ALBERTON WIND FARM

FLORA AND FAUNA ASSESSMENT

BIRD AND BAT UTILISATION SURVEYS

MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Synergy Wind Pty Ltd

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Report No. 14107 (8.0)

INTRODUCTION

Synergy Wind Pty Ltd engaged Brett Lane & Associates Pty. Ltd. (BL&A) to conduct a flora and fauna assessment, a bird utilisation survey (BUS) and bat surveys of a number of private properties as well as public road and rail reserves around the township of Alberton West in South Gippsland, Victoria. A wind farm and associated infrastructure are proposed for this land.

The Proposed Alberton Wind Farm Layout Plan (Post-Optimised Layout 7 June 2017) may vary slightly from the layout plans included the initial report figures as adjustments to the design have been made to minimise environmental and cultural impacts. The findings and recommendations of the ecological reports in this document are still valid.

This document contains the following three ecological reports prepared by BL&A for the proposed Alberton Wind Farm.

Flora and Fauna Assessment - Report 14107(3.3)

The Flora and Fauna was finalised in August 2016 and was based on the layout current at that time. The investigation was commissioned to provide information on the extent and condition of native vegetation in the study areas according to Victoria's *Biodiversity assessment guidelines* (DEPI 2013b), as well as any potential impacts on flora and fauna matters listed under the state *Flora and Fauna Guarantee Act 1988* (FFG Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This report outlines any implications under relevant national, state and local legislation and planning policies that control development impacts on biodiversity.

Bird and Bat utilisation and migratory shorebird surveys – Report 14107(1.3)

This bird and bat surveys were commissioned to provide baseline data on the pre-construction utilisation of the wind farm site by birds and bats as a basis for the development of any mitigation measures that may be necessary. As it was finalised at the same of the initial Flora and Fauna assessment it is based on the same layout of the wind farm given at that time.

The bird utilisation survey (BUS) scope was consistent with the requirements for a "Level One" bird risk assessment in accordance with 'Wind Farms and Birds - Interim Standards for Risk Assessment' issued by the then Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2013).

Bat surveys were undertaken in accordance with Clean Energy Councils' Best Practice Guidelines (2013) using bat detection systems to record the echolocation calls of bats. Records were made from five sites during February and March 2015. The sites included monitoring with two recorders at a wind mast with one microphone at 50 metres, and another at ground level (1-2 metres) at the same location. The survey sites represented the various habitat types within the wind farm with a focus on the possible presence of threatened species of bats.

A migratory shorebird survey was undertaken in February 2015 along the coast of the Corner Inlet and Nouramunga Marine and Wildlife Reserves, whose main coastlines lie approximately three kilometres south of the proposed wind farm site. The detailed methodology and results of this survey are included in BL&A Report 14107 (1.3).

Matters of National Environmental Significance (MNES) – Report 14107(7.2)

In July 2017, BL&A prepared an additional report addressing a request for further information for the Department of the Environment, and Energy regarding Matters of National Environmental Significance (MNES). This report has been prepared to supplement the flora and fauna report prepared by BL&A (2016) on the Alberton Wind Farm project. It aims to address specific concerns about the impacts of the project on matters of national environmental significance (MNES) protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). This is required as the Commonwealth Minister for the Environment has made the project a 'controlled action' under this Act.

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1. EXECUTIVE SUMMARY

Brett Lane and Associates Pty Ltd undertook a flora and fauna assessment of a number of private properties as well as public road and rail reserves around the township of Alberton West in South Gippsland, Victoria. A wind farm and associated infrastructure are proposed for this land.

The study area supported mostly extensive areas of cleared pasture with small, fenced patches of native scrub. Large, extensive remnant forests, woodlands, heathlands, sedgelands and scrubs abutted some edges of the study areas and also occurred across a number of road and rail reserves. The Albert River crossed the study area.

Much of the study area was being used for dairy farming. As such, most of its remnant native vegetation and original fauna habitats had been removed through historical clearing for agricultural development. In this respect, the biodiversity value of the site is no different from most cleared agricultural landscapes in south eastern Australia.

Six fauna habitat types were identified:

- Eucalypt Forest;
- Agricultural pastures/Grazing paddocks;
- Rows of native and introduced trees;
- Heathy woodland;
- Saltmarsh and mangroves; and
- Aquatic habitats (drainage lines, creeks, rivers).

Native vegetation was categorised during the overview assessment into 62 Vegetation Sites (each comprising one or more areas of a distinct vegetation type or grouping), and as 116 habitat zones and 40 scattered trees (within areas impacted by past or current development layouts). A total of 20 Ecological Vegetation Classes were determined to occur or potentially occur on site.

Two listed threatened ecological communities were considered to potentially occur in the study area: Natural Damp Grassland of the Victorian Coastal Plains (within the proposed development footprint) and Subtropical and Temperate Coastal Saltmarsh (outside the proposed development footprint). Targeted surveys have been undertaken in November 2016 to determine whether Natural Dam Grassland occurs within the proposed development footprint and it has not been found.

A total of 267 flora species (mostly indigenous) and 120 fauna species (mostly indigenous) were recorded during the current investigations. Seven EPBC and FFG Act listed flora species and 27 listed fauna species (state and Commonwealth, including migratory species) were considered to potentially occur. Of these, all flora species and three fauna species were considered to be susceptible to proposed impacts. These species are listed below:

Flora

- Clover Glycine
- Eastern Spider-orchid
- Maroon Leek-orchid
- Metallic Sun-orchid

- River Swamp Wallaby-grass
- Strzelecki Gum
- Thick-lip Spider-orchid

Targeted surveys for the above listed flora species have been undertaken in November 2016 and none of these species have been found within the proposed impact areas (see BL&A 2016b).

Fauna

- Powerful Owl

The Powerful Owl may utilise some wooded areas of the study area and move occasionally into the southern forest at Hedley, where there are large hollow-bearing trees. The primary risk to this species is during nocturnal dispersive and foraging movements when they may potentially fly at RSA heights. Movements by the Powerful Owl are generally confined within forests habitats, which would therefore not involve any part of the proposed wind farm. Juvenile Owl dispersal from a breeding territory may result in a one-off flight across a gap between forest patches, such as north and south of the South Gippsland Highway between large nearby forest blocks, such as Alberton and Hedley. As no turbines are proposed between treed habitats at Hedley and the Alberton West State Forest at the narrowed gap between them, the likelihood of Powerful Owl being affected by nearby wind turbines is considered very low.

- Fork-tailed Swift
- White-throated Needletail

Both of these species could be susceptible to collisions with turbines and other structures as the species fly mostly at and above RSA height and it is likely the occasional individual will be affected by the proposed project. The population of these species numbers 10,000 or more and the loss of the occasional individual is expected to have negligible consequences for these species' populations.

A total of ***1.195 hectares*** of remnant patch native vegetation and ***sixteen scattered trees*** are ***proposed to be removed*** from the study area with a Strategic Biodiversity Score of 0.358.

Proposed vegetation removal would result in an estimated ***offset requirement of 0.386 General Biodiversity Equivalence Units (BEUs)*** with a minimum Strategic Biodiversity Score of 0.286. Offsets would need to be achieved within the West Gippsland CMA or Wellington Shire Council and would need to be secured prior to the removal of native vegetation.

A permit is required under Environmental Significance Overlay and Schedules 1 and 2 to that overlay within the Wellington Planning Scheme to remove, destroy or lop any vegetation, including dead vegetation. A planning permit under Clause 52.17 of the Wellington Planning Scheme is also required for the removal of native vegetation. The current proposal will be assessed under the high-risk assessment pathway and will be referred to the state Department of Environment land water and Planning (DELWP).

A Referral under the EPBC Act has been submitted in December 2016..

A Protected Flora Permit would be required from DELWP to remove the plant taxa comprising a listed threatened community, listed threatened flora species or otherwise protected values from public land.

A Referral to the state Minister for Planning is not required under the EE Act as the effects of the project on the environment are below the biodiversity impact criteria of the Ministerial Guidelines on Referral under this Act.

2. INTRODUCTION

Synergy Wind Pty Ltd engaged Brett Lane & Associates Pty. Ltd. (BL&A) to conduct a flora and fauna assessment of a number of private properties as well as public road and rail reserves around the township of Alberton West in South Gippsland, Victoria. The specific area investigated included the private properties listed in Appendix 1. A wind farm and associated infrastructure are proposed for this land (see Figure 1).

This investigation was commissioned to provide information on the extent and condition of native vegetation in the study areas according to Victoria's *Biodiversity assessment guidelines* (DEPI 2013b), as well as any potential impacts on flora and fauna matters listed under the state *Flora and Fauna Guarantee Act 1988* (FFG Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This report outlines any implications under relevant national, state and local legislation and planning policies that control development impacts on biodiversity.

This investigation was divided into two stages: an initial overview assessment of the broader wind farm site (referred to herein as the 'broader study area') followed by a detailed assessment of various proposed development footprints (referred to herein as the 'detailed study area').

The scopes of the two assessments are listed below.

1) Vegetation overview assessment of the broader wind farm site

- An initial site survey involved characterisation and moderate-scale mapping of remnant native vegetation across the broader wind farm site in order to identify potential constraints for wind farm design.
- Discussions were held with the proponent to provide advice on micrositing options for an initial layout option, based on the findings of the overview assessment to minimise impacts on native vegetation and other biodiversity.

2) Flora and fauna assessment of the proposed development footprint

Once a preferred wind farm layout had been developed, the development footprint was assessed in detail for its flora and fauna. This investigation included:

- A review of existing information on the flora, fauna and native vegetation of the area, including:
    - Victorian Biodiversity Atlas administered by the Department of Environment, Land, Water and Planning (DELWP);
    - The Commonwealth EPBC Act Protected Matters Search Tool; and
    - DELWP Native Vegetation Information Management system (using the EnSym Tool).
- A detailed flora and fauna field assessment of the development footprint, involving:
    - Detailed mapping and habitat hectare assessment of remnant native vegetation affected by the development footprint;
    - Compilation of flora and fauna species lists for the footprint and its surrounds;
    - Assessment of the nature and quality of native fauna habitat; and
    - Assessment of the likelihood of occurrence on and adjacent to the development footprint of EPBC Act and the FFG Act listed flora and fauna.

A number of layout iterations were surveyed.

Note that off-site native vegetation impacts of road upgrades for heavy vehicles and the external power grid connector were not included in the current scope of work.

This report is divided into the sections described below.

Section 3 provides legislative background, including details of all relevant Commonwealth, state and local legislation and planning policies and provisions.

Section 4 describes the sources of information, including the methods used for the field survey.

Section 5 presents the assessment results, including details of the native vegetation, flora and fauna of the study areas.

Section 6 discusses the proposed impacts of the project and details the implications of the findings under the relevant legislation and policies.

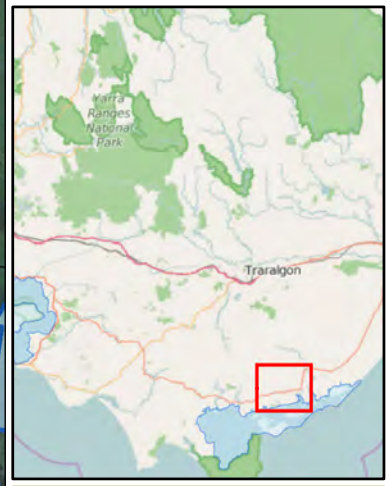
This investigation was undertaken by a team from BL&A, comprising Davide Coppolino (Senior Ecologist), Jeremy Ward (Senior Zoologist), Inga Kulik (Senior Ecologist & Project Manager) and Brett Lane (Principal Consultant).

Figure 1: Overview map

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Turbines
- Development footprint
- Ramsar site



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3. LEGISLATIVE BACKGROUND

This section of the report reviews the legislation and planning provisions that relate to biodiversity considered relevant to the control of the proposed development's impacts on biodiversity. The implications of these controls for the project are addressed in Section 6 of this report.

3.1. Local laws and regulations

Section 111, Part 5 of the *Local Government Act 1989* gives authority to local governments to make local laws for or with respect to any act, matter or thing that it has jurisdiction over under any Act.

There are no local laws relevant to biodiversity that relate to the current proposal.

3.2. Planning and Environment Act 1987

The Victorian *Planning and Environment Act 1987* (P&E Act) establishes a framework for planning the use, development and protection (or conservation) of land in Victoria.

Section 4A (1-2) of the Act allows the Minister for Planning to prepare and approve standard planning provisions (i.e. Victorian Planning Provisions, or VPPs). VPPs are implemented through Victoria's planning schemes which are constituted and approved under the Act.

VPPs within each planning scheme are divided into State Planning Provisions, which apply across Victoria; and Local Planning Provisions, which apply specifically to the applicable local planning scheme in the relevant municipality.

This section discusses planning provisions in the Welshpool planning scheme applicable to flora, fauna and native vegetation.

3.2.1. Land designation

Zoning of land within the broader study area is detailed in Appendix 1. Zones in the broader study area comprise the following:

- Farming Zone
- Road Zone – Category 1
- Road Zone – Category 2
- Public Conservation and Resource Zone
- Industrial 1 Zone

The entire study area is located within a Bushfire-prone Area.

3.2.2. Local provisions

Local Planning Policy Framework

There are no local planning policies relevant to the current investigation.

Overlays

The study area is subject to the overlays outlined below that are relevant to this assessment. The purposes of these overlays in the Wellington Planning Scheme are also discussed below.

