leaf litter, course woody debris and vegetation supporting a dense canopy/ shrub layer. The 2014 Fauna Survey Report (Landtech Consulting 2014b) indicates that the northern half of the reserve provides suitable habitat for a number of significant fauna species (Section 4.2).

Planted native and non-native vegetation across the site is likely to contribute to local wildlife corridors and depending on the type, condition and structure of plantings, has the potential to support a diversity of fauna species. Mature planted Eucalypts within windrows and around dwellings have the potential to support hollows and fissures which may provide roosting, nesting and sheltering habitat for hollow-dependent birds and mammals.

Farm dams scattered across the site, natural and artificial wetlands within Tozer Memorial Reserve, and the dissecting Russell Creek are likely to provide important water resources for a range of fauna species (Plates 7-10). Despite being relatively modified by past and current land use, a number of these ephemeral waterbodies support key habitat features, including submergent, emergent and floating aquatic vegetation, and refuge features such as rocks and coarse woody debris. In its current form, Russell Creek is considered to be of low quality; with the noxious weed Hawthorn dominating the banks of this waterway across the study area.

The large areas of pasture within the study area are likely to be utilised by common bird, reptile and mammal species. A number of bird species common to modified, grassy or open habitats were recorded during the current assessment. Diurnal and nocturnal raptors are also likely to forage over these areas.

Plate 7. Disturbed farm dam within the study area (Ecology and Heritage Partners Pty Ltd 26/09/2017).

Plate 8. Russell Creek within the study area (Ecology and Heritage Partners Pty Ltd 26/09/2017).

Plate 9. Wetland within Tozer Memorial Reserve (Ecology and Heritage Partners Pty Ltd 26/09/2017).

Plate 10. Wetland within Tozer Memorial Reserve (Ecology and Heritage Partners Pty Ltd 26/09/2017).

3.3 Flora and Fauna Species

The VBA (DELWP 2017d) indicates that only 15 flora species have been previously recorded within the study area, none of which are of conservation significance (Section 4.1). The previous records are sourced from two surveys completed in the western section of the site in 2000 and prior to 1980. Of the 15 flora species previously recorded, eight are introduced.

Flora surveys completed within the northern half of Tozer Memorial Reserve between 2012 and 2014 (Landtech Consulting 2014a) recorded 73 flora species, of which 20 are introduced. Records held by the managing trust committee indicate there may be up to 100 indigenous flora species present within the reserve.

The VBA (DELWP 2017d) indicates that 15 fauna species have been previously recorded within the study area, including 13 birds, one reptile and one mammal. The previous records are sourced from three surveys completed in the western and eastern sections of the site between 1971 and 2015. Of the fauna species previously recorded, four are exotic, including Common Blackbird *Turdus merula*, House Sparrow *Passer domesticus*, European Skylark *Alauda arvensis* and European Goldfinch *Carduelis carduelis*.

The VBA does not contain any records of conservation-listed fauna species within the study area; however the locally significant Koala *Phascolarctos cinereus* was recorded near the intersection of Horne Road and Rodgers Road in 2015.

Detailed fauna surveys completed within the northern half of Tozer Memorial Reserve between 2013 and 2014 (Landtech Consulting 2014b) recorded a range of native and introduced species including Bush Rat *Rattus fuscipes*, Koala, Eastern Grey Kangaroo *Macropus giganteus*, Swamp Wallaby *Wallabia bicolor*, Brush-tail Possum *Trichosurus vulpecula*, Short-beaked Echidna *Tachyglossus aculeatus*, Gould's Wattled Bat *Chalinolobus gouldii*, Blotched Blue-tongue Lizard *Tiliqua nigrolutea*, Copperhead Snake *Austrelaps superbus*, Striped Marsh Frog *Limnodynastes peronii*, Southern Brown Tree Frog *Litoria ewingii* and Common Froglet *Crinia signifera*. The surveys also recorded a number of conservation-listed fauna species (Section 4.2).

Information supplied by Council indicates that recent remote camera footage from Tozer Memorial Reserve contained a potential record of Agile Antechinus *Antechinus agilis*. Although this species is not conservation-listed, if confirmed present within the reserve, this will represent the only documented record within the Warrnambool region.

4 SIGNIFICANT AND PROTECTED VALUES

4.1 Flora

The VBA (DELWP 2017d) indicates that no conservation significant flora species have been recorded within the study area. Inspections undertaken across the site as part of the current assessment (September 2017), and within the northern section of Tozer Memorial Reserve between 2012 and 2014 (Landtech Consulting 2014a), did not record any significant flora species.

According to information provided by Council and the NatureShare Database (NatureShare 2017), the following State-significant flora species have been recorded within Tozer Memorial Reserve:

- Golden Cowslips *Diuris behrii* (2004)
- Arching Flax-lily *Dianella sp. aff. longifolia* (Benambra) (2014)
- Swamp Flax-lily *Dianella callicarpa* (2014)

The above noted species are listed on the Victorian Advisory List (DEPI 2014), with Golden Cowslips and Arching Flax-lily classified as Vulnerable and Swamp Flax-lily classified as Rare.

The VBA contains previous records of two nationally significant and an additional 10 State significant flora species within 10 kilometres of the study area (excluding the State significant species noted above) (DELWP 2017d) (Appendix A; Figure 3). The PMST nominated an additional eight nationally significant species which have not been previously recorded but have the potential to occur in the locality (DoEE 2017).

A likelihood of occurrence assessment identified that none of the 18 significant flora species recorded or predicted to occur within the project locality are likely to be present within the study area. This determination is based on the absence of suitable habitat and the history of previous disturbance within the study area, and the high level of survey effort employed to date within Tozer Memorial Reserve, including targeted seasonal flora surveys.

4.2 Fauna

The VBA (DELWP 2017d) indicates that no conservation significant fauna species have been recorded within the study area and none were recorded during recent inspections undertaken as part of the current assessment (September 2017). Detailed fauna surveys completed within the northern section of Tozer Memorial Reserve between 2013 and 2014 (Landtech Consulting 2014b) recorded the following significant fauna species:

- Nationally significant:
    - Growling Grass Frog *Litoria raniformis*
- State significant:
    - Swamp Skink *Lissolepis coventryi*
    - Southern Toadlet *Pseudophryne semimarmorata*
- Regionally significant:
    - Common Long-necked Turtle *Chelodina longicollis*

The 2013-14 assessments included targeted surveys for Golden Sun Moth *Synemon plana*, Striped Legless Lizard *Delma impar*, Grassland Earless Dragon *Tympanocryptis pinguicolla* and Fat-tailed Dunnart *Sminthopsis crassicaudata*; however these species were not recorded within the reserve.

The VBA contains previous records of 20 nationally significant, 34 State significant and 17 regionally significant fauna species within 10 kilometres of the study area (DELWP 2017d; (Appendix B; Figure 4). The PMST nominated an additional 23 nationally significant species which have not been previously recorded but have the potential to occur in the locality (DoEE 2017). Owing to the inclusion of the marine environment within the database search area (all land within 10 kilometres of the study area), a large number of the nominated species are restricted to marine and coastal environments e.g. Southern Right Whale *Eubalaena australis* and Southern Elephant Seal *Mirounga leonina.* These species have been removed from Appendix B and are not considered further.

A likelihood of occurrence assessment identified that the following significant fauna species have a moderate or higher likelihood of occurring within the study area (Appendix B) (in addition to the four significant species known to occur within Tozer Memorial Reserve):

- Nationally significant:
    - Grey-headed Flying-fox *Pteropus poliocephalus* - The study area provides foraging habitat for this species, which is capable of nightly flights of to 50 kilometres from roost sites. Foraging resources include nectar and pollen from Eucalypts and other native/ introduced plants. No roost sites are present within the study area or immediate surrounds.
    - Southern Bent-wing Bat *Miniopterus orianae bassanii* - The study area provides suitable foraging habitat for this species and is located within 6.5 kilometres of the Warrnambool maternity cave. Given the sites location between the maternity cave and known roosting caves (particularly the Grassmere, Panmure Cave and Yambuck sites), it is considered likely that bats forage within, or fly over the site during key migration periods (September-November and February-April).
- State significant:
    - Hardhead *Aythya australis* - This species may occasionally forage within on site waterbodies; however larger and higher quality habitats are present in the broader locality.
    - Blue-billed Duck *Oxyura australis* - As above.
    - Eastern Great Egret *Ardea modesta* - This relatively common species is likely to occasionally forage within the study area. The species is likely to be found in on site waterbodies and in areas of inundated pasture following rainfall.
    - Grey Goshawk *Accipiter novaehollandiae* - The study area is likely to form part of the foraging range of this species, with scattered native and non-native trees providing vantage points above large areas of pasture likely to support key prey species (rodents, reptiles and insects).
- Regionally significant:
    - Royal Spoonbill *Platalea regia* - This species has similar habitat requirements to Eastern Great Egret (described above).