Environmental Significance Overlay – Schedule 1

Purpose: The purpose of ESO1 is to ensure the long-term protection and enhancement of the environmental quality, natural beauty and visual amenity of coastal and Gippsland Lakes environs.

Environmental Significance Overlay – Schedule 2

Purpose: The purpose of ESO1 is to protect and enhance the ecological, habitat, aesthetic, scientific, floristic, faunal, cultural, educational, and recreation values of wetlands.

Significant Landscapes Overlay – Schedule 3

Purpose: The purpose of ESO3 is to ensure that any use and development of the Gippsland Coalfields preserves opportunities for coal exploration and mining in the future.

An eight-year retention licence for coal exploration, covering much of the study area, was granted to Ignite Resources in 2015 (Licence RL2013).

3.2.3. State provisions

Under Clause 52.17 of all Victorian Planning Schemes a planning permit is required for the destruction, lopping or removal of native vegetation on land which has an area of 0.4 hectares or more (together with all contiguous land in single ownership). This includes the removal of dead trees with a DBH (diameter at breast height or 1.3 metres) of 40 centimetres or more and any individual scattered native plants.

On 20th December 2013 a planning scheme amendment was gazetted to implement a number of reforms to Victoria's native vegetation permitted clearing regulations, particularly Clauses 12.01 (Biodiversity), 52.16 (Native vegetation precinct plan) and 52.17 (Native vegetation). As part of these reforms the previously incorporated document *Victoria's Native Vegetation – a Framework for Action* was replaced by a new incorporated document, *Permitted clearing of native vegetation – Biodiversity assessment guidelines* (DEPI 2013b).

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 the following online tool and document:

- The Native Vegetation Information Management system (NVIM) (DEPI 2014b) — a database administered by DELWP; and
- *Permitted clearing of native vegetation – Biodiversity assessment guidelines* (DEPI 2013b).

These are discussed below.

Native Vegetation Information Management system (NVIM)

The online Native Vegetation Information Management system (NVIM) is an interactive mapping tool, which provides some of the information required to accompany a permit to remove native vegetation. It does not replace the application process.

The information provided by NVIM can include the following (described in more detail below):

- The *location risk* of the native vegetation;

- The *condition* of the native vegetation – used for the low-risk assessment pathway only;
- The *strategic biodiversity score* of the native vegetation proposed to be removed; and
- The *native vegetation offset* requirement – used for the low risk assessment pathway only.

Preliminary proposals are analysed using DELWP's EnSym Tool, which uses the same data and processes as NVIM.

Biodiversity assessment guidelines

Guidelines objective

As set out in *Permitted clearing of native vegetation – Biodiversity assessment guidelines* ('the Guidelines') the objective for permitted clearing of native vegetation in Victoria is 'No net loss in the contribution made by native vegetation to Victoria's biodiversity'. The key strategies for ensuring this outcome when considering an application to remove native vegetation are:

- Avoiding the removal of native vegetation that makes a significant contribution to Victoria's biodiversity;
- Minimising impacts on Victoria's biodiversity from the removal of native vegetation; and
- Where native vegetation is permitted to be removed, ensuring it is offset in a manner that makes an equivalent contribution to Victoria's biodiversity made by the native vegetation to be removed.

Note: if native vegetation does not meet the definition of either a remnant patch or scattered trees, the Guidelines are not required to be applied.

Risk-based assessment pathways

The first step in determining the type of assessment required for any site in Victoria is to determine the risk to biodiversity associated with the proposed native vegetation removal and therefore the risk-based assessment pathway for the proposed native vegetation removal. There are three risk-based pathways for assessing an application to remove native vegetation, below.

- Low risk
- Moderate risk
- High risk

This risk-based assessment pathway is determined by two factors, outlined below.

Extent risk – the area in hectares proposed to be removed *or* the number of scattered trees. *Note:* extent risk also includes any native vegetation clearing for which permission has been granted in the last five years.

Location risk – the likelihood that removing native vegetation in a location will have an impact on the persistence of a rare or threatened species classified into three categories: Location A, Location B and Location C.

The risk-based pathway for assessing an application to remove native vegetation is determined by the following matrices for remnant patches and scattered trees:

Extent (remnant patches)	Location A	Location B	Location C
< 0.5 hectares	Low	Low	High
≥ 0.5 hectares and < 1 hectare	Low	Moderate	High
≥ 1 hectare	Moderate	High	High
Extent (scattered trees)	**Location A**	**Location B**	**Location C**
< 15 scattered trees	Low	Moderate	High
≥ 15 scattered trees	Moderate	High	High

Notes: All native vegetation within any subdivision plot of less than 0.4 hectares is deemed to be lost; For applications with combined removal of both remnant patch and scattered trees, the extent of the scattered trees is converted to an area by assigning a standard area of 0.071 hectares per tree – the total extent is then used to determine the risk-based pathway.

The presence of any Location B or Location C risk categories within an area of proposed native vegetation removal means this whole area of removal is considered to belong to that category for the purpose of determining the risk-based assessment pathway.

Strategic biodiversity score

The strategic biodiversity score generated by NVIM acts as a measure of the site's importance for Victoria's biodiversity relative to other locations across the landscape. It is calculated based on a weighted average of scores across an area of native vegetation proposed for removal on a site.

Habitat importance

Habitat importance mapping produced by DELWP is based on one or a combination of habitat importance models, habitat distribution models or site record data. It identifies the following:

- *Habitat importance for dispersed species* – based on habitat distribution models and assigned a habitat importance score ranging from 0 to 1; and
- *Highly localised habitats* – considered to be equally important for a particular species and assigned a habitat importance score of 1.

Habitat importance mapping is used to determine the type of offset required under the moderate and high risk assessment pathways.

Biodiversity equivalence

Biodiversity equivalence scores are used to quantify losses in the contribution to Victoria's biodiversity from removing native vegetation and gains in this contribution from a native vegetation offset.

There are two types of biodiversity equivalence scores depending on whether or not the site makes a contribution to the habitat of a Victorian rare or threatened species.

- A *general* biodiversity equivalence score is a measure of the contribution native vegetation on a site makes to Victoria's biodiversity overall and applies when no habitat importance scores are applicable according to the equation:

General biodiversity equivalence score =
habitat hectares x strategic biodiversity score

- A *specific* biodiversity equivalence score is a measure of the contribution that native vegetation on a site makes to the habitat of a particular rare or threatened species – calculated for each such species for which the site provides important habitat (using habitat importance scores provided by DELWP) according to the equation:

Specific biodiversity equivalence score =
habitat hectares x habitat importance score

Offset requirements

A native vegetation offset is required for the approved removal of native vegetation. Offsets conform to one of two types and each type incorporates a risk factor to address the risk of offset failing:

- A *general* offset applies if the removal of native vegetation impacts Victoria's overall biodiversity and has an offset risk factor of 1.5 applied according to the equation:

General risk-adjusted offset requirement =
general biodiversity equivalence score (clearing site) x 1.5

- A *specific* offset applies if the native vegetation makes a significant impact to habitat for a rare or threatened species determined by a *specific-general offset test*. It applies to each species impacted and has an offset risk factor of 2 applied according to the equation:

Specific risk-adjusted offset requirement =
specific biodiversity equivalence score (clearing site) x 2

Note: if native vegetation does not meet the definition of either a remnant patch or scattered trees an offset is not required.

DELWP referral criteria

Clause 66.02 of the planning scheme determines the role of DELWP in the assessment of native vegetation removal permit applications. If an application is referred, DELWP may make certain recommendations to the responsible authority in relation to the permit application. An application to remove native vegetation must be referred to DELWP in the following circumstances:

- Applications where the native vegetation to be removed is 0.5 hectares or more (this does not apply to removal of scattered trees only);
- All applications in the high risk-based pathway;
- Applications where a property vegetation plan applies to the site; and
- Applications on Crown land which is occupied or managed by the responsible authority.

Summary of the assessment process

The assessment process, decision guidelines and offset requirements for approved native vegetation removal are outlined in Table 1.

Table 1: Summary of the assessment process and offset requirements

Risk-based pathway	Assessment quantum inputs	Decision guidelines	Offset requirements
Low	▪ Habitat hectares* (NVIM) ▪ Strategic biodiversity score (NVIM) ▪ General biodiversity equivalence score	An application for removal cannot be refused on biodiversity grounds (unless it is not in accordance with any property vegetation plan that applies to the site). *Note: this guideline also applies to native vegetation that does not meet the definition of either a remnant patch or scattered trees.*	General offset applies: ▪ General offset = general biodiversity equivalence score (clearing site) x 1.5 ▪ Offset must be located in the same CMA^ or Local Government Area as the removal ▪ Offset must have a strategic biodiversity score at least 80% of the native vegetation removed ▪ Offset must be secured before the removal of native vegetation
Moderate	▪ Habitat hectares* (site assessment) ▪ Strategic biodiversity score (NVIM) ▪ Habitat importance scores for each Victorian rare and threatened species ▪ Specific biodiversity equivalence score for each rare and threatened species *OR* ▪ *General* biodiversity equivalence score if no habitat importance scores apply	The responsible authority will consider: ▪ The strategic biodiversity score and habitat importance score of the native vegetation proposed to be removed ▪ Any property vegetation plan that applies to the site ▪ Whether reasonable steps have been taken to ensure that impacts of the proposed removal of native vegetation on biodiversity have been minimised with regard to the contribution to biodiversity made by the native vegetation to be removed and the native vegetation to be retained ▪ Whether an offset has been identified that meets the requirements ▪ The need to remove native vegetation to create defendable space to reduce the risk of bushfire	If the specific biodiversity equivalence scores for any rare and threatened species fails the specific-general offset test, then a general offset applies (as above) Otherwise, a specific offset applies for <u>each</u> rare and threatened species: ▪ Specific offset = specific biodiversity equivalence score (clearing site) x 2 ▪ Offset must be located in the same species habitat anywhere in Victoria as determined by DELWP habitat importance mapping ▪ When a specific offset is required for multiple species, the offset site must satisfy the specific offset requirements for all of these species or multiple offset sites may be used ▪ Offset must be secured before the removal of native vegetation
High		In addition to the considerations for the moderate pathway (above) the responsible authority will determine whether the native vegetation to be removed makes a significant contribution to Victoria's biodiversity. This includes considering: ▪ Impacts on important habitat for rare or threatened species, particularly highly localised habitat ▪ Proportional impacts on remaining habitat for rare or threatened species ▪ If the removal of the native vegetation will contribute to a cumulative impact that is a significant threat to the persistence of a rare or threatened species ▪ The availability of, and potential for, gain from offsets	

*** Habitat hectares = condition score (out of 1) x extent (hectares)**

^ Catchment Management Authority

Note: All applications must provide information about the vegetation to be removed such as location and address of the property, description of the vegetation, maps and recent dated photographs.

3.3. EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* protects a number of threatened species and ecological communities that are considered to be of national conservation significance. Any significant impacts on these species require 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 (lasting between three and nine months, depending on the level of assessment).

3.4. FFG Act

The Victorian *Flora and Fauna Guarantee Act 1988* lists threatened and protected species and ecological communities (DEPI 2013a, DELWP 2015a). Any removal of threatened flora species or communities (or protected flora) listed under the FFG Act from public land requires a Protected Flora Permit under the Act, obtained from DELWP.

The FFG Act only applies to private land in relation to the commercial collection of grasstrees, tree-ferns and sphagnum moss.

3.5. EE Act

The "Ministerial Guidelines for Assessment of Environmental Effects under the *Environment Effects Act 1978"* (DSE 2006), identifies criteria which trigger a Referral to the State Minister for Planning. The criteria related to flora, fauna and native vegetation are outlined below.

<u>One or more</u> of the following would trigger a Referral:

- Potential clearing of 10 ha or more of native vegetation from an area that:
    - Is of an Ecological Vegetation Class identified as endangered by the Department of Sustainability and Environment (in accordance with Appendix 2 of Victoria's Native Vegetation Management Framework); or
    - Is, or is likely to be, of very high conservation significance (as defined in accordance with Appendix 3 of Victoria's Native Vegetation Management Framework); and
    - Is not authorised under an approved Forest Management Plan or Fire Protection Plan
- Potential long-term loss of a significant proportion (e.g. 1 to 5 percent depending on the conservation status of the species) of known remaining habitat or population of a threatened species within Victoria
- Potential long-term change to the ecological character of a wetland listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia'
- Potential extensive or major effects on the health or biodiversity of aquatic, estuarine or marine ecosystems, over the long term

Two or more of the following would also trigger a Referral:

- Potential clearing of 10 ha or more of native vegetation, unless authorised under an approved Forest Management Plan or Fire Protection Plan
- Matters listed under the Flora and Fauna Guarantee Act 1988:
    - Potential loss of a significant area of a listed ecological community; or
    - Potential loss of a genetically important population of an endangered or threatened species (listed or nominated for listing), including as a result of loss or fragmentation of habitats; or
    - Potential loss of critical habitat; or
    - Potential significant effects on habitat values of a wetland supporting migratory bird species.

3.6. CaLP Act

The *Catchment ad Land Protection Act 1994* (CaLP Act) requires that land owners (or a third party to whom responsibilities have been legally transferred) must take all reasonable steps on their land to:

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

4. SOURCES OF INFORMATION

4.1. Existing information

Existing information used for this investigation is described below.

4.1.1. Existing reporting and documentation

The reports, planning schemes and/or development plans below, relating to the study area were reviewed.

- Wellington Planning Scheme (DTPLI 2015)
- Proposed wind farm layouts received between 14th December 2015 and 11th May 2016.

4.1.2. Location and extent risk

The likely risk-based pathway for assessment of any proposed vegetation removal relies on the 'location risk' and 'extent risk' determined with the assistance of the online Native Vegetation Information Management system (NVIM) administered by the Department of Environment, Land, Water and Planning (DEPI 2014b).

NVIM online mapping was viewed to determine the mapped location risk of the study area and to gain a preliminary indication of the extent risk, described in Section 3.2.3.

4.1.3. Native vegetation

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

- Relevant EVC benchmarks for the Gippsland Plain bioregion[1] (DELWP 2015b); and
- Biodiversity Interactive Maps (DELWP 2015c).

4.1.4. Listed matters

Existing flora and fauna species records and information about the potential occurrence of listed matters was obtained from an area termed the 'search region', defined here as an area with a radius of ten kilometres from the approximate centre point of the study area (coordinates: latitude 38˚ 37' 22" S and longitude 146˚ 35' 42" E).

A list of the flora and fauna species recorded in the search region was obtained from the Victorian Biodiversity Atlas (VBA), a database administered by DELWP.

The 'Vegetation/ Modelled FFG Communities' layer in DELWP's Biodiversity Interactive Map (DELWP 2015c) was consulted to determine which ecological communities listed as threatened under the FFG Act were modelled to potentially occur in or near the broader study area.

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

The online *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (Department of the Environment 2015) was consulted to determine whether nationally listed species or communities potentially occurred in the search region based on habitat modelling.

4.2. Field methodology

An initial overview assessment was carried out from 23rd to 27th March 2015. During this assessment, the broader study area (comprising most of the properties participating in the wind farm project) was inspected from a vehicle. This overview assessment was supplemented by a later overview assessment on 6th June 2016 and a detailed habitat hectare assessment between the 21st and 23rd September 2016, a targeted flora survey for EPBC Act listed species between the 2nd and 4th November 2016. The second,third and fourth assessment focused on parts of additional properties within which over-head transmission lines were proposed.

During the overview assessments, each distinct site found to support native vegetation (in the form of patches and/or scattered trees – see Section 4.2.1) was mapped at a course-scale using aerial photograph interpretation. The following information was recorded for each site:

- Ecological Vegetation Classes identified or likely to occur;
- General weediness;
- Indication of indigenous flora diversity;
- Basic notes of vegetation such as dominant species; and
- General quality of vegetation.

During the targeted surveys the following listed values were assessed.

- Natural Damp Grassland of the Victorian Coastal Plains
- Clover Glycine
- Eastern Spider-orchid
- Maroon Leek-orchid
- Metallic Sun-orchid
- River Swamp Wallaby-grass
- Strzelecki Gum and
- Thick-lip Spider-orchid

The subsequent flora and fauna assessments were conducted from 7th to 11th December 2015,from 7th to 10th June 2016 as well as 2nd to 4th November 2016 (flora survey only, during the latter two). During the fauna assessments, the wind farm site was surveyed by sampling the various distinct landscapes and habitat types recorded during the overview assessment. These areas were initially surveyed from a vehicle and areas supporting notable fauna habitat were inspected in more detail on foot.

Native vegetation sites intersecting with, or in close proximity to development footprint options were mapped and assessed in detail. Mapping was undertaken through a combination of aerial photograph interpretation and ground-truthing using a hand held GPS (accurate to approximately five metres). Species and ecological communities listed

as threatened under the EPBC Act or FFG Act (where the latter occurred on public land) were also mapped using the same method, then later assessed in detail during the relevant flowering periods (November 2016). Vegetation was initially assessed as outlined in Section 4.2.1 below, then in a more targeted manner in the latter survey.

4.2.1. Native vegetation assessment

Native vegetation is currently defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. The *Biodiversity assessment guidelines* apply to native vegetation belonging to two categories (DEPI 2013b):

- Remnant patch; or
- Scattered trees.

The definitions of these categories are provided below, along with the prescribed DELWP methods to assess them.

Remnant patch

A remnant patch of native vegetation is either:

- An area of native vegetation where at least 25 per cent of the total perennial understorey plant cover is native; and/or
- Any area with three or more native canopy trees[2] where the canopy foliage cover[3] is at least 20 per cent of the area.

Remnant patch condition is assessed using the habitat hectare method (Parkes *et al*. 2003; DSE 2004) whereby components of native vegetation (e.g. tree canopy, understorey and ground cover) are assessed against an EVC benchmark. The score effectively measures the percentage resemblance of the vegetation to its original condition.

The NVIM system (DEPI 2014b) provides modelled condition scores for native vegetation to be used in certain circumstances (Section 3.2.3). All wetlands mapped on DELWP's native vegetation layer are treated as a remnant patch.

The condition score assists in defining the biodiversity equivalence score (described in Section 3.2.3) of the native vegetation and the offset targets if removal of native vegetation is approved.

Scattered trees

The *Biodiversity assessment guidelines* define scattered trees as a native canopy tree[2] that does not form part of a remnant patch of native vegetation.

Scattered trees are counted, the species identified and their DBH (diameter at breast height or 1.3 metres above ground) measured or estimated.

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[2] A canopy tree is a reproductively mature tree that is greater than 3 metres in height and is normally found in the upper layer of the relevant vegetation type.
[3] Foliage cover is the proportion of the ground that is shaded by vegetation foliage when lit from directly above.

4.2.2. Flora species and habitats

Records of flora species were made in conjunction with sampling methods used to undertake habitat hectare assessments of native vegetation, described above. Specimens requiring identification using laboratory techniques were collected.

Species protected under the FFG Act were determined by crosschecking against the FFG Act Protected Flora List (DEPI 2013a).

The potential for habitats to support listed flora species was assessed based on the criteria outlined below:

- The presence of suitable habitat for flora species such as soil type, floristic associations and landscape context; and
- The level of disturbance of suitable habitats by anthropogenic disturbances and invasions by pest plants and animals.

Wherever appropriate, a precautionary approach was adopted in determining the likelihood of occurrence or flora listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and Victorian *Flora and Fauna Guarantee Act 1988*. That is, where insufficient evidence was available on the potential occurrence of a listed species, it is assumed that it could be in an area of suitable habitat.

4.2.3. Fauna species and habitats

The techniques below were used to detect fauna species utilising the study area:

- Incidental searches for mammal scats, tracks and signs (e.g. diggings, signs of feeding and nests/burrows);
- Turning over logs/rocks and other ground debris for reptiles, frogs and mammals;
- Bird observation during the day in addition to transect surveys in relevant habitats in association with the proposed wind farm;
- General searches for reptiles and frogs; including identification of frog calls in seasonally wet areas; and
- General searches for bat habitat including waterbodies, potential commuting corridors, foraging sites and potential roosting sites such as caves, trees with hollows and lifted bark for crevice dwelling species.

The broader study area's habitat connectivity (i.e. degree of isolation/fragmentation), including linkages to other habitats in the region, was determined using field observations, recent aerial photography and DELWP's Biodiversity Interactive Maps (DELWP 2015c).

In addition to the fauna assessment in this report, detailed avifauna and bat investigations have been undertaken in the broader study area and its environs, in particular:

- Bird Utilisation Studies;
- Bat Utilisation Studies; and
- Migratory and resident shorebird surveys of the intertidal and shallow marine habitats in the nearby parts of the Nooramunga Marine and Coastal Parks.

These studies were undertaken in 2014 and have been reported in a separate document (BL&A 2015).

Wherever appropriate, a precautionary approach was adopted in determining the likelihood of occurrence or fauna listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and Victorian *Flora and Fauna Guarantee Act 1988*. That is, where insufficient evidence was available on the potential occurrence of a listed species, it is assumed that it could be in an area of suitable habitat.

4.2.4. Threatened ecological communities

During the overview assessment, the likelihood of listed threatened ecological communities occurring in the study area was determined. This involved checking areas of native vegetation within the proposed development footprint and assessing them in more detail against published descriptions of relevant listed ecological communities modelled to potentially occur in the study area.

Reviewed ecological community descriptions comprised identification criteria and condition thresholds from listing advice for EPBC Act communities as well as FFG Act listed community descriptions (SAC 2015).

4.3. Limitations of field assessment

The short duration of field assessments can result in a failure to record all species and life-forms because of the seasonal absence of some species. However, this limitation was not considered to undermine the current investigation, which was designed to provide an indicative, rather than exhaustive inventory of flora and fauna species in the study area.

The site assessments were carried out in early autumn (overview assessment), early summer (detailed flora and fauna assessment),early spring (habitat hectare assessment of powerline layout) and spring (targeted EPBC Act species surveys).

Some paddocks had been heavily grazed during the assessments, leaving little vegetation available to determine the presence, extent and/or composition of native vegetation. The timing of the survey and condition of vegetation was otherwise considered suitable to ascertain the extent and condition of native vegetation and fauna habitats.

Identification of EVCs considers vegetation types which would have naturally occupied the landscape prior to European impacts. Significant past alteration of parts of the study area's land form, hydrology and soil composition as well as past vegetation clearance has resulted in the emergence of an artificial site ecology and the reestablishment of vegetation that is likely to be notably different to what would have naturally occupied the study area. Identification of EVCs in altered areas was therefore based upon consideration of:

- Modelled EVC mapping (DELWP 2015c);
- Observations of adjacent landforms that had not been significantly altered;
- Observations of nearby natural vegetation remnants;
- Any observed indigenous flora species that are useful for determining EVCs; and
- Relevant published EVC benchmark descriptions.

EVC identification was based upon the structure and floristic composition of current observed vegetation if the above information was not sufficient to allow for a reasonable conclusion to be made on which EVC would have naturally occurred and the observed vegetation resembled an EVC, which is likely to have naturally occurred in the region.

No information was available on whether planted vegetation had been planted and maintained with public or private funding. Therefore, for the purposes of the current investigation, vegetation planted on private land was assumed to have been planted and maintained with private funding while that on public land was assumed to have been planted and maintained with public funding.

A small patch of vegetation on the banks of the Jack River was not able to be adequately assessed due to site access constraints. However this is not expected to be affected by the development due to the fact it is so close to the river and construction guidelines state that no infrastructure is to be erected that close to river/creek-lines.

4.4. Determination of impact extent

The detailed study area (comprising the proposed disturbance footprint described in Section 6.1) and mapped biodiversity values were overlaid using GIS to determine the extent of proposed impacts on biodiversity values in the study area. DELWP guidelines to determine whether a scattered tree or canopy tree in a remnant patch is lost or retained when it occurs near proposed development works (Appendix 6) were applied to determine impacts to scattered/canopy trees.

GIS shapefiles of the native vegetation (including location, extent, EVC number and habitat hectare score) that would be impacted by the proposed project were analysed using DELWP's EnSym Tool. The EnSym report is attached as Appendix 9.

5. ASSESSMENT RESULTS

5.1. Site description

The broader study area (Figure 1) was approximately 3200 hectares of private land and public infrastructure reserves in South Gippsland within the townships of Alberton, Alberton West, Devon North, Gelliondale, Hedley and Yarram.

The study area comprised four distinct landscapes, described below.

The central north-western part of the broader study area comprised lower slopes of the foothills of the Strzelecki Ranges. Much of this land had been cleared. However, some notable blocks of remnant Yellow Stringybark forest had been retained within areas abutting the more extensive forests of the Strzelecki Ranges.

The southern part of the broader study area supported a gently undulating coast barrier dune complex with light-loamy to sandy soils. This area would have once supported a complex of heathy vegetation types with Sedgy Wetland and Swamp Scrub in larger wet depressions and along drainage lines. Almost all this area (except for mainly roadside vegetation and scattered paddock trees) had been cleared of native vegetation and was being used for stock grazing. Adjacent state forests (to the south) supported extensive expanses of Heathy Woodland, Swamp Scrub, Sedge Swamp and Damp Heathland.

Land between the coastal dune complex and higher, hilly country further inland comprised relatively flat swampy ground with loamy to clayey soils. This land would have once supported Swamp Scrub and grassland vegetation but had been extensively cleared, drained and converted to intensively managed dairy farms. Groundwater had also been significantly drained. Much of the extant woody vegetation in this area comprised planted shelterbelts of non-indigenous trees.

The Albert River was the largest watercourse crossing the broader study area. Its reaches in the northern sections meandered through the landscape and held shallow to moderately deep, flowing fresh water. Although the river banks and channel were vegetated (with a mixture of indigenous reeds, rushes, herbs, climbers, trees and shrubs as well as introduced vegetation), surrounding land was mostly cleared dairy farms. Closer to the mouth of the river, water became brackish, shallower and slower-flowing. These areas, including a number of tributaries (possibly spring-fed) supported mostly degraded brackish wetland vegetation (e.g. Sea Rush and Australian Salt-grass). These areas were being used to graze dairy cattle. The tidal reaches of the river were wider and were lined with Mangrove Shrubland, with Saltmarsh and associated vegetation types further from the river.

The Jack River was another significant, meandering permanent waterway that crossed the north-eastern part of the broader study area. This river ran almost parallel to the Albert River, within a kilometre or so of the latter, and joined with the Albert River at a number of locations. A number of wet and dry ox-bows occurred between and along the two rivers. Stony Creek, which had been channelized for part of its length, was a notable tributary to the Jack River. This creek dissected the far north-eastern corner of the broader study area.