- Spotted Harrier *Circus assimilis* - This species has similar habitat requirements to Grey Goshawk (described above).
- Latham's Snipe *Gallinago hardwickii* - This species breeds in Japan and far-eastern Russia, visiting Australia between July and November. Waterbodies throughout the study area, particularly those with a high cover of fringing vegetation (i.e. wetlands within Tozer Memorial Reserve) provide suitable habitat for this species.

4.3 Ecological Communities

According to the EPBC Act PMST (DoEE 2017), four nationally listed ecological communities are predicted to occur within 10 kilometres of the study area:

- Giant Kelp Marine Forests of South East Australia;
- Grassy Eucalypt Woodland of the Victorian Volcanic Plain;
- Natural Temperate Grassland of the Victorian Volcanic Plain; and,
- Subtropical and Temperate Coastal Saltmarsh.

The 2014 Vegetation Survey Report (Landtech Consulting 2014a) indicates that remnant patches of Plains Grassy Woodland within the northern half of Tozer Memorial Reserve correspond with the Grassy Eucalypt Woodland of the Victorian Volcanic Plain ecological community. The remaining areas of the study area do not support any EPBC Act listed ecological communities.

4.4 Significant Sites and Corridors

Sites of Biological Significance (BioSites) are areas containing biological assets that contribute to the conservation of Victoria's indigenous flora and fauna. The identification of BioSites allows for the prioritisation of conservation management and reservation, and incorporation of these assets into regional and local planning procedures.

There are no BioSites mapped within the study area; however two sites of regional significance adjoin the northern boundary - 'Wangoon Road' (Site #6424) and 'Wigg Lane roadside remnant veg, Warrnambool' (#2109). It is considered that these BioSites have been classified to identify remnant grassland within the adjoining road reserve areas. Additional BioSites within two kilometres of the study area include:

- Regionally significant: Wigg Lane (#6423), Stafford Rd roadside remnant veg, Stafford Rd Sub-division (#2110) and Stafford Road (#6422)
- Locally significant: Maam Wetlands (#6408)

Bio-links (areas of habitat connecting wildlife populations) within the study area are limited due to the extent of historical disturbance associated with agricultural land use and adjoining urban development. Tozer Memorial Reserve, Russell Creek, scattered vegetation and farm dams provide some level of connectivity within the highly fragmented landscape.

The study area includes an approximate two hectare property managed by DELWP, located approximately 230 metres south of Russell Creek and 300 metres north of the Boiling Down Road/ Gateway Road intersection. This property supports a large dam and provides to the opportunity to develop local connections with Russell Creek.

The planning of future development activity within the study area at a precinct scale will provide the opportunity to identity and improve existing bio-links (i.e. the existing link between Tozer Memorial Reserve and Russell Creek), and potentially create new habitat corridors through revegetation and habitat management activities.

5 SUMMARY OF ECOLOGICAL VALUES

The desktop review and field survey identified the following key ecological values within the study area:

- Tozer Memorial Reserve, which supports approximately eight hectares of remnant and naturally regenerating Plains Grassy Woodland (north), and 12 hectares of planted native vegetation (south). The reserve is also known to support the nationally significant Grassy Eucalypt Woodland of the Victorian Volcanic Plain ecological community and provide known habitat for significant fauna species including Growling Grass Frog, Swamp Skink, Southern Toadlet and Common Long-necked Turtle.
- Significant flora species recorded within the northern half of Tozer Memorial Reserve, including Golden Cowslips, Arching Flax-lily and Swamp Flax-lily.
- Planted native trees across the study area, predominately in windbreaks.
- Suitable habitat for species of national (Grey-headed Flying-fox and Southern Bent-wing Bat), State (Hardhead, Blue-billed Duck, Eastern Great Egret and Grey Goshawk) and Regional (Royal Spoonbill, Spotted Harrier and Latham's Snipe) conservation significance.
- Russell Creek, which provides local habitat connectivity.

These values are subject to a range of pressures associated with rural and semiurban environments, including:

- Land clearing associated with existing agricultural practices and encroaching urban development;
- Habitat fragmentation and edge effects, noting that the area of highest ecological value within the study area, Tozer Memorial Reserve, has a high edge/ area ratio which increases the sites susceptibility to incursion by weeds and pests (i.e. edge effects);
- Weed invasion; and,
- Erosion and sedimentation of waterways.

6 IMPLICATIONS FOR FUTURE DEVELOPMENT WITHIN THE STUDY AREA

A summary of biodiversity legislation and policy relevant to future development within the study area is provided in Table 3.

Table 3. Summary of legislative implications

Legislation/ Policy	Notes
Environment Protection and Biodiversity Conservation Act 1999	The EPBC Act establishes a Commonwealth process for the assessment of proposed actions likely to have a significant impact on matters of NES, or those that are undertaken on Commonwealth Land. An action, unless otherwise exempt, requires approval from the Commonwealth Minister for the Environment if it is likely to have an impact on any of the following matters of NES: World Heritage properties, National Heritage places, Ramsar wetlands of international significance, nationally listed threatened species and ecological communities, Migratory species protected under international agreements, Commonwealth marine areas, the Great Barrier Reef Marine Park, nuclear actions and water resources (for coal seam gas and large coal mining projects). Key ecological constraints associated with the EPBC Act relate to the known or potential presence of ecological communities and threatened species of flora and fauna. Any action that is likely to significantly impact upon these values or any other matter of NES would need to be referred to DoEE for assessment and approval. Referrals are assessed over a period of 20 working days, including a ten day public comment period. A referred action will subsequently be classed as one of the following: • *Not a controlled action* – approval is not required if the action is undertaken in accordance with the referral • *Not a controlled Action 'particular manner'* – approval is not required if the action is undertaken in accordance with the manner specified. • *Controlled action* – the action is subject to the assessment and approval process under the EPBC Act. Tozer Memorial Reserve is known to support the EPBC Act listed Grassy Eucalypt Woodland of the Victorian Volcanic Plain ecological community and Growling Grass Frog. The Grey-headed Flying-fox and Southern Bent-wing Bat are also likely to use foraging resources within the study area on occasion. Given that the reserve is likely to be retained for conservation, the supported values are unlikely to be impacted by future development. Although waterbodies outside the reserve, including Russell Creek and scattered farm dams, represent low quality habitat for Growling Grass Frog, there is potential for this species to inhabit or disperse between these features. Prior to any future development within the study area, it is recommended that a targeted survey for Growling Grass Frog is undertaken within all areas of potentially suitable habitat. Surveys should be undertaken in October or November and comply with the EPBC Act Survey Guidelines (DEWHA 2010). Future development within the study area is unlikely to significantly impact Grey-headed Flying-fox or Southern Bent-wing Bat given the highly dispersive nature of the species and availability of similar and higher quality foraging habitat in the locality. Following the completion of a targeted Growling Grass Frog survey, the significant impact test should be applied to determine the requirement for an EPBC Act referral.