In addition to the aforementioned waterways, the broader study area had many small to large farm dams, divided by numerous minor to prominent man-made drainage channels. Many of these water bodies were inundated during the current investigations

and supported a mixture of indigenous and introduced aquatic and wetland vegetation (e.g. reeds, rushes, herbs and shrubs).

The following DELWP BioSites occurred within the broader study area:

- Albert River (Site No. 1903) – national significance;
- Gelliondale Railway (Site No. 1955) – regional significance; and
- Hedley (Site No. 1914) – regional significance.

The rivers and creeks crossing the broader study area, particularly the Albert and Jack Rivers, provided important aquatic and terrestrial habitat linkages and migratory routes for aquatic fauna through cleared farmland from the Strzelecki Ranges (in the north-west) to Corner Inlet (in the south-east). The disused Gelliondale Railway which crosses the broader study area provided the only narrow, densely vegetated east to west wildlife corridor through the otherwise cleared landscape.

The key habitat areas listed below occurred within the region.

- Alberton West State Forest

  This area comprised an extensive forest remnant on the foothills of the Strzelecki Ranges, immediately north-west and contiguous with remnant forest blocks in the central north-western part of the broader study area.

- Strzelecki Ranges

  The main expanse of remaining remnant native forest covering the Strzelecki Ranges occurred less than 10 kilometres to the north-west. This habitat was somewhat linked to the broader study area via a patchwork of cleared farmland and small to large patches of remnant native forest.

- Unnamed State Forest

  This area supported extensive heathy woodlands and other near-coastal vegetation types. It extended southwards from the southern edge of the broader study area.

- Nooramunga Marine and Coastal Parks

  This area supported extensive coastal banksia woodlands, saltmarshes and other coastal vegetation types, as well as areas of intertidal sand and mud flats and shallow marine waters. It extended southwards from the southern edge of the abovementioned unnamed state forest, to Corner Inlet. Nooramunga Marine Coastal Park occurs approximately 3.5 kilometres south of the broader study area.

- Corner Inlet (Ramsar and listed Important Wetland)

  This area extended westward from the southern end of Nooramunga Marine Coastal Park. Corner Inlet lies approximately seven kilometres southwest of the broader study area.

- Wilsons Promontory National Park

  This area extended southward from Corner Inlet, approximately 15 kilometres south-west of the study area.

The study area lies within the Gippsland Plain bioregion and falls within the West Gippsland catchment.

Figure 2-20: Study areas and native vegetation – overview and detailed

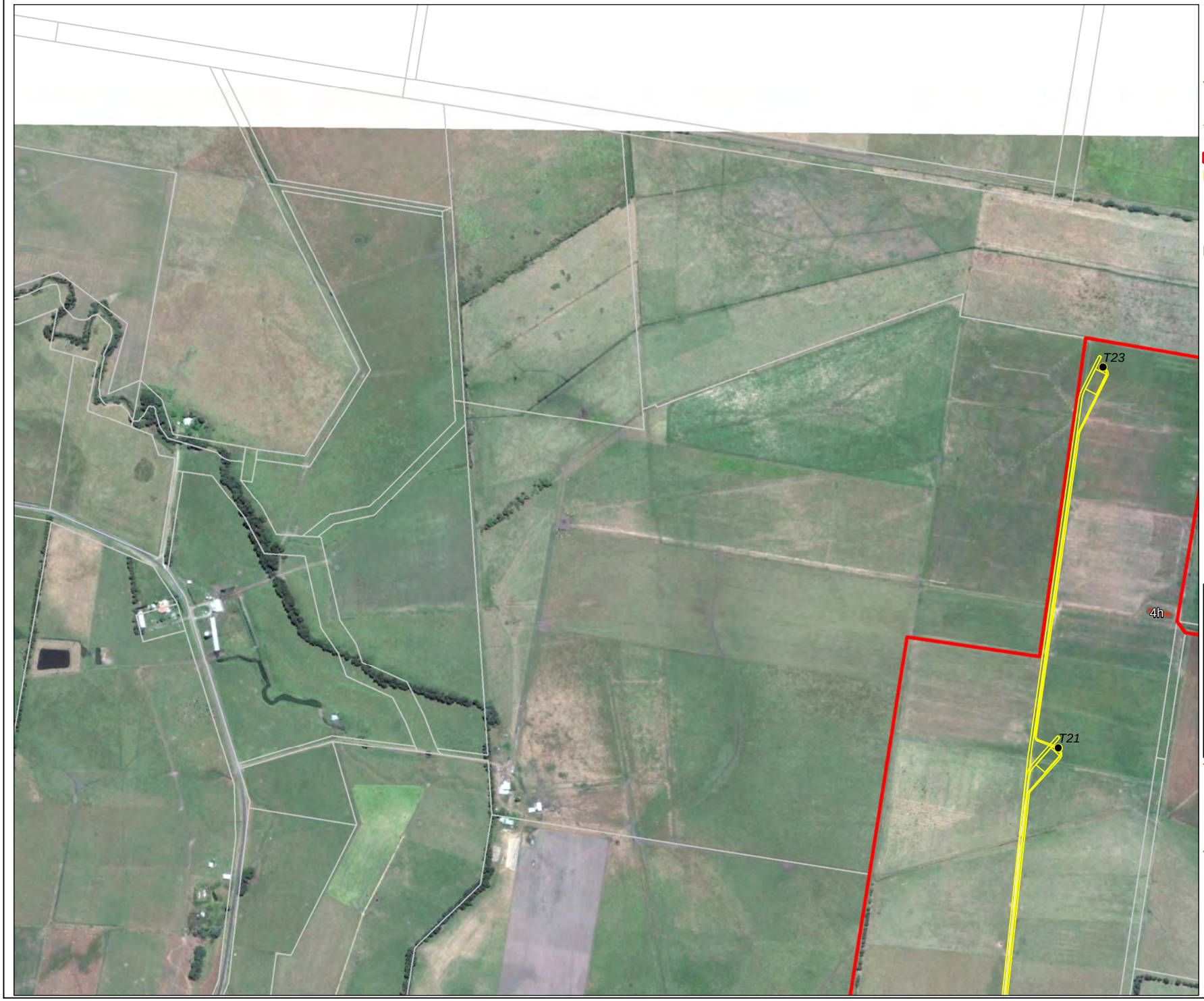


Figure 2: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

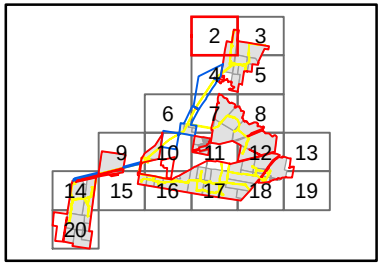
Legend

Study area
Development footprint

Overview assessment

General quality

Very low (1)



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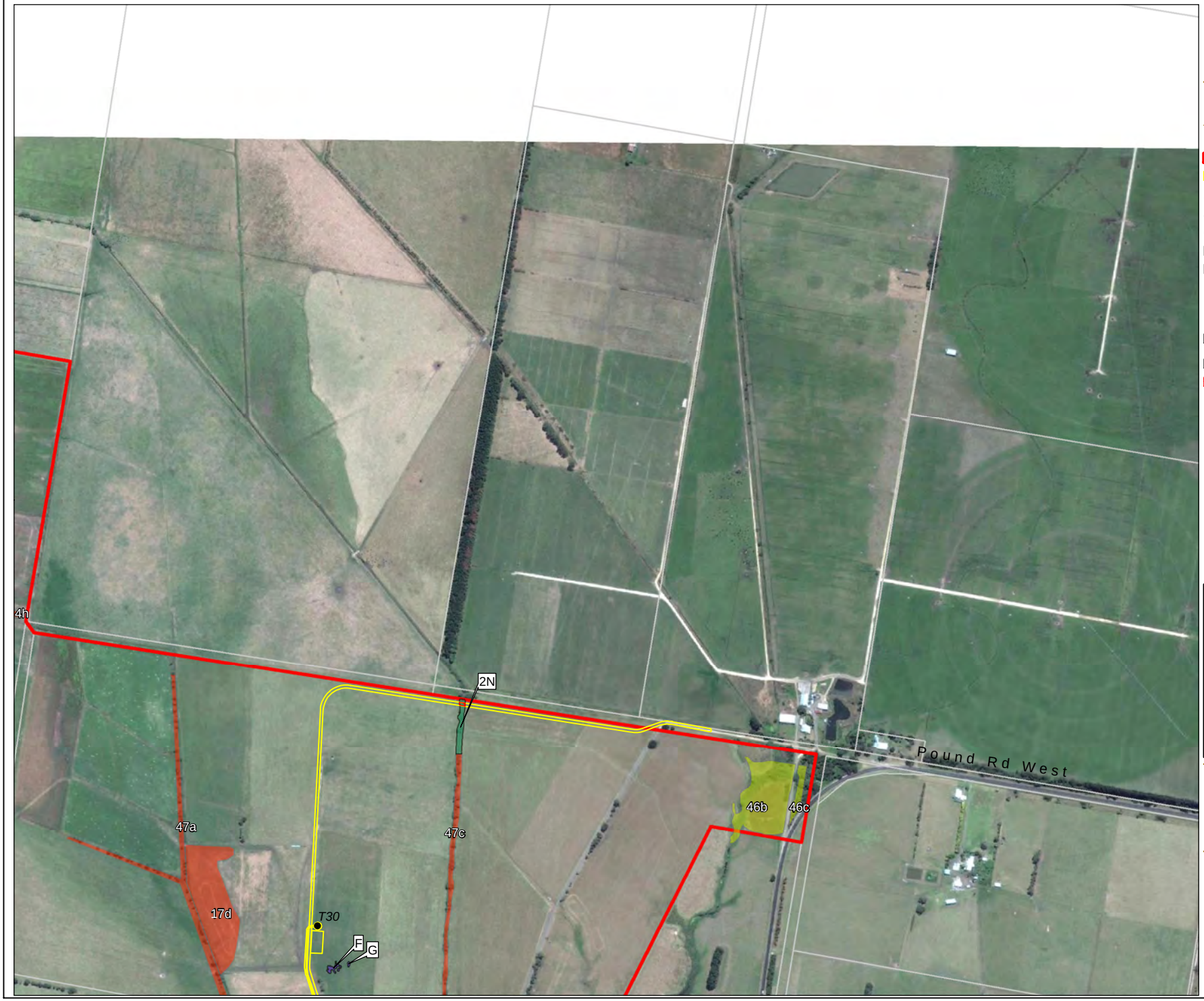


Figure 3: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

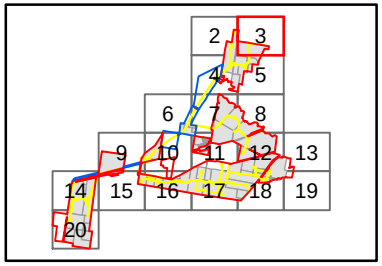
General quality

- Moderate (2)
- Very low (4)

Detailed native vegetation survey

EVCs

- South Gippsland Plains Grassland (EVC 132_62) (2)
- Tall Marsh (EVC 821) (1)
- Native vegetation to be removed (1)



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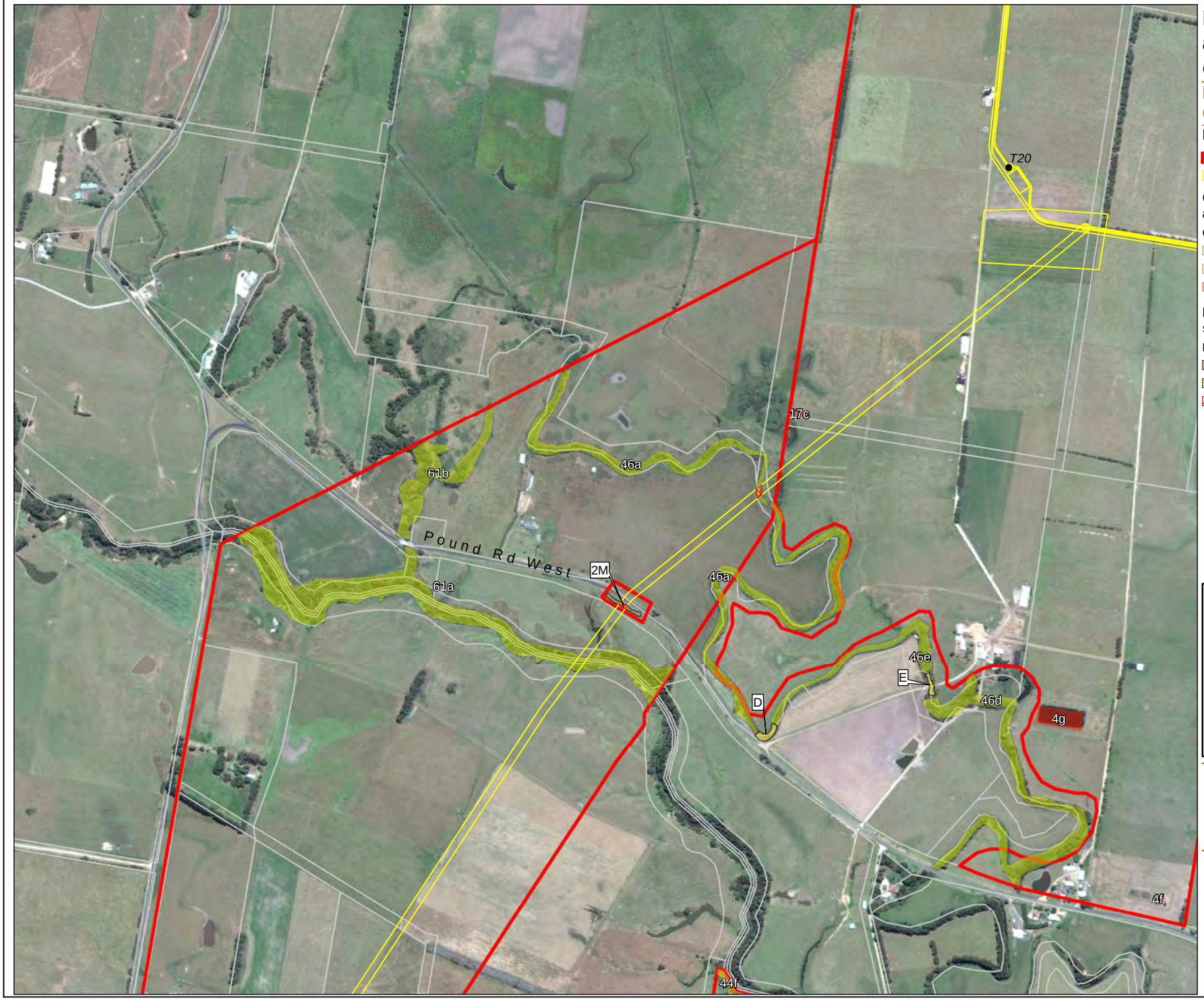