Legislation/ Policy	Notes
Environment Effects Act 1978	The *Environment Effects Act 1978* (EE Act) provides for an assessment of proposed activities that are capable of having a significant impact on the environment at a State level. The Act allows the Victorian Minister for planning to decide whether an Environment Effects Statement (EES) is required to be completed. The "*Ministerial Guidelines for Assessment of Environmental Effects under the Environment Effects Act 1978*" provides triggers for which an EES is required, such as the removal of 10 or more hectares of native vegetation or potential impacts on remaining habitat or populations of threatened species. Any action that is likely to have a significant impact on State matters, as defined under the relevant guidelines, would need to be referred under the EE Act. Actions undertaken in accordance with a prescribed Precinct Structure Plan (PSP) are exempt from the requirements of the EE Act.
Flora and Fauna Guarantee Act 1988	The FFG Act is the primary legislation dealing with biodiversity conservation and the sustainable use of native flora and fauna in Victoria. The provisions of the FFG Act bind all public agencies, public landowners and land managers. The Act contains lists of threatened flora and fauna species, 'protected flora species' and threatened vegetation communities, as well as action statements to protect the long-term viability of these values. The Act applies to the removal of listed threatened species and communities, as well as protected flora species. Protected flora species include any of the Asteraceae (Daisies) family, all orchids, ferns (excluding Pteridium esculentum) and Acacia species (excluding *Acacia dealbata, Acacia decurrens, Acacia implexa, Acacia melanoxylon* and *Acacia paradoxa*); in addition to any taxa that forms a component of a listed FFG Act vegetation community. A species may be both listed and protected. Proponents are required to apply for an FFG Act permit to 'take' listed and/or protected flora species and listed vegetation communities in areas of public land (i.e. within road reserves). An FFG Act permit is generally not required for removal of listed and/or protected flora species and communities on private land. There are currently no requirements for proponents to apply for a permit under the FFG Act where a proposed activity requires the removal of habitat for a listed terrestrial fauna species. The Act does however regulate the removal, salvage, temporary holding, translocation, taking, trading and keeping of FFG Act-listed fish species, and as such, an FFG Act permit is required if listed fish species are likely to be affected by a proposed activity. Key ecological values within the study area associated with the FFG Act are likely to include listed threatened and protected species of flora and fauna. The majority of land within the study area is privately owned and therefore exempt from most provisions under the FFG Act including the requirement to obtain a permit for the removal or disturbance of listed/ protected plants, ecological communities and fish species. Any such action on public land affecting these values would require a permit from DELWP.
Planning and Environment Act 1987	The *Planning and Environment Act 1987* outlines the legislative framework for planning in Victoria and for the development and administration of planning schemes. All planning schemes contain native vegetation provisions at Clause 52.17 which require a planning permit from the relevant local Council to remove, destroy or lop native vegetation on a site of more than 0.4 hectares, unless an exemption clause under 52.17-6 of the Victorian Planning Schemes applies, or if the proposed clearing is in accordance with a Native Vegetation Precinct Plan (NVPP) (Clause 52.16) that has been incorporated into the Planning Scheme. Permitting requirements associated with the removal of native vegetation will be dependant on the future planning process and will draw upon the findings of this assessment.

Legislation/ Policy	Notes
Permitted clearing of native vegetation Biodiversity Assessment Guidelines' (the Guidelines)	The Victorian Planning Provisions relating to biodiversity protection and native vegetation management was amended in December 2013 to reflect the new permitted clearing of native vegetation and biodiversity policy encapsulated in the Guidelines (DEPI 2013). Any permitted clearing of native vegetation within the study area would be offset in accordance with the Guidelines. Given that native vegetation (as defined by the Guidelines) within the study area is confined to Tozer Memorial Reserve and that this area is likely to be retained for conservation, future development is unlikely to result in the removal of any native vegetation. Prior to each development proposal, detailed vegetation surveys will be required to confirm the presence/ absence of native vegetation. The future removal of any native vegetation and habitat for significant species will trigger the requirement to source offsets at the State level in accordance with the Guidelines (DEPI 2013). Offsets will also be required at the Commonwealth level (EPBC Act) in the event that future development will significantly impact any matter of NES (i.e. the Grassy Eucalypt Woodland of the Victorian Volcanic Plain ecological community or Growling Grass Frog).
***Wildlife Act 1975* and Wildlife Regulations 2002**	The *Wildlife Act 1975* (and associated Wildlife Regulations 2002) is the primary legislation in Victoria providing for protection and management of wildlife. The Act requires people engaged in wildlife research (e.g. fauna surveys, salvage and translocation activities) to obtain a permit under the Act to ensure that these activities are undertaken in a manner consistent with the appropriate controls. A permit would be required for the removal of habitat and/ or native fauna within the study area. A separate permit under the Wildlife Act may not be required where the removal of habitat is covered by a permit to remove native vegetation under the *Planning and Environment Act 1987*. A Wildlife Act permit would be required to undertake any action that is likely to result in the death of wildlife, or require the translocation of wildlife.
Catchment and Land Protection Act 1994	The *Catchment and Land Protection Act 1994* (CaLP Act) contains provisions relating to catchment planning, land management, noxious weeds and pest animals. The Act also provides a legislative framework for the management of private and public land and sets out the responsibilities of land managers, stating that they must take all reasonable steps to: • Avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner; • Protect water resources; • Conserve soil; • Eradicate regionally prohibited weeds; • Prevent the growth and spread of regionally controlled weeds; and, • Prevent the spread of, and as far as possible eradicate, established pest animals. A number of weeds listed as noxious under the CaLP Act are known occur throughout the study area. Similarly, it is likely that the region is occupied by several pest fauna species listed under the Act. Landowners are responsible for the control of any infestation of noxious weeds and pest fauna species. To meet CaLP Act requirements listed noxious weeds and pests should be appropriately controlled during any development activity to minimise their spread and impact on ecological values within the study area.

7 PRINCIPLES FOR FUTURE DEVELOPMENT

The study area contributes to the biodiversity value of the Warrnambool region and as such, the planning of future development to address population growth must be implemented on a precinct-wide scale to facilitate a consistent and informed approach to ensuring the future protection and enhancement of ecological values present. Detailed desk-based assessments and field surveys have been undertaken to establish a set of recommended principles aimed at balancing the needs for future development and biodiversity. The following table outlines the key principles and provides a set off recommended planning and design principles developed to inform the Structure Plan.

Table 4. Principles for future development

Principle	Objective	Existing Conditions	Recommended Planning and Design Principles
Integrated and Accessible	Future development integrates biodiversity into the urban landscape and ensures all neighbourhoods have access to nature.	In its current form, the study area supports large tracts of undeveloped land under private ownership. Limited areas of publically accessible open space are present.	• Design areas of open space (informal parks, recreation reserves, landscape and amenity areas, and land encumbered by service infrastructure) to promote the integration of biodiversity features. Opportunities to meet this objective include the application of environmentally sensitive design and environmentally conscious revegetation. The establishment of 'pocket parks', which provide limited connectivity and opportunities for fauna movement, should be avoided. • Selective interpretative signage should be used in key areas to highlight environmental features and promote increased community awareness. • Consider significant view lines between urbanised and natural areas to promote connections with nature and the use of these assets.
Connected	Future development maintains, improves and creates Biolinks, allowing the passive movement of fauna species across the landscape.	Bio-links within the study area are limited. Tozer Memorial Reserve, Russell Creek, scattered vegetation and farm dams provide connectivity within the highly fragmented landscape.	• Promote passive fauna movement by establishing native vegetation between Tozer Memorial Reserve and Russell Creek. • Rehabilitate the Russell Creek corridor, replacing the fringing stands of Hawthorn with species representative of the Swamp Scrub EVC. Fauna friendly culverts should be installed at any new crossing points. • Drainage infrastructure, such as wetlands, should be strategically located to integrate biodiversity features. An opportunity to achieve this outcome is the establishment of appropriately designed wetlands within the vicinity of Tozer Memorial Reserve, which is known to support the nationally significant Growling Grass Frog. • Prioritise the retention and enhancement of any planted native vegetation within road reserves during any future road upgrade proposals.

Principle	Objective	Existing Conditions	Recommended Planning and Design Principles
Extent	Future development increases the extent of land managed for biodiversity within the study area.	With the exception of Tozer Memorial Reserve, there are no areas within the study area managed for conservation.	• Ensure that any offset requirements generated by future development activity within the study area are met through the securement of offsets within this locality. Offsetting arrangements may lead to the establishment of dedicated conservation areas through active management and subsequent land transfers. Clearing proposals should result in a no net loss outcome for biodiversity. • As part of future planning processes, an Open Space Plan should be prepared to identify the extent of passive public open space areas on a precinct-wide scale and demonstrate the integration of different open space types; and how encumbered land has been appropriately used. A precinct wide approach will ensure that sufficient land has been set aside for the purposes of conservation.
Quality	Future development ensures that the quality of biodiversity assets within the study area is enhanced.	Native vegetation and habitat within the study area ranges in quality. Key values include native vegetation and significant flora/ fauna species within Tozer Memorial Reserve.	• Investigate the potential for Tozer Memorial Reserve to be formally secured for conservation in perpetuity (potentially as an offset site). • Apply appropriate planning controls, zones and overlays (PCRZ, ESOs, VPOs) to significant environmental values within the study area, including the Tozer Memorial Reserve and Russell Creek Corridor. • Apply appropriate development setbacks from Tozer Memorial Reserve and Russell Creek. The applied setbacks will be dependent on a range of factors (e.g. flood modelling); however based on the ecological values present, it is considered that a minimum buffer of 20 metres should be applied to these features (i.e. 20 metres from the reserve boundary and 20 metres either side of Russell Creek). • Appropriate setback distances will be dependant on the findings of detailed assessments (e.g. targeted Growling Grass Frog surveys). • Any future development within the study area should adopt the principles of Water Sensitive Urban Design (WSUD). This should include an integrated approach to stormwater and flood management that meets the objectives for hydraulic capacity, flood management and water cycle management. • Prioritise the siting of infrastructure within areas which have already been disturbed or support existing infrastructure, thereby limiting the requirement for further environmental rehabilitation. • Design of the open space network should consider potential issues associated with climate change, including the requirement to build resilience by increasing connectivity, changes to the abundance and distribution of invasive species and the potential for increased fire events.

Principle	Objective	Existing Conditions	Recommended Planning and Design Principles

Remnant	Future development protects and promotes the enhancement of key remnant features, including vegetation, habitat and species.	Vegetation mapping completed across 271 hectares (72%) of the study area recorded approximately eight hectares of Plains Grassy Woodland (EVC 55_63), the majority of which comprised natural regrowth within the northern half of Tozer Memorial Reserve. Approximately 1.2 hectares of EVC 55_63 within the northern half of the reserve are considered likely to be remnant.	• The hierarchy of environmental management should be applied to all future development within the study area. In order of priority, environmental impacts should be avoided, minimised and offset.
			• Utilise existing road networks to limit the crossing of Russell Creek.
			• Active revegetation within areas of open space should be undertaken using appropriate indigenous species. Revegetation should attempt to reproduce the EVC that would have occurred naturally in the area. All revegetation activities in open space reserves should:
			  ○ Represent at least 30% of the original communities EVC diversity;
			  ○ Be based on the EVC benchmark tree densities; and,
			  ○ Ensure all plants are indigenous and of local providence.
			• Establish design and siting standards for future development within the study area, including recommended planting lists.

Representative	Future development maintains and promotes biodiversity through the retention and re-establishment of features representative of the natural landscape.	The study area supports a diversity of flora and fauna species.	• Ensure that the siting and design of open space areas considers the diversity of vegetation and habitat types being protected. • Adopt appropriate planting standards for all revegetation activities within areas of open space to ensure that all created habitats are representative of the natural environment and that vegetation and habitat diversity is increased.

Significance	Future development retains and facilitates the long-term resilience of key significant species and ecological communities recorded or potentially present within the landscape.	A number of significant flora and fauna species are known and predicted to occur within the study area.	• As part of the future planning process, undertake targeted surveys to determine the presence and distribution of Growling Grass Frog within the study area. An appropriate management response should consider the following:
			  ○ Ecological requirements;
			  ○ Legislative requirements;
			  ○ Threats (existing and those predicted to arise through future development of the study area);
			  ○ Demonstrated approaches to conservation and enhancement; and,
			  ○ Appropriate management responses to direct the avoidance, minimisation and offsetting of future impacts.
			• If Growling Grass Frog is recorded outside Tozer Memorial Reserve, formalise the management of the species through the preparation of a Conservation Management Plan.

8 CONCLUSION

The Aberline to Horne Growth Corridor has been identified as being suitable for development accommodating the medium and longer term growth of Warrnambool. In assessing the feasibility of this scenario, Council have committed to the development of a Structure Plan and Development Contribution Plan, which will be informed by the findings of this Flora and Fauna Assessment Report.

Detailed desk-based assessments and field surveys were undertaken to assess the biodiversity value of the study area and inform future planning processes. The findings of the assessment confirmed that the study area is highly modified, with key ecological values largely limited to the Tozer Memorial Reserve and Russell Creek corridor. Ecological values within the study area are subject to the natural and anthropogenic pressures commonly associated with developed and fringing landscapes.

Given the potential for future development within the study area to intensify existing pressures and threaten the overall viability of retained ecological values, a precinct-wide approach is required to ensure all known values are accounted for and that management responses are consistent and implemented on a landscape-scale.

Knowledge gathered from this assessment has been used to develop a set of principles aimed at balancing the needs of population growth and biodiversity:

- Integrated and Accessible - Future development integrates biodiversity into the urban landscape and ensures all neighbourhoods have access to nature.
- Connected - Future development maintains, improves and creates Biolinks, allowing the passive movement of fauna species across the landscape.
- Extent - Future development increases the extent of land managed for biodiversity within the study area.
- Quality - Future development ensures that the quality of biodiversity assets within the study area is enhanced.
- Remnant - Future development protects and promotes the enhancement of key remnant features, including vegetation, habitat and species.
- Representative - Future development maintains and promotes biodiversity through the retention and re-establishment of features representative of the natural landscape.
- Significance - Future development retains and facilitates the long-term resilience of key significant species and ecological communities recorded or potentially present within the landscape.

For each key principle, recommended design and planning principles have been developed to inform preparation of the Structure Plan (Section 7). It is recommended that these principles are reassessed and built upon as future planning of the growth corridor progresses and as knowledge of ecological values increases through succeeding targeted studies. As part of the precinct planning process, it is recommended that targeted surveys are undertaken for Growling Grass Frog. Whilst future development activities are unlikely to significantly impact Southern Bent-wing Bat, it is recommended that further detailed studies to assess site use are considered. A Kangaroo Management Plan (KMP) is also recommended to assess and mitigate the risk of land-locking associated with future development.

Based on the findings of this Flora and Fauna Assessment Report, it is considered that the study area can accommodate the medium and longer term growth of Warrnambool whilst maintaining and enhancing the key ecological values present.