Figure 4: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

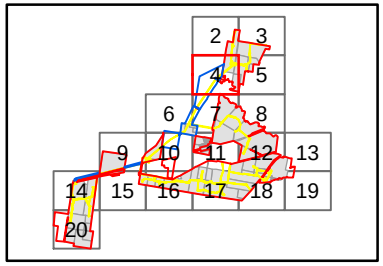
General quality

- Moderate (6)
- Low-Moderate (1)
- Very low (3)

Detailed native vegetation survey

EVCs

- Swamp Scrub (EVC 53) (1)
- Floodplain Reedbed (EVC 863) (2)
- Native vegetation to be removed (2)



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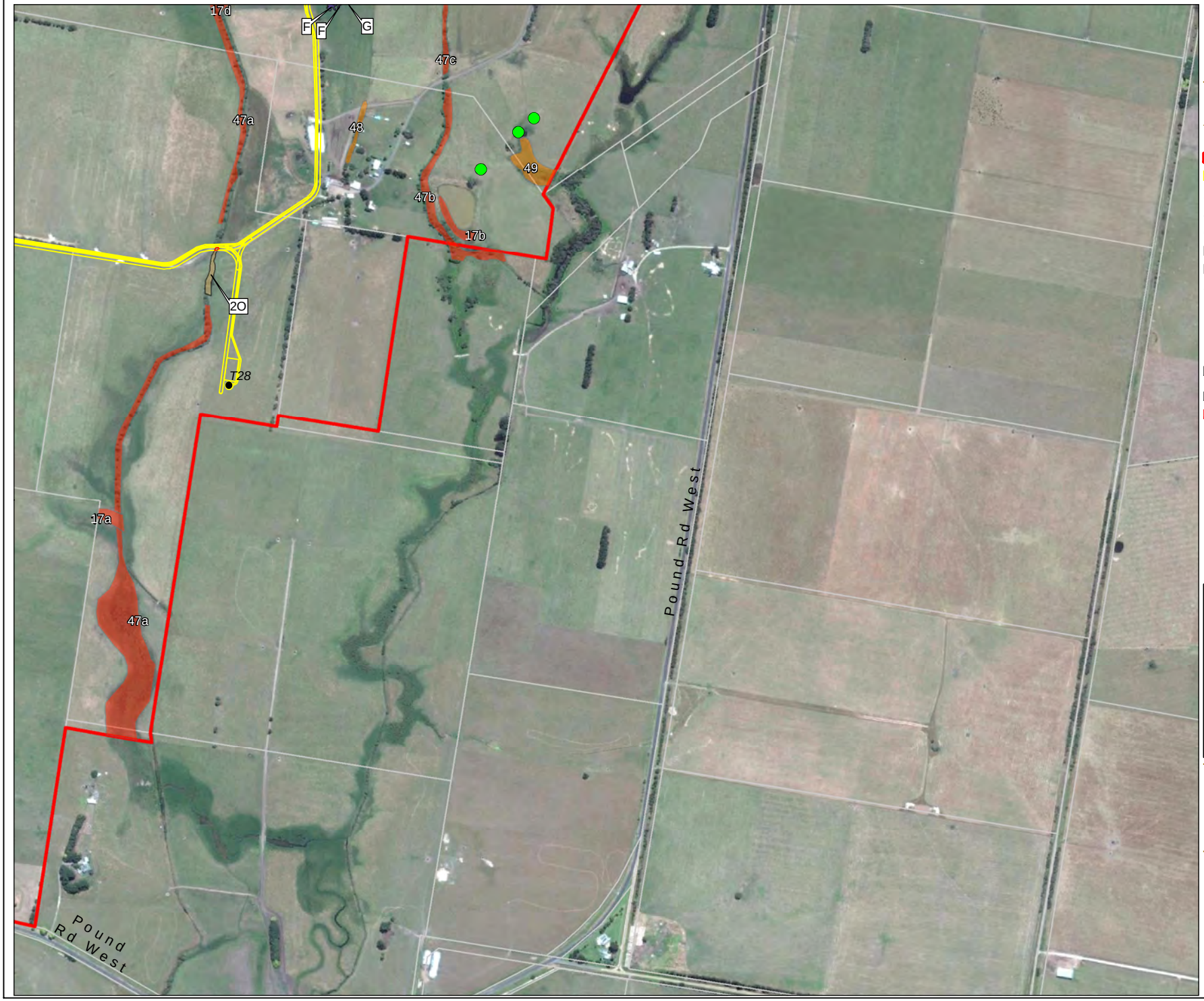


Figure 5: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- Low (2)
- Very low (7)

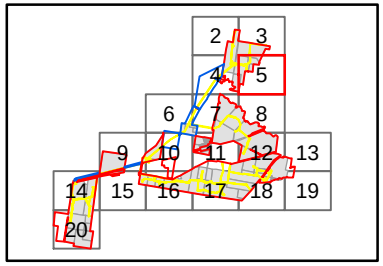
Scattered trees

- Confirmed scattered tree

Detailed native vegetation survey

EVCs

- South Gippsland Plains Grassland (EVC 132_62) (2)
- Swamp Scrub (EVC 53) (1)
- Native vegetation to be removed (1)



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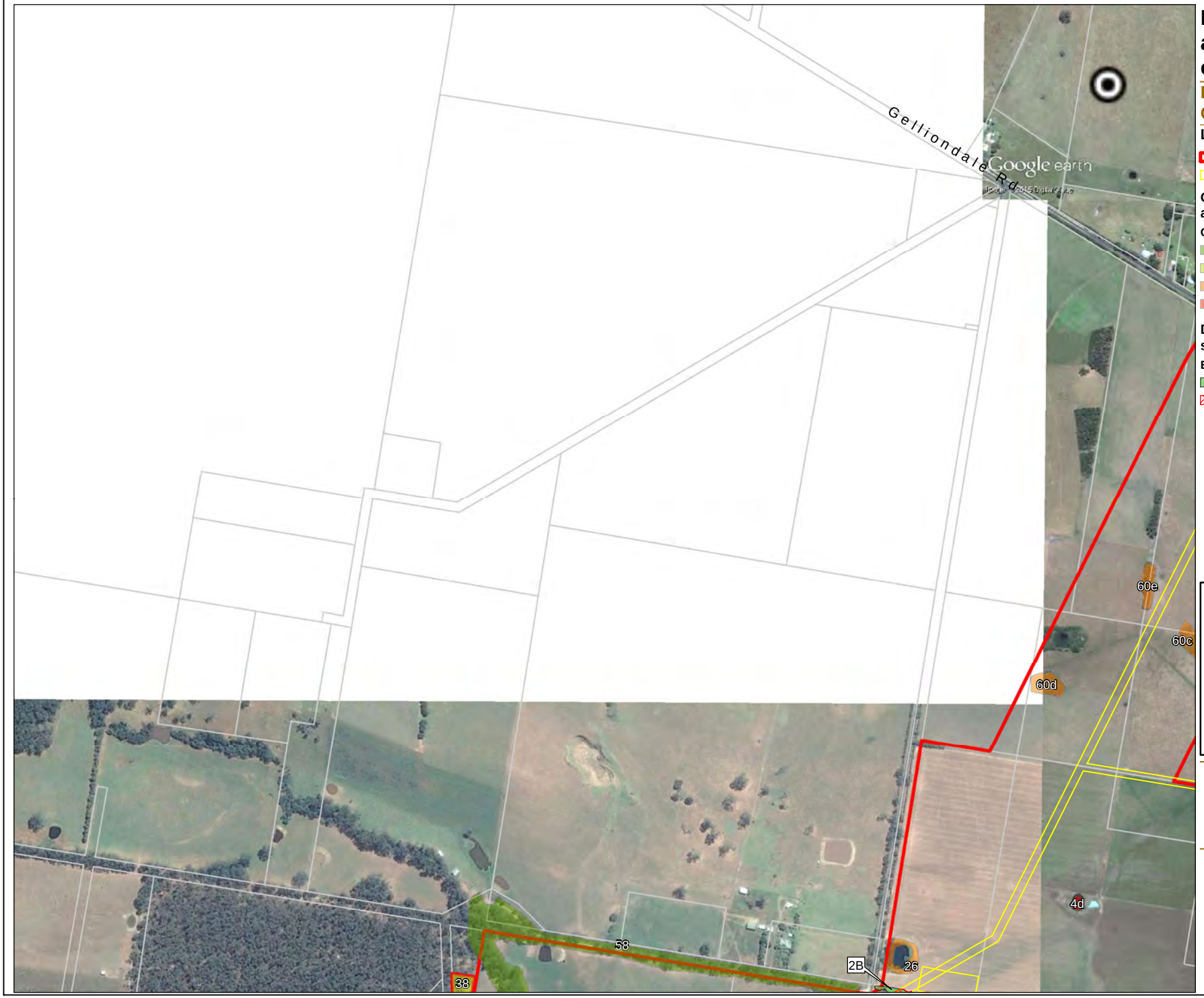


Figure 6: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

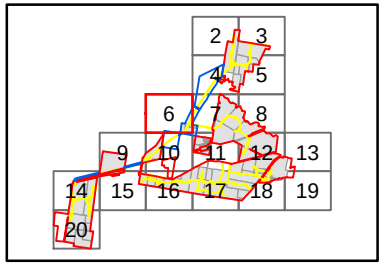
General quality

- Moderate-High (1)
- Moderate (1)
- Low (4)
- Very low (1)

Detailed native vegetation survey

EVCs

- Plains Grassy Forest (EVC 151) (1)
- Native vegetation to be removed (1)



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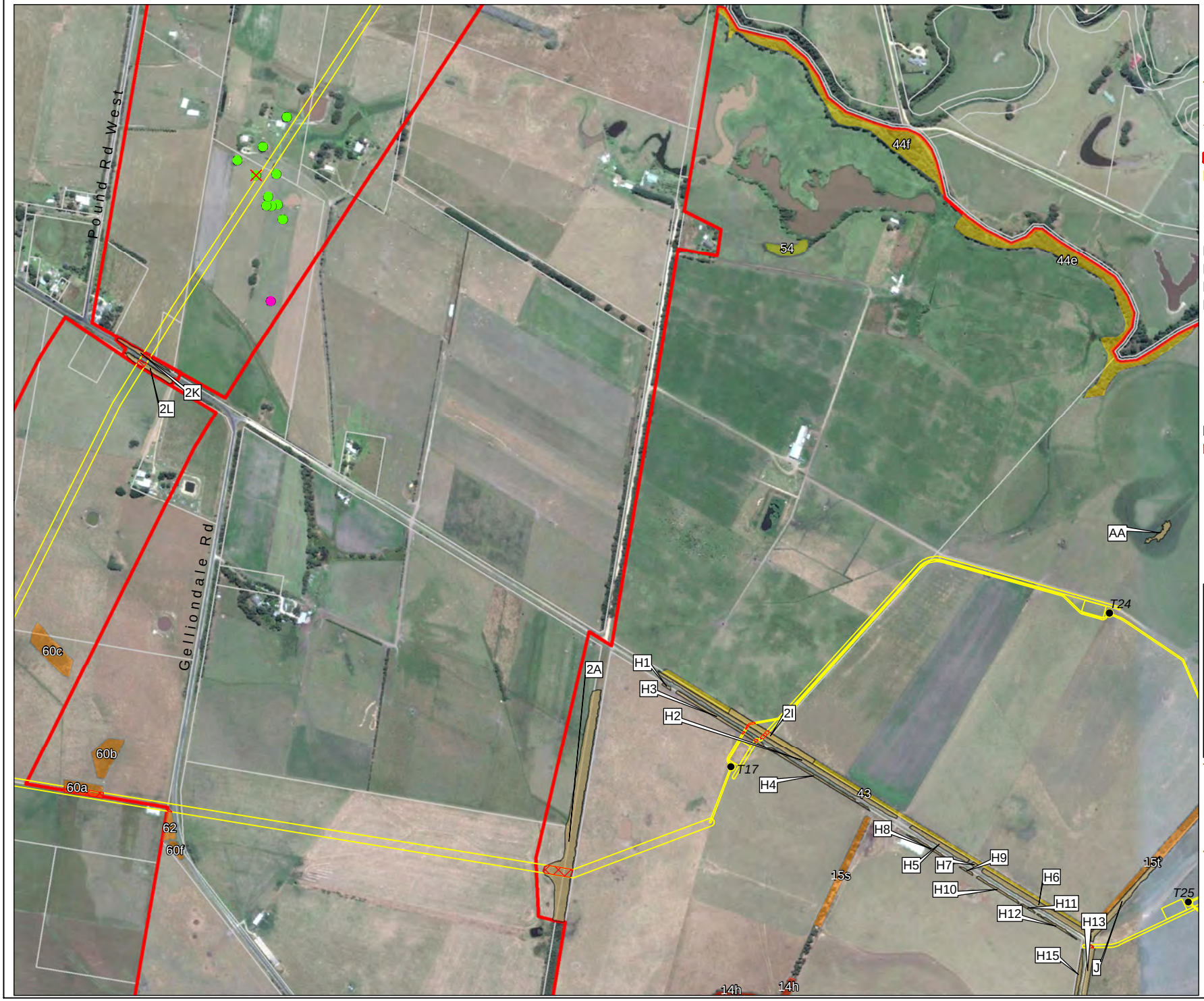

Figure 7: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- Moderate (1)
- Low-Moderate (3)
- Low (7)
- Very low (1)

Scattered trees

- Potential scattered tree
- Trees to be removed (1)

Detailed native vegetation survey

EVCs

- Swamp Scrub (EVC 53) (20)
- Native vegetation to be removed (12)

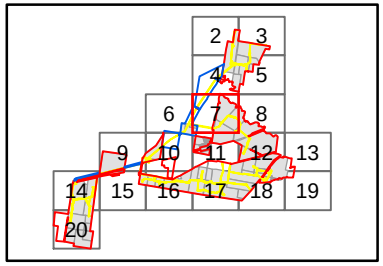

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Figure 8: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

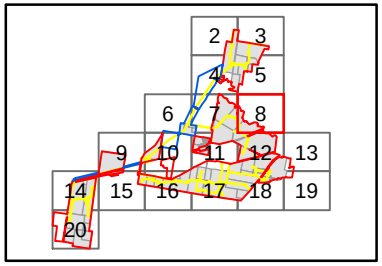
General quality

- Low-Moderate (5)
- Low (1)

Detailed native vegetation survey

EVCs

- Swamp Scrub (EVC 53) (1)



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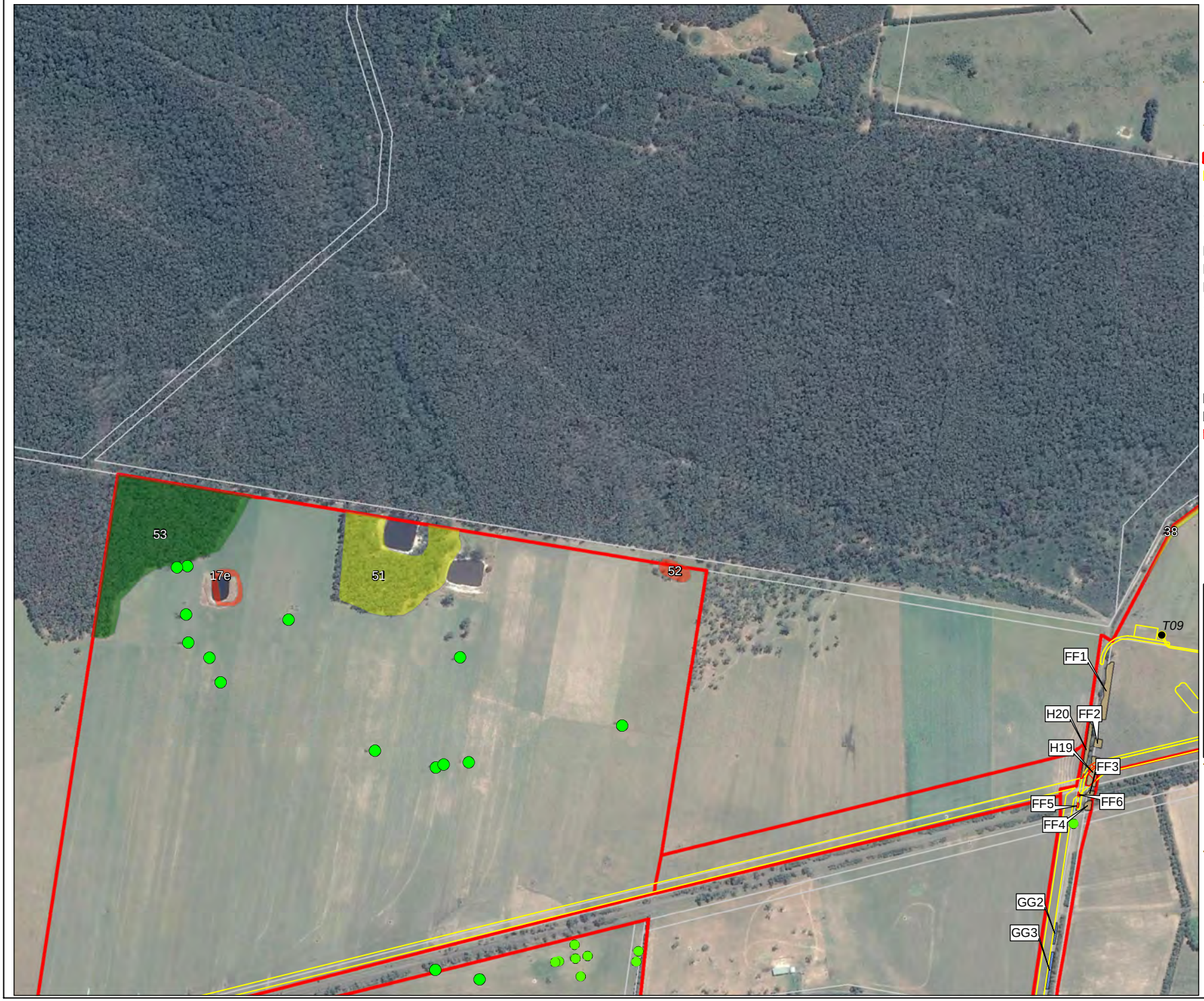


Figure 9: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- High (1)
- Moderate (2)
- Very low (2)

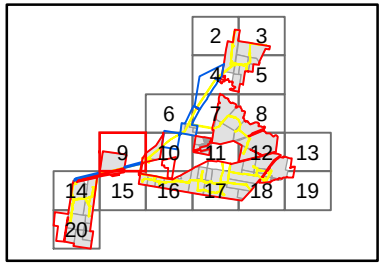
Scattered trees

- Confirmed scattered tree

Detailed native vegetation survey

EVCs

- Swamp Scrub (EVC 53) (8)
- Wet Heathland (EVC 8) (2)
- Native vegetation to be removed (5)



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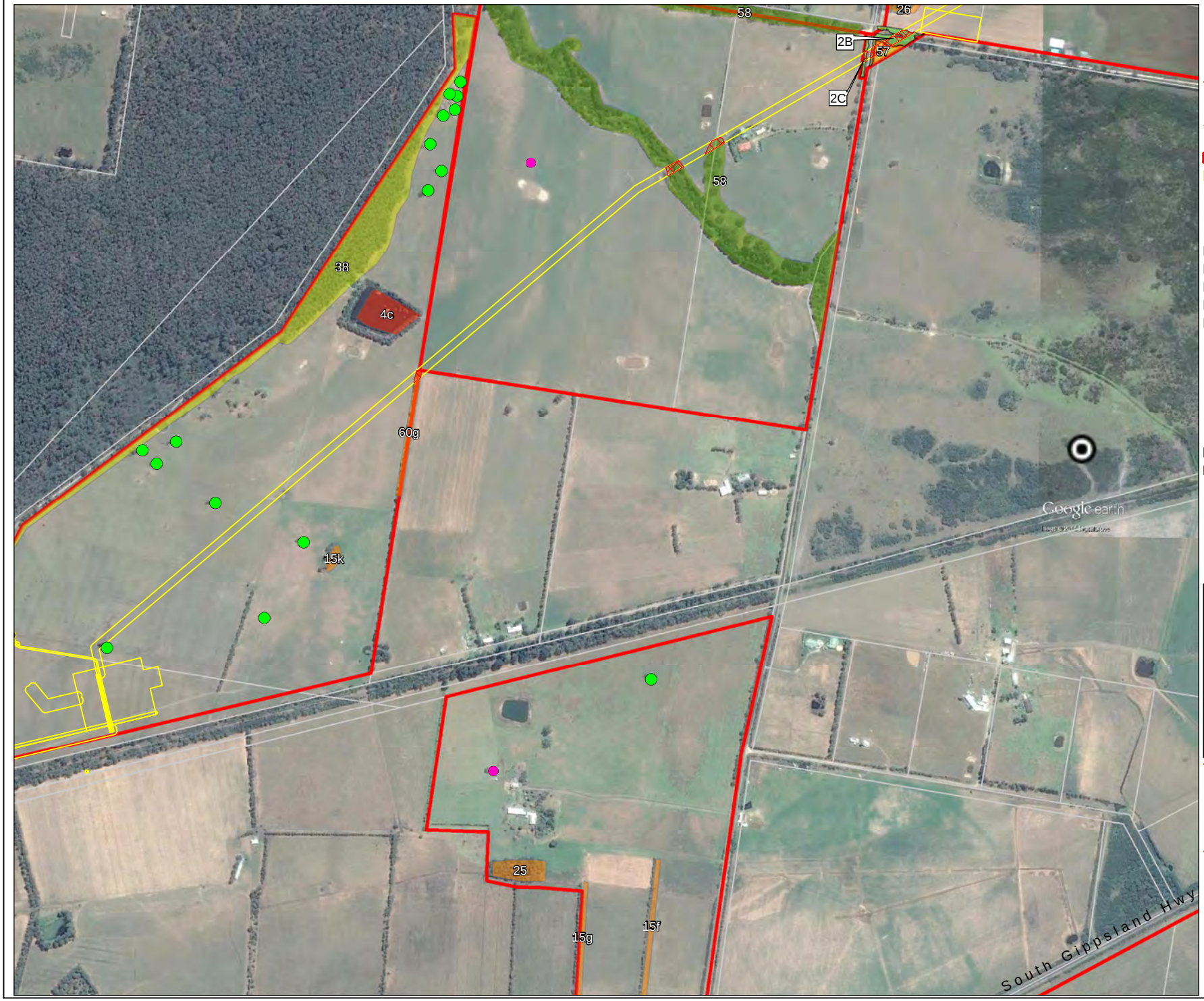

Figure 10: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- Moderate-High (1)
- Moderate (1)
- Low-Moderate (1)
- Low (6)
- Very low (1)

Scattered trees

- Confirmed scattered tree
- Potential scattered tree

Detailed native vegetation survey

EVCs

- Plains Grassy Forest (EVC 151) (2)
- Native vegetation to be removed (7)

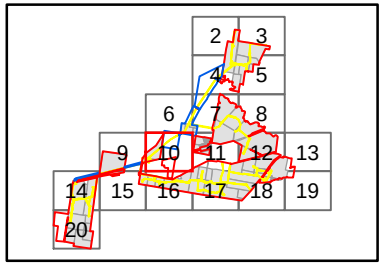

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Figure 11: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

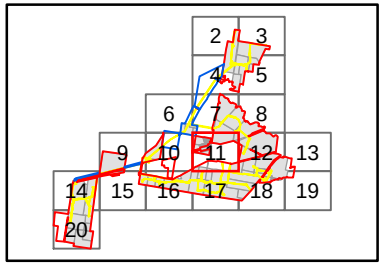
General quality

- Moderate (2)
- Low (10)
- Very low (3)

Detailed native vegetation survey

EVCs

- Swamp Scrub (EVC 53) (16)