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10 FIGURES

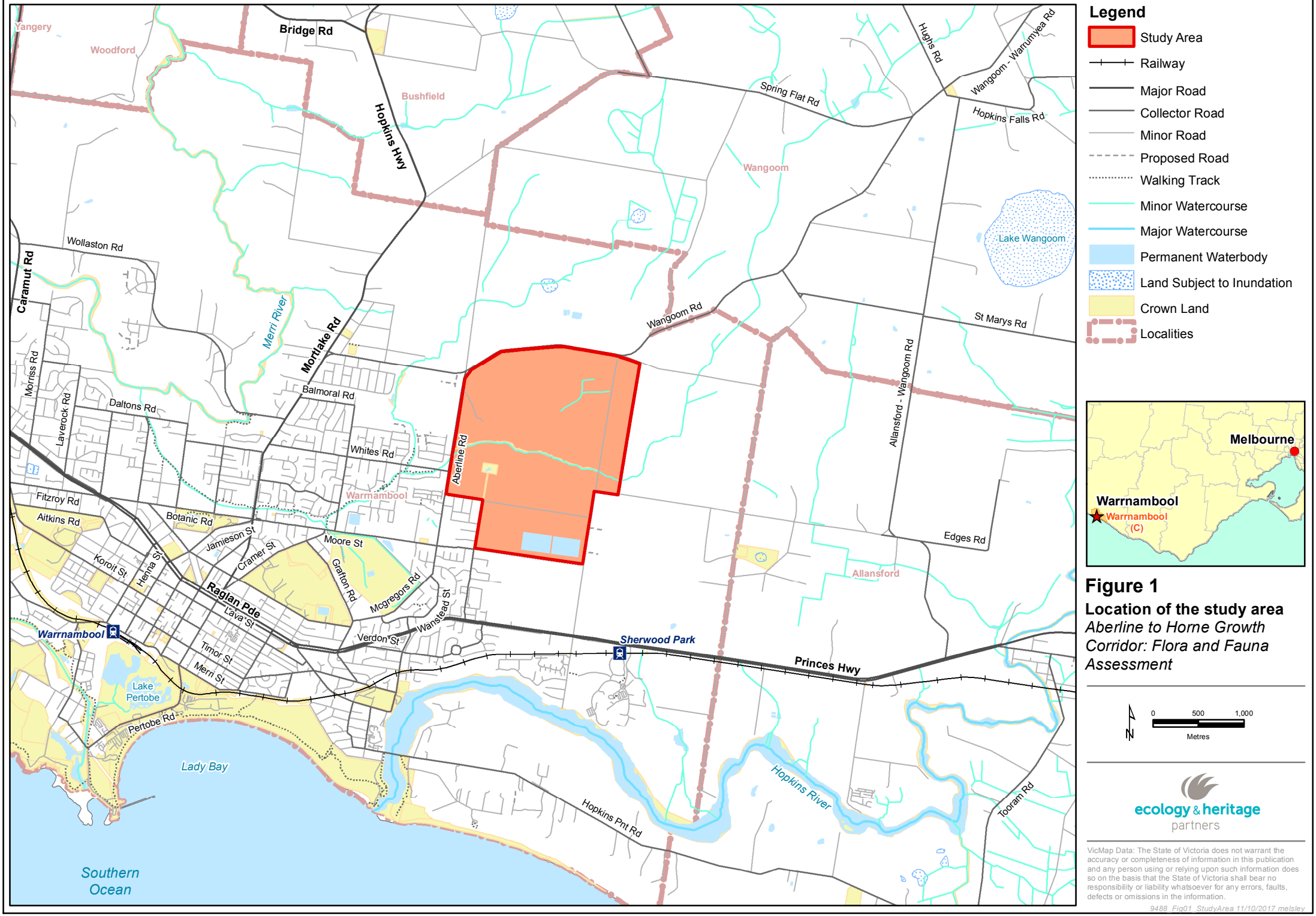

Figure 1

Location of the study area

Aberline to Horne Growth Corridor: Flora and Fauna Assessment

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9488_Fig01_StudyArea 11/10/2017 melsley

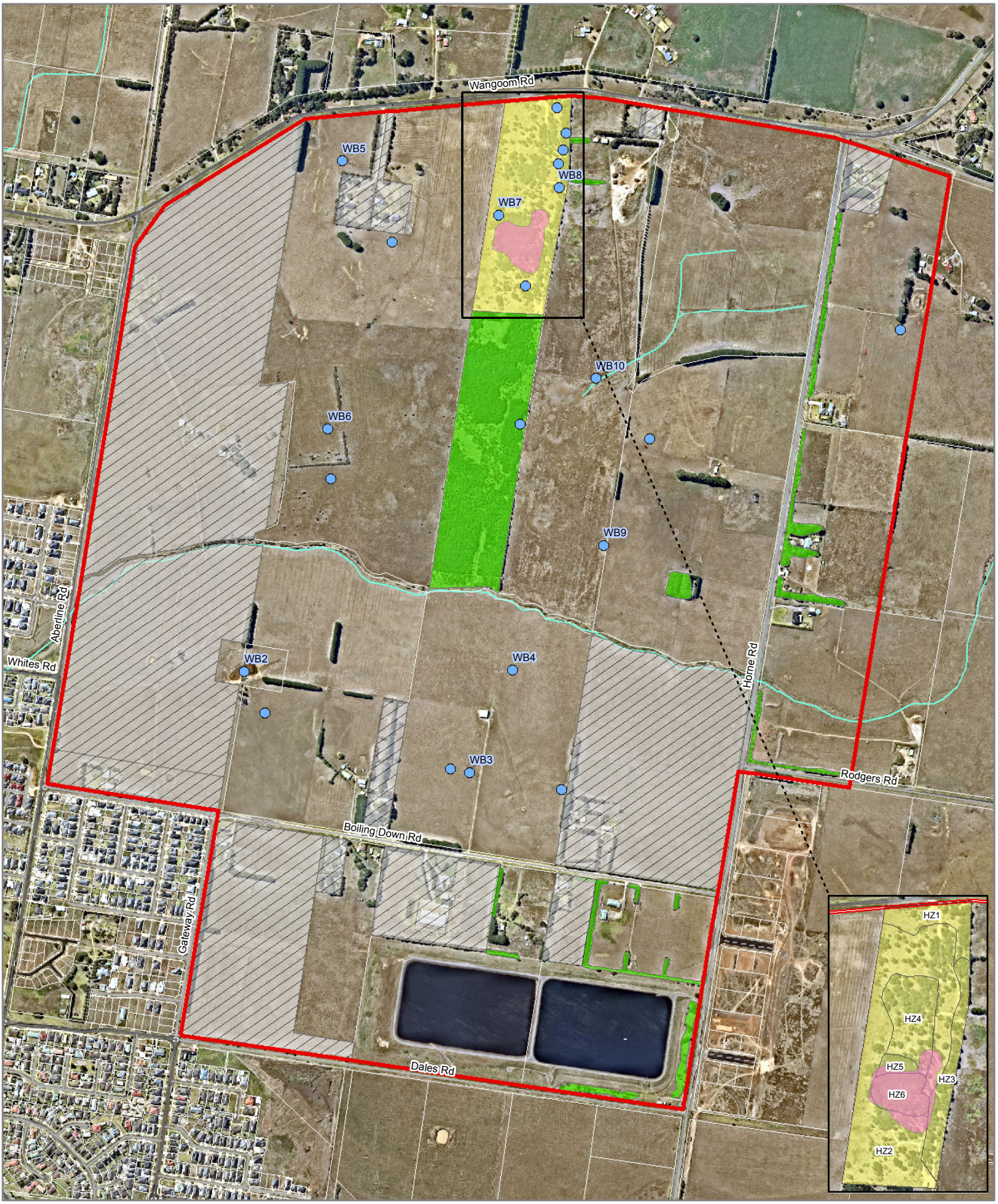

Figure 2

Ecological features

Aberline to Horne Growth Corridor: Flora and Fauna Assessment

Legend

- Study area
- Properties not accessed
- Scattered dams or wetlands

Native vegetation

- Plains Grassy Woodland (EVC 55_63) - Regrowth
- Planted native vegetation
- Plains Grassy Woodland (EVC 55_63) - Potentially remnant

N

0 120 240

Metres

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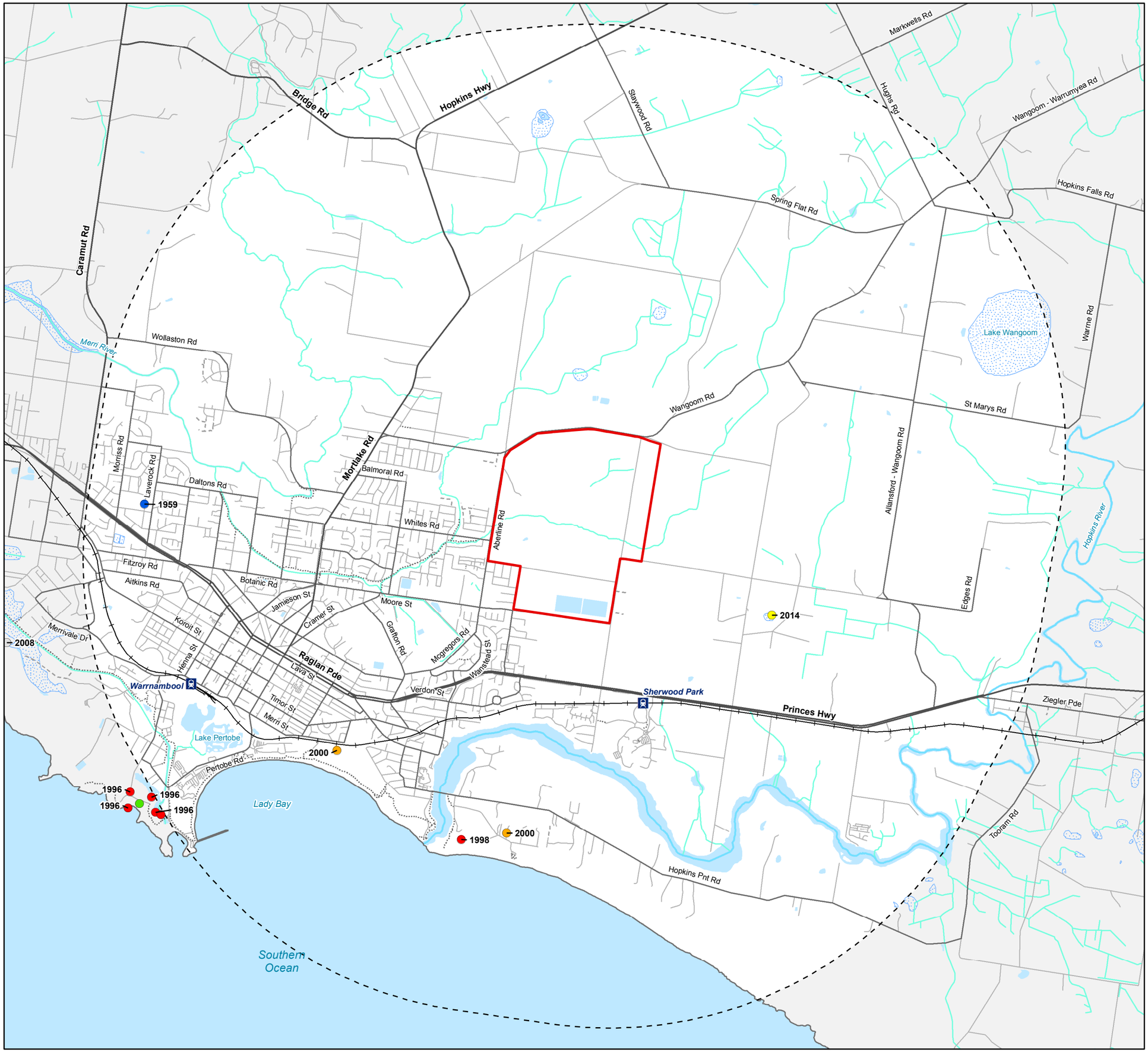
ecology & heritage partners

Aerial source: Nearmap 2017



Legend

- Study Area

Significant flora

- Coast Ballart
- Coast Stackhousia
- Coast Twin-leaf
- Pale Swamp Everlasting
- Salt Blown-grass
- Short Spider-orchid

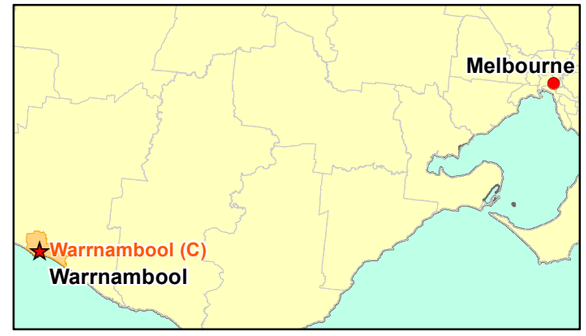


Figure 3

Previously documented significant flora within 5km of the study area

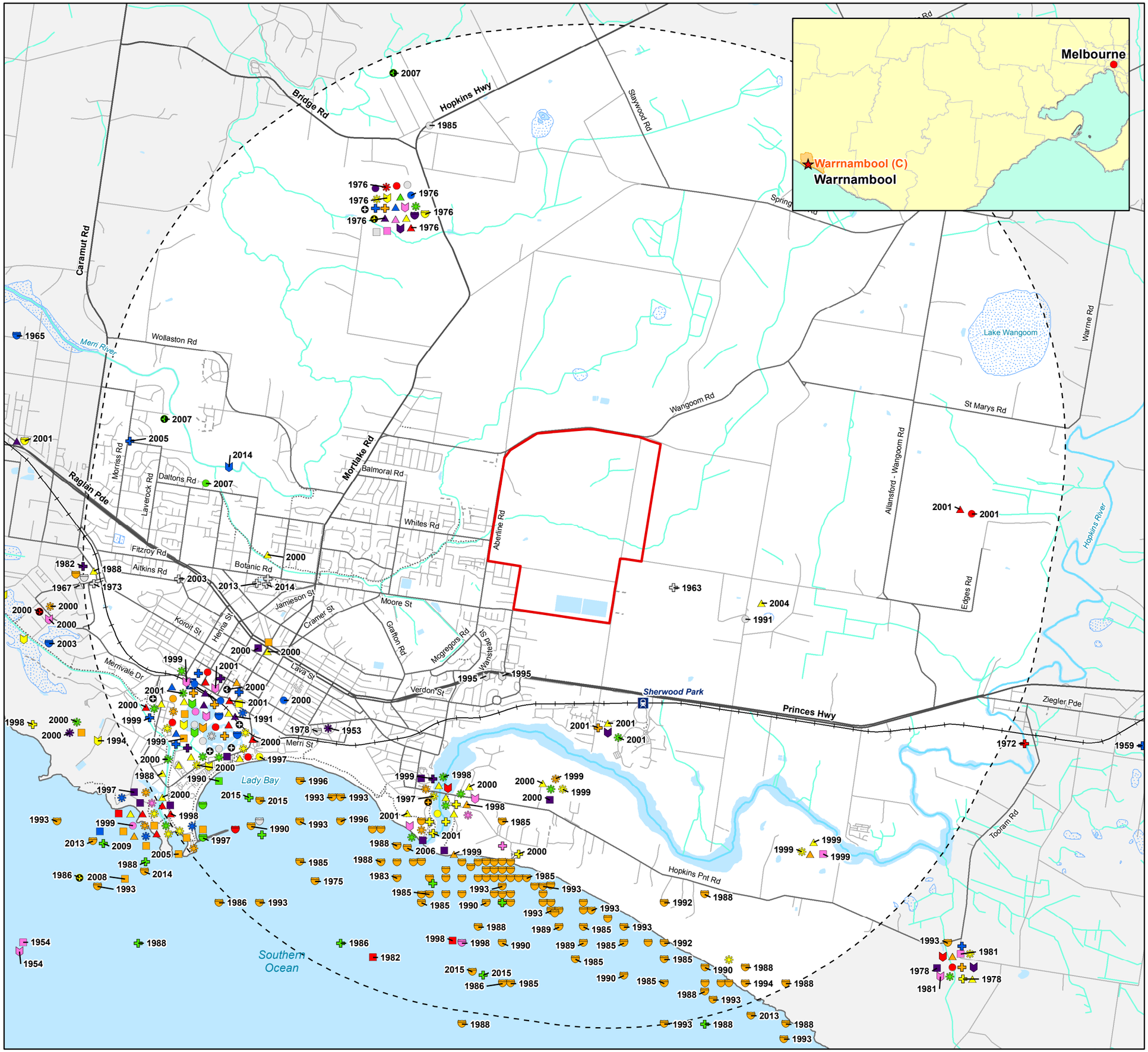
Aberline to Horne Growth Corridor: Flora and Fauna Assessment