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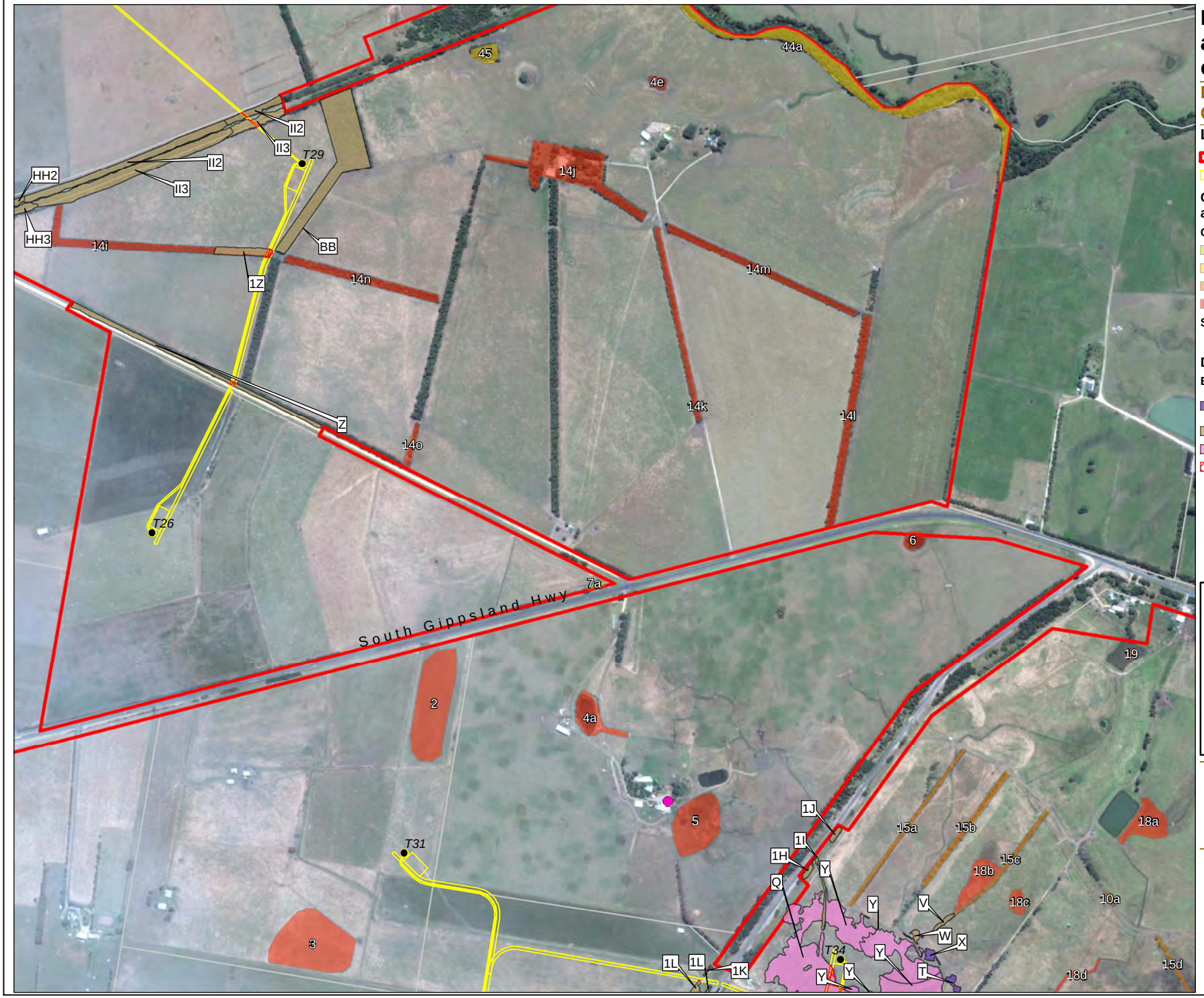


Figure 12: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- Moderate (1)
- Low-Moderate (2)
- Low (6)
- Very low (17)

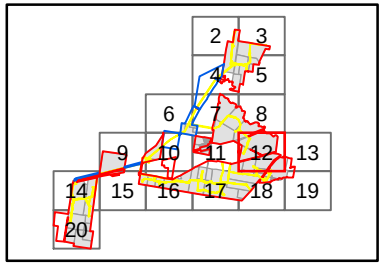
Scattered trees

- Potential scattered tree

Detailed native vegetation survey

EVCs

- South Gippsland Plains Grassland (EVC 132_62) (2)
- Swamp Scrub (EVC 53) (17)
- Aquatic Herbland (EVC 653) (4)
- Native vegetation to be removed (13)



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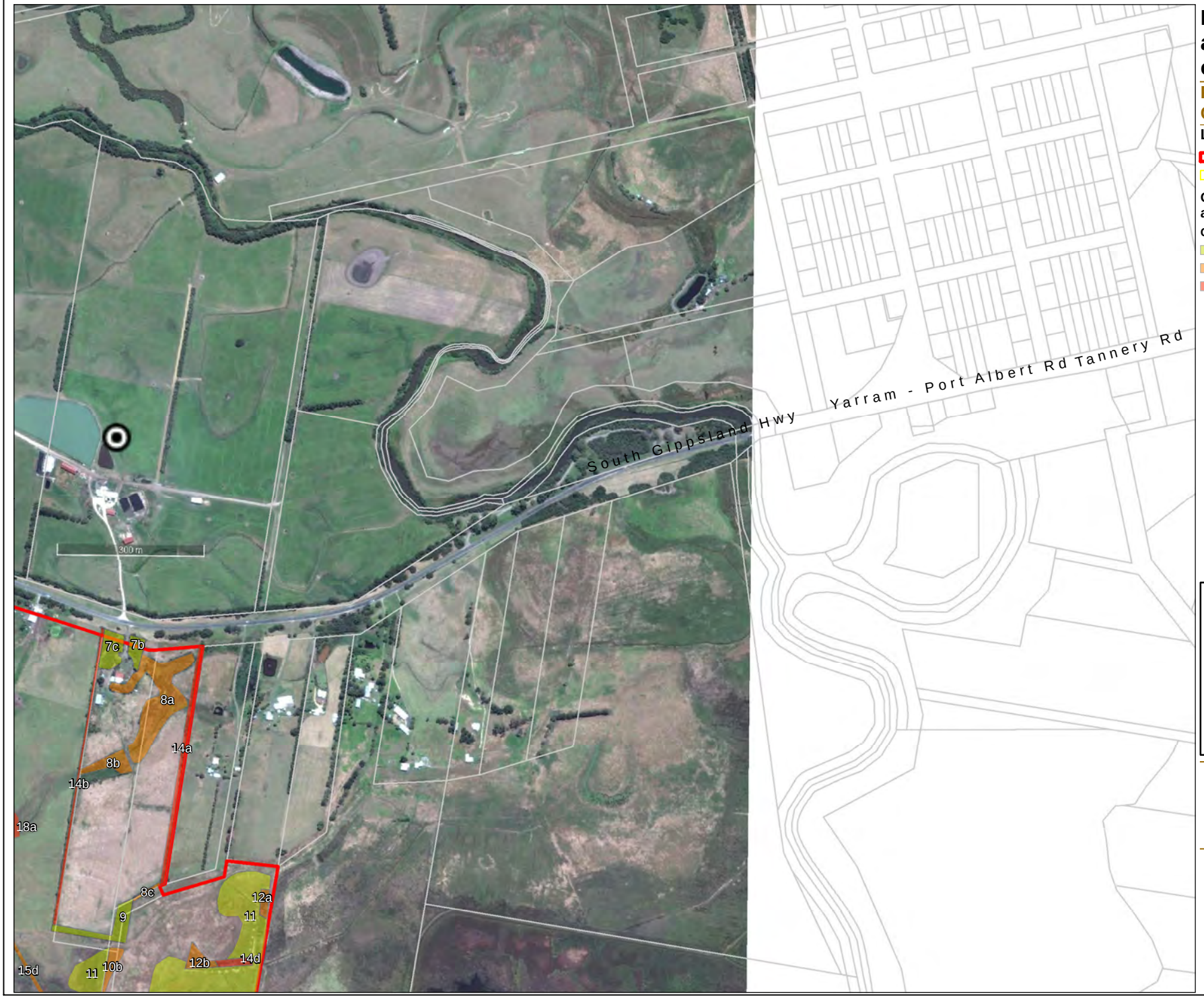


Figure 13: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

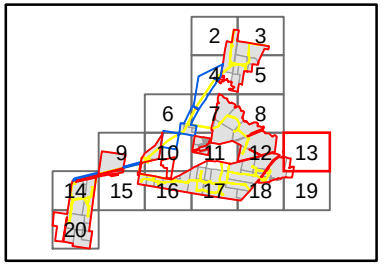
Legend

- Study area
- Development footprint

Overview assessment

General quality

- Moderate (4)
- Low (7)
- Very low (4)



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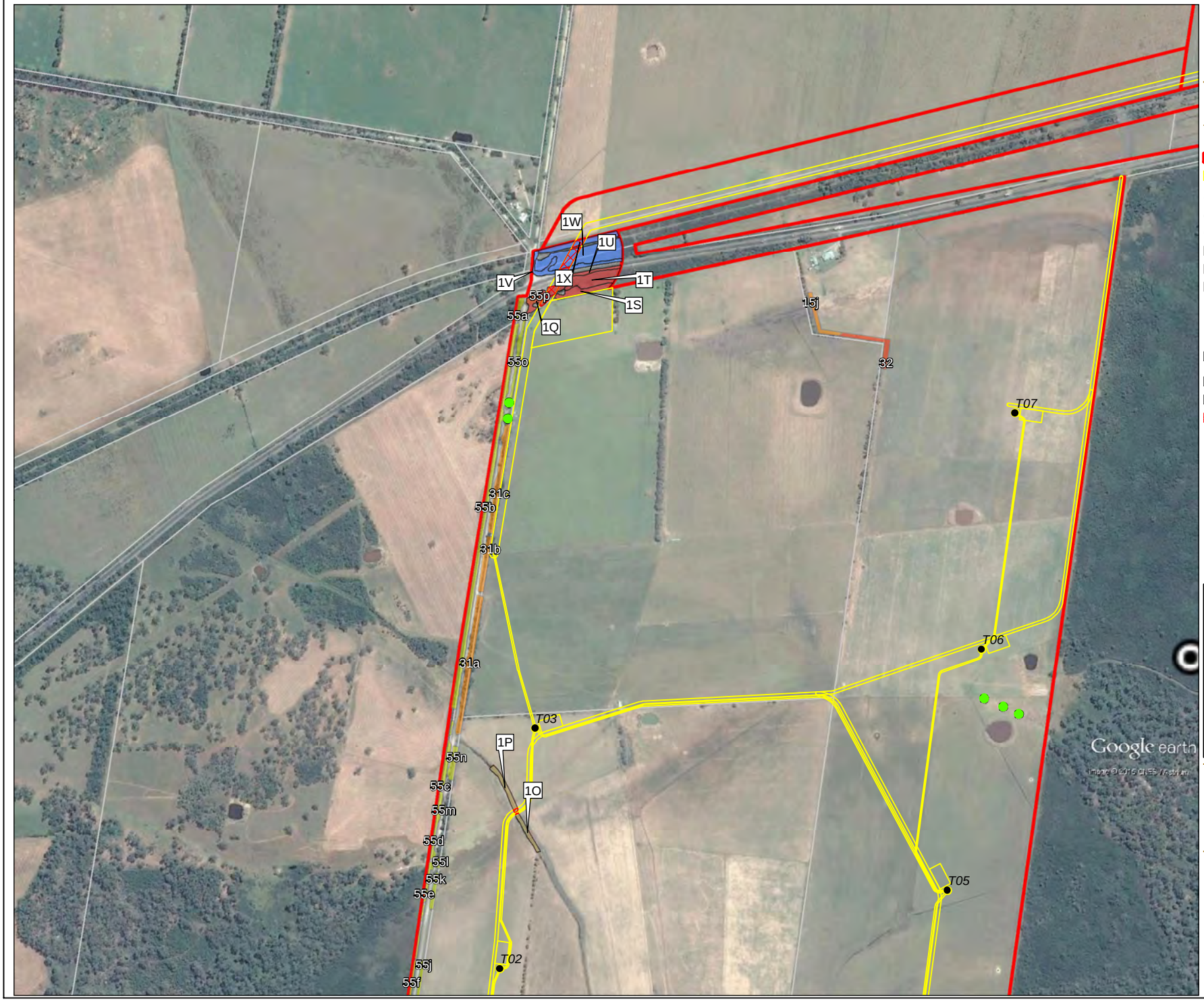

Figure 14: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- Moderate (13)
- Low (4)
- Very low (1)

Detailed native vegetation survey

EVCs

- Damp Sands Herb-rich Woodland (EVC 3) (5)
- Swamp Scrub (EVC 53) (2)
- Wet Heathland (EVC 8) (3)
- Native vegetation to be removed (9)

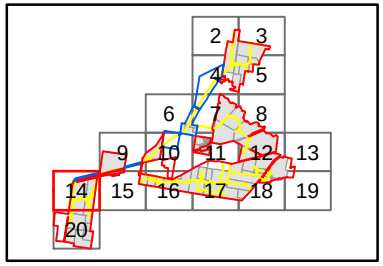

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Figure 15: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- Low-Moderate (1)
- Low (3)

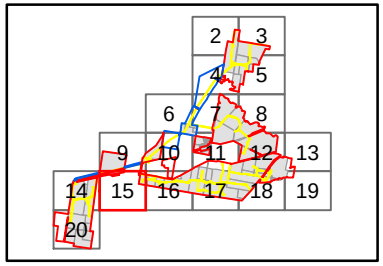
Scattered trees

- Confirmed scattered tree
- Trees to be removed (3)

Detailed native vegetation survey

EVCs

- Swamp Scrub (EVC 53) (5)
- Wet Heathland (EVC 8) (2)
- Native vegetation to be removed (2)