N

0 1 2

Kilometres

ecology & heritage partners



Legend

- Study Area

Significant fauna

- Australasian Bittern
- Australasian Shoveler
- Australian Painted Snipe
- Australian Sea Lion
- Azure Kingfisher
- Baillon's Crake
- Bar-tailed Godwit
- Barking Owl
- Black Falcon
- Black-browed Albatross
- Black-faced Cormorant
- Black-tailed Godwit
- Blue Petrel
- Blue Whale
- Blue-billed Duck
- Caspian Tern
- Common Bent-wing Bat
- Common Greenshank
- Common Sandpiper
- Eastern Great Egret
- Emu
- Freckled Duck
- Glossy Ibis
- Grey Goshawk
- Grey-headed Flying-fox
- Growling Grass Frog
- Hardhead
- Hooded Plover
- Humpback Whale
- Latham's Snipe
- Leathery Turtle
- Lewin's Rail
- Little Bittern
- Little Egret
- Long-toed Stint
- Magpie Goose
- Marsh Sandpiper
- Murray Spiny Crayfish
- Musk Duck
- Nankeen Night Heron
- Orange-bellied Parrot
- Pacific Golden Plover
- Pacific Gull
- Pied Cormorant
- Royal Spoonbill
- Ruddy Turnstone
- Sanderling
- Shy Albatross
- Southern Elephant Seal
- Southern Giant-Petrel
- Southern Right Whale
- Spotted Harrier
- Subantarctic Fur Seal
- Swamp Skink
- Wandering Albatross
- Whimbrel
- Whiskered Tern
- White-bellied Sea-Eagle
- White-fronted Tern
- White-throated Needletail
- Yarra Pygmy Perch

Figure 4

Previously documented significant fauna within 5km of the study area

Aberline to Horne Growth Corridor: Flora and Fauna Assessment

N

0 1 2

Kilometres

ecology & heritage partners

11 APPENDICES

APPENDIX A – SIGNIFICANT FLORA SPECIES RECORDED WITHIN THE PROJECT LOCALITY

Table A4. Significant flora species recorded within 10 kilometres of the study area (VBA)

Scientific name	Common name	Total # records[1]	Last documented record	EPBC[2]	FFG[3]	Vic[4]	Likelihood of Occurrence[5]
NATIONAL SIGNIFICANCE							
Caladenia brachyscapa	Short Spider-orchid	1	1959	EX	L	rx	4
Glycine latrobeana #	Clover Glycine	-	-	VU	L	v	3
Ixodia achillaeoides subsp. *arenicola* #	Coast Ixodia	-	-	VU	-	v	4
Lepidium hyssopifolium s.s.	Basalt Peppercress	2	1959	EN	L	e	3
Prasophyllum frenchii #	Maroon Leek-orchid	-	-	EN	L	e	3
Prasophyllum spicatum #	Dense Leek-orchid	-	-	VU	-	e	3
Pterostylis cucullata #	Leafy Greenhood	-	-	VU	L	e	3
Pterostylis tenuissima #	Swamp Greenhood	-	-	VU	-	v	3
Taraxacum cygnorum #	Coast Dandelion	-	-	VU	L	e	3
Thelymitra epipactoides #	Metallic Sun-orchid	-	-	EN	L	e	3
STATE SIGNIFICANCE							
Berula erecta	Water Parsnip	2	1991	-	-	k	3
Coronidium gunnianum	Pale Swamp Everlasting	1	2014	-	-	v	3
Dianella callicarpa	**Swamp Flax-lily**	**1**	**2007**	**-**	**-**	**r**	**1**
Exocarpos syrticola	Coast Ballart	1	2008	-	-	r	4
Isotoma tridens	Hypsela	1	1935	-	-	k	3
Lachnagrostis robusta	Salt Blown-grass	1	1997	-	-	r	3
Poa billardierei	Coast Fescue	6	1998	-	-	r	4
Pultenaea canaliculata	Coast Bush-pea	7	1904	-	-	r	4
Scaevola calendulacea	Dune Fan-flower	1	1895	-	-	v	4

Scientific name	Common name	Total # records[1]	Last documented record	EPBC[2]	FFG[3]	Vic[4]	Likelihood of Occurrence[5]
Stackhousia spathulata	Coast Stackhousia	9	1998	-	-	k	4
Zygophyllum billardierei	Coast Twin-leaf	2	2000	-	-	r	4

Notes:

1) # - Species only nominated by the EPBC Act PMST (not previously recorded within 10 kilometres of the study area)
2) Listed as Regionally Extinct (EX), Critically Endangered (CR), Endangered (E) or Vulnerable (V) under the EPBC Act

3) Listed (L) under the FFG Act.

4) Listed as Regionally Extinct (rx), Endangered (e), Vulnerable (v), Rare (r) or Status Poorly Known (k) on the Victoria Advisory List (DEPI 2014)

5) Likelihood of occurrence: 1 Known Occurrence - Recorded within the project locality recently (i.e. within ten years), 2 High Likelihood - Previous records of the species in the local vicinity; and/or, the study area contains areas of high quality habitat, 3 Moderate Likelihood - Limited previous records of the species in the local vicinity; and/or, the study area contains poor or limited habitat, 4 Low Likelihood - Poor or limited habitat for the species however other evidence (such as a lack of records or environmental factors) indicates there is a very low likelihood of presence, 5 Unlikely - No suitable habitat and/or outside the species range.

APPENDIX B – SIGNIFICANT FAUNA SPECIES RECORDED WITHIN THE PROJECT LOCALITY

Table A5. Significant fauna species recorded within 10 kilometres of the study area

Common name	Scientific name	Last record [1]	Total # records	EPBC[2]	FFG[3]	Vic[4]	Likelihood of Occurrence[5]
NATIONAL SIGNIFICANCE							
Birds							
Wandering Albatross	*Diomedea exulans*	1998	2	VU	L	en	4
Black-browed Albatross	*Thalassarche melanophris melanophris*	2001	11	VU	-	vu	4
Shy Albatross	*Thalassarche cauta*	2000	8	VU	L	vu	4
Grey-headed Albatross	*Thalassarche chrysostoma*	1957	1	EN	L	vu	4
Indian Yellow-nosed Albatross	*Thalassarche carteri*	1978	2	VU	L	vu	4
Antipodean Albatross #	*Diomedea exulans antipodensis*	-	-	VU	-	-	4
White-capped Albatross #	*Thalassarche cauta steadi*	-	-	VU	-	-	4
Salvin's Albatross #	*Thalassarche salvini*	-	-	VU	-	-	4
Buller's Albatross #	*Thalassarche bulleri*	-	-	VU	L	-	4
Northern Buller's Albatross #	*Thalassarche bulleri platei*	-	-	VU	-	-	4
Southern Royal Albatross #	*Diomedea epomophora epomophora*	-	-	VU	-	-	4
Northern Royal Albatross #	*Diomedea epomophora sanfordi*	-	-	EN	-	-	4
Sooty Albatross #	*Phoebetria fusca*	-	-	VU	L	-	4
Southern Giant-Petrel	*Macronectes giganteus*	1987	4	EN	L	vu	4
Northern Giant-Petrel #	*Macronectes halli*	-	-	VU	L	nt	4
Blue Petrel	*Halobaena caerulea*	1990	1	VU	-	-	4
Fairy Prion	*Pachyptila turtur*	1992	13	VU	-	vu	4
Soft-plumaged Petrel #	*Pterodroma mollis*	-	-	VU	-	-	4
Gould's Petrel #	*Pterodroma leucoptera*	-	-	EN	-	-	4
Australasian Bittern	*Botaurus poiciloptilus*	1994	8	EN	L	en	3

Common name	Scientific name	Last record [1]	Total # records	EPBC[2]	FFG[3]	Vic[4]	Likelihood of Occurrence[5]
Lesser Sand Plover #	*Charadrius mongolus*	-	-	EN	-	cr	4
Hooded Plover	*Thinornis rubricollis rubricollis*	2001	37	VU	L	vu	4
Plains-wanderer #	*Pedionomus torquatus*	-	-	CR	L	cr	4
Australian Painted Snipe	*Rostratula australis*	1995	1	VU	L	cr	3
Northern Siberian Bar-tailed Godwit #	*Limosa lapponica menzbieri*	-	-	EN	-	-	4
Eastern Curlew #	*Numenius madagascariensis*	-	-	CR	-	vu	4
Great Knot	*Calidris tenuirostris*	1977	1	CR	L	en	4
Red Knot	*Calidris canutus*	1978	2	EN	-	en	4
Curlew Sandpiper	*Calidris ferruginea*	1992	14	CR	-	en	4
Fairy Tern	*Sternula nereis nereis*	1978	3	VU	L	en	3
Swift Parrot #	*Lathamus discolor*	-	-	CR	L	en	3
Orange-bellied Parrot	*Neophema chrysogaster*	2005	3	CR	L	cr	4
Painted Honeyeater #	*Grantiella picta*	-	-	VU	L	vu	3
Mammals							
Swamp Antechinus #	*Antechinus minimus maritimus*	-	-	VU	L	nt	3
Spot-tailed Quoll #	*Dasyurus maculatus macula*	-	-	EN	L	en	4
Southern Brown Bandicoot #	*Isoodon obesulus obesulus*	-	-	EN	L	nt	4
Long-nosed Potoroo #	*Potorous tridactylus tridactylus*	-	-	VU	L	nt	4
Grey-headed Flying-fox	***Pteropus poliocephalus***	**2014**	**8**	**VU**	**L**	**vu**	**2**
Southern Bent-wing Bat #	***Miniopterus orianae bassanii***	**-**	**-**	**CR**	**L**	**cr**	**2**
Reptiles							
Striped Legless Lizard #	*Delma impar*	-	-	VU	L	en	3
Frogs							
Growling Grass Frog	***Litoria raniformis***	**1972**	**12**	**VU**	**L**	**en**	**1**
Fish							
Dwarf Galaxias #	*Galaxiella pusilla*	-	-	VU	L	en	4

Common name	Scientific name	Last record [1]	Total # records	EPBC[2]	FFG[3]	Vic[4]	Likelihood of Occurrence[5]
Australian Grayling	*Prototroctes maraena*	1988	10	VU	L	vu	4
Yarra Pygmy Perch	*Nannoperca obscura*	2007	10	VU	L	vu	4
STATE SIGNIFICANCE							
Birds							
Magpie Goose	*Anseranas semipalmata*	2013	64	-	L	nt	4
Musk Duck	*Biziura lobata*	2006	55	-	-	vu	3
Freckled Duck	*Stictonetta naevosa*	2004	7	-	L	en	**3**
Australasian Shoveler	*Anas rhynchotis*	2005	58	-	-	vu	3
Hardhead	***Aythya australis***	**2004**	**29**	**-**	**-**	**vu**	**2**
Blue-billed Duck	***Oxyura australis***	**1999**	**9**	**-**	**L**	**en**	**2**
White-throated Needletail	*Hirundapus caudacutus*	1986	2	-	-	vu	3
White-faced Storm-Petrel	*Pelagodroma marina*	1977	2	-	-	vu	**4**
Little Bittern	*Ixobrychus minutus dubius*	1995	2	-	L	en	3
Eastern Great Egret	***Ardea modesta***	**2006**	**135**	**-**	**L**	**vu**	**2**
Intermediate Egret	*Ardea intermedia*	1999	2	-	L	en	3
Little Egret	*Egretta garzetta nigripes*	1997	8	-	L	en	3
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	2000	1	-	L	vu	3
Grey Goshawk	***Accipiter novaehollandiae novaehollandiae***	**2001**	**7**	**-**	**L**	**vu**	**2**
Black Falcon	*Falco subniger*	1977	3	-	-	vu	3
Lewin's Rail	*Lewinia pectoralis pectoralis*	1999	6	-	L	vu	3
Baillon's Crake	*Porzana pusilla palustris*	2000	5	-	L	vu	3
Australian Bustard	*Ardeotis australis*	1878	1	-	L	cr	3
Pacific Golden Plover	*Pluvialis fulva*	1977	3	-	-	vu	4
Grey Plover	*Pluvialis squatarola*	1979	4	-	-	en	4
Black-tailed Godwit	*Limosa limosa*	1999	1	-	-	vu	4

Common name	Scientific name	Last record [1]	Total # records	EPBC[2]	FFG[3]	Vic[4]	Likelihood of Occurrence[5]
Whimbrel	*Numenius phaeopus*	1960	1	-	-	vu	4
Common Sandpiper	*Actitis hypoleucos*	1999	12	-	-	vu	4
Grey-tailed Tattler	*Tringa brevipes*	1977	2	-	L	cr	4
Common Greenshank	*Tringa nebularia*	2006	56	-	-	vu	4
Marsh Sandpiper	*Tringa stagnatilis*	1994	3	-	-	vu	4
Ruddy Turnstone	*Arenaria interpres*	2000	29	-	-	vu	4
Gull-billed Tern	*Gelochelidon nilotica macrotarsa*	1977	1	-	L	en	4
Caspian Tern	*Hydroprogne caspia*	2000	30	-	L	nt	4
Barking Owl	*Ninox connivens connivens*	1960	1	-	L	en	3
Mammals							
Common Bent-wing Bat	*Miniopterus schreibersii GROUP*	2000	30	-	L	-	3
Reptiles							
Swamp Skink	***Lissolepis coventryi***	**2003**	**4**	**-**	**L**	**vu**	**1**
Crustaceans							
Murray Spiny Crayfish	*Euastacus armatus*	2014	1	-	L	nt	3
Western Crayfish	*Geocharax falcata*	2001	1	-	-	en	3
REGIONAL SIGNIFICANCE							
Birds							
Common Diving-Petrel	*Pelecanoides urinatrix*	1980	3	-	-	nt	4
Pied Cormorant	*Phalacrocorax varius*	2000	27	-	-	nt	3
Black-faced Cormorant	*Phalacrocorax fuscescens*	2008	19	-	-	nt	4
Nankeen Night Heron	*Nycticorax caledonicus hillii*	2013	8	-	-	nt	3
Glossy Ibis	*Plegadis falcinellus*	2004	4	-	-	nt	4
Royal Spoonbill	***Platalea regia***	**2005**	**88**	**-**	**-**	**nt**	**2**
Spotted Harrier	***Circus assimilis***	**2001**	**6**	**-**	**-**	**nt**	**2**
Sooty Oystercatcher	*Haematopus fuliginosus*	1981	4	-	-	nt	4

Common name	Scientific name	Last record [1]	Total # records	EPBC[2]	FFG[3]	Vic[4]	Likelihood of Occurrence[5]
Latham's Snipe	***Gallinago hardwickii***	**2006**	**33**	**-**	**-**	**nt**	**2**
Sanderling	*Calidris alba*	1999	17	-	-	nt	4
Long-toed Stint	*Calidris subminuta*	1991	1	-	-	nt	4
Whiskered Tern	*Chlidonias hybridus javanicus*	2005	42	-	-	nt	4
White-winged Black Tern	*Chlidonias leucopterus*	1992	3	-	-	nt	4
White-fronted Tern	*Sterna striata*	1996	1	-	-	nt	4
Pacific Gull	*Larus pacificus pacificus*	2001	15	-	-	nt	4
Azure Kingfisher	*Alcedo azurea*	2007	2	-	-	nt	3
Fish							
Golden Perch	*Macquaria ambigua*	1989	2	-	-	nt	4

Notes:

1) # - Species only nominated by the EPBC Act PMST (not previously recorded within 10 kilometres of the study area)

2) Listed as Critically Endangered (CR), Endangered (E) or Vulnerable (V)) under the EPBC Act

3) Listed (L) under the FFG Act

4) Listed as Extinct (ex), Critically Endangered (cr), Endangered (e), Vulnerable (v) or Near Threatened (nt) on the Victoria Advisory List (DSE 2009;2013).

5) Likelihood of occurrence:

1	High Likelihood	Known resident in the Study area based on site observations, database records, or expert advice; and/or, Recent records (i.e. within five years) of the species in the local area (VBA 2011); and/or, The Study area contains the species' preferred habitat.	2	Moderate Likelihood	The species is likely to visit the Study area regularly (i.e. at least seasonally); and/or, Previous records of the species in the local area (DSE 2011b); and/or, The Study area contains some characteristics of the species' preferred habitat.
3	Low Likelihood	The species is likely to visit the Study area occasionally or opportunistically whilst en route to more suitable sites; and/or, There are only limited or historical records of the species in the local area (i.e. more than 20 years old); and/or, The Study area contains few or no characteristics of the species' preferred habitat.	4	Unlikely	No previous records of the species in the local area; and/or, The species may fly over the Study area when moving between areas of more suitable habitat; and/or, Out of the species' range; and/or, No suitable habitat present.