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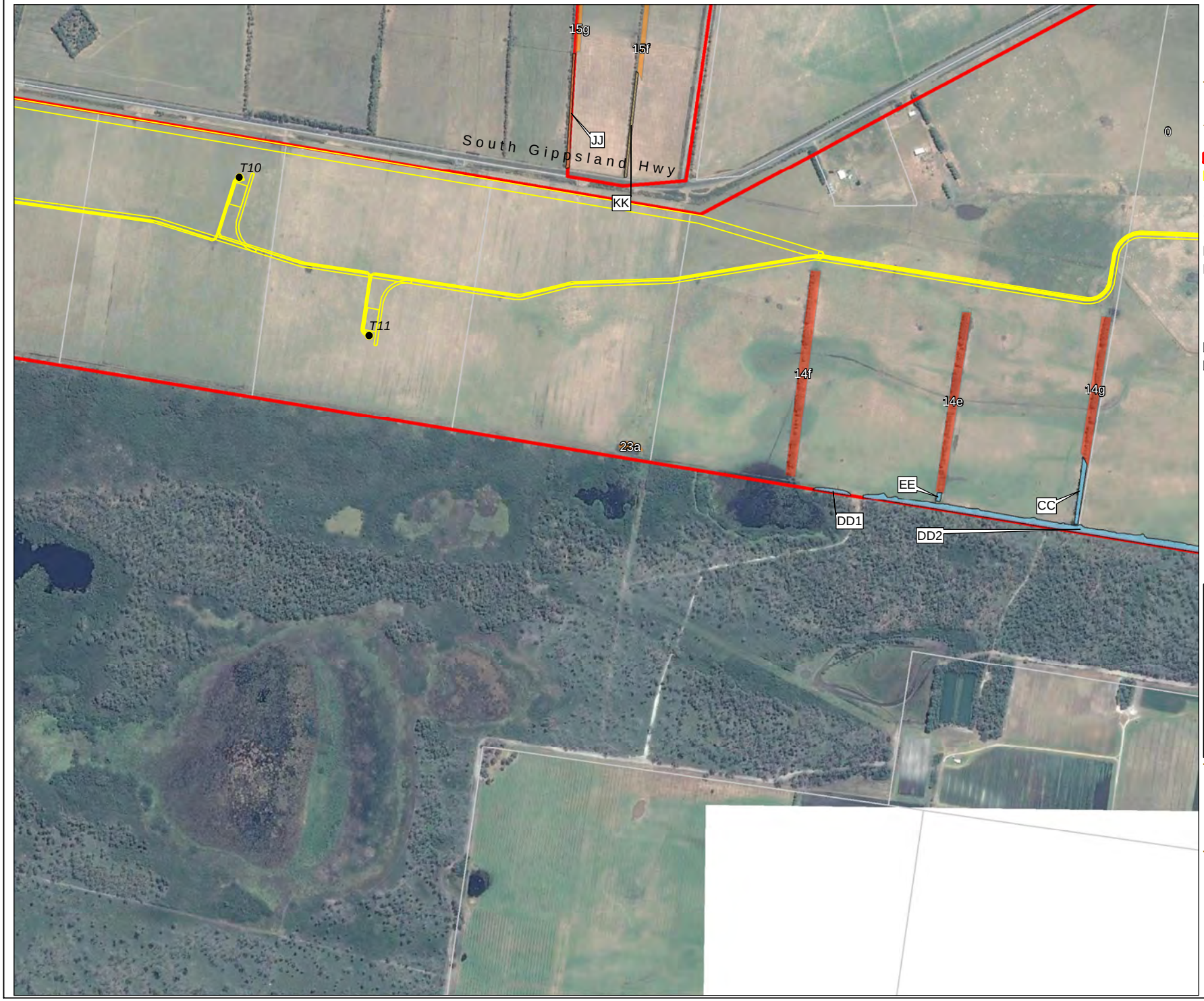


Figure 16: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

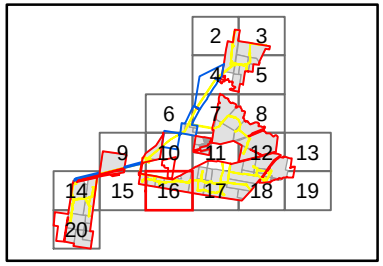
General quality

- Low (3)
- Very low (3)

Detailed native vegetation survey

EVCs

- Heathy Woodland (EVC 48) (4)
- Swamp Scrub (EVC 53) (2)



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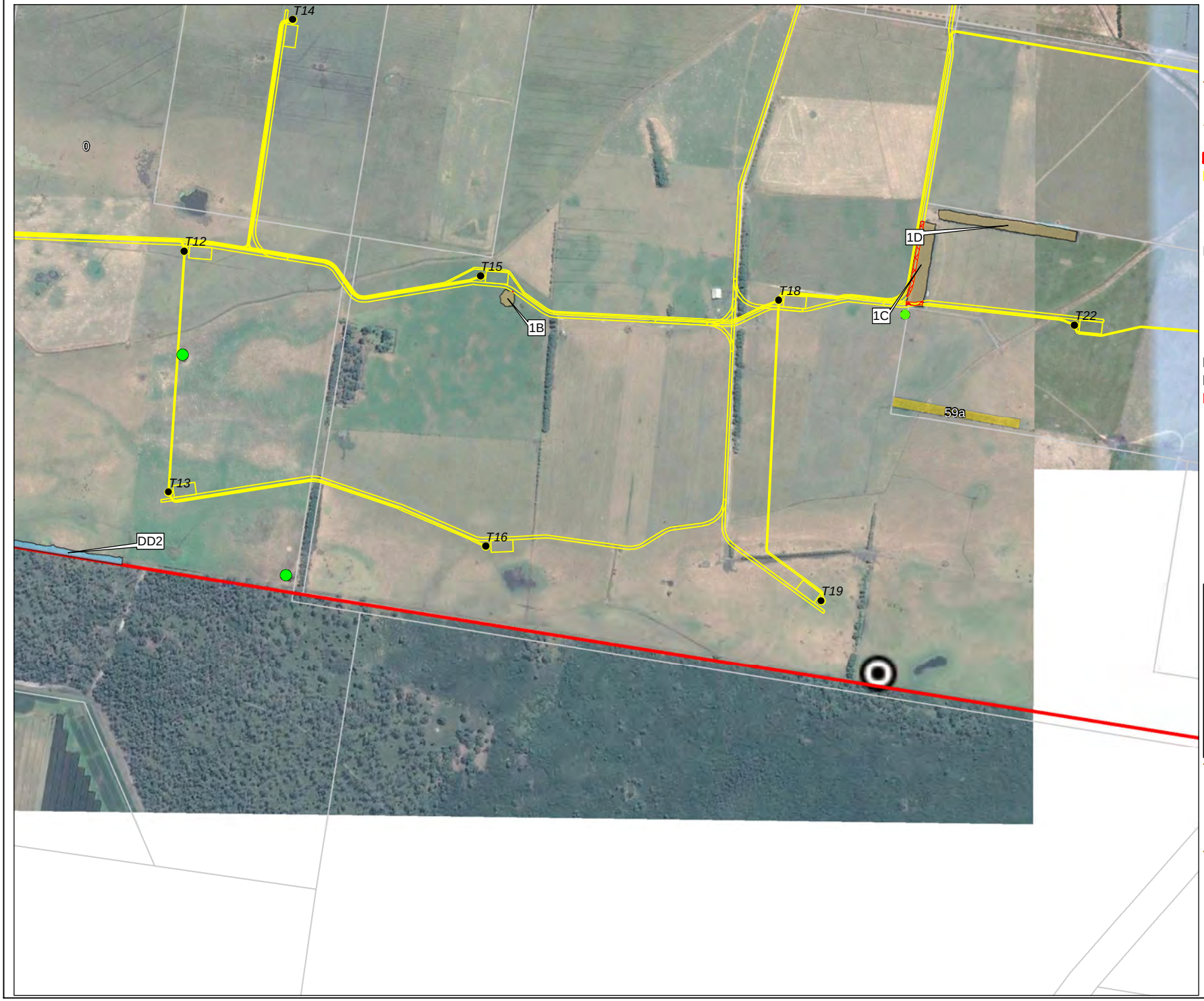

Figure 17: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

Overview assessment

General quality

- Low-Moderate (1)

Scattered trees

- Confirmed scattered tree

Detailed native vegetation survey

EVCs

- Heathy Woodland (EVC 48) (1)
- Swamp Scrub (EVC 53) (3)
- Native vegetation to be removed (5)

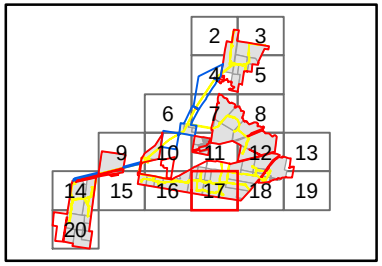

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Figure 18: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint
- Ramsar site

Overview assessment

General quality

- High (1)
- Moderate (2)
- Low (4)
- Very low (4)

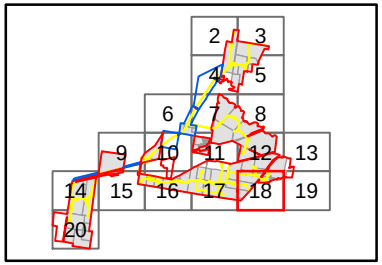
Scattered trees

- Confirmed scattered tree
- Trees to be removed (12)

Detailed native vegetation survey

EVCs

- South Gippsland Plains Grassland (EVC 132_62) (9)
- Swamp Scrub (EVC 53) (9)
- Aquatic Herbland (EVC 653) (8)
- Native vegetation to be removed (13)



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Yarram - Port Albert Rd

Figure 19: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint
- Ramsar site

Overview assessment

General quality

- High (1)
- Moderate (1)
- Low (3)
- Very low (1)

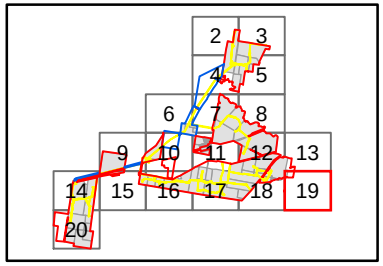

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Figure 20: Study area and native vegetation - overview and detailed

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint

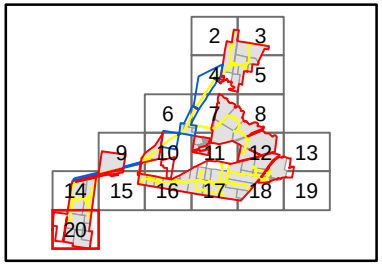
Overview assessment

General quality

- Moderate-High (1)
- Moderate (5)
- Low (3)
- Very low (5)

Scattered trees

- Confirmed scattered tree
- Potential scattered tree



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5.2. Ecological Vegetation Classes

Pre–European EVC mapping (DELWP 2015c) indicated that the study area and surrounds would have supported the EVCs listed below, prior to European settlement, based on modelling of factors including rainfall, aspect, soils and remaining vegetation:

- Damp Sands Herb-rich Woodland (EVC 3)
- Wet Heathland (EVC 8)
- Coastal Saltmarsh (EVC 9)
- Lowland Forest (EVC 16)
- Heathy Woodland (EVC 48)
- Swamp Scrub (EVC 53)
- Plains Grassy Forest (EVC 151)
- Wet Heathland/Damp Heathland Mosaic (EVC 686)
- Swamp Scrub/Plains Grassland Mosaic (EVC 687)

Evidence on site, including floristic composition and soil characteristics, suggested that the EVCs listed below were present or potentially occurred within the study area (Figure 2 to Figure 20).

- Damp Sands Herb-rich Woodland (EVC 3)
- Wet Heathland (EVC 8)
- Coastal Saltmarsh (EVC 9)
- Riparian Forest (EVC 18)
- Heathy Woodland (EVC 48)
- Swamp Scrub (EVC 53)
- Floodplain Riparian Woodland (EVC 56)
- Swampy Riparian Woodland (EVC 83)
- South Gippsland Plains Grassland (EVC 132_62)
- Sedge Wetland (EVC 136)
- Mangrove Shrubland (EVC 140)
- Plains Grassy Forest (EVC 151)
- Riparian Scrub (EVC 191)
- Aquatic Herbland (EVC 653)
- Brackish Wetland (EVC 656)
- Damp Heathland (EVC 710)
- Tall Marsh (EVC 821)
- Floodplain Reedbed (EVC 863)
- Estuarine Flats Grassland (EVC 914)
- Brackish Grassland (EVC 934)

Descriptions of these EVCs are provided within the EVC benchmarks in Appendix 8.

5.3. Native vegetation assessment

Sites found to support native vegetation during the overview and detailed assessment are shown in Figure 2 to Figure 20 and described in Table 2.

During the targeted surveys, no EPBC Act listed species/communities were recorded in any of the patches assessed.

Table 2: Sites found to support native vegetation during the overview assessment

Site No.	EVC/s	Weediness	Indigenous flora diversity	Flora notes	Quality
1	53/132	High	Very Low	One or more patches dominated by Common Spike-sedge	Very Low
2	53/132	High	Very Low	One or more patches of Rushes	Very Low
3	53/132	High	Very Low	One or more patches of Rushes	Very Low
4	53/132	High	Very Low	Bulrush dominated vegetation in man-made dam and drainage channel	Very Low
5	53/132	High	Very Low	Common Reed dominated vegetation in man-made dam and drainage channel	Very Low
6	53/132	High	Low	Some very small patches of aquatic reeds, grasses and herbs dominated by Bulrush and Common Spike-sedge occupying man-made dam	Very Low
7	53/83	Moderate to High	Moderate	One or more patches and possibly scattered trees dominated by Swamp Paperbark and Swamp Gum	Moderate
8	53/83	High	Low	One or more patches and possibly scattered trees dominated by Swamp Paperbark and Swamp Gum	Low
9	53	Moderate	Moderate	Dominated by Swamp Paperbark with some Coast Manna-gum	Moderate
10	53	High	Low	Dominated by Swamp Paperbark	Low
11	9	Low to Moderate	Low to Moderate	Dominated by Sea Rush	Moderate
12	53	High	Low	Dominated by Swamp Paperbark	Low
13	9/140/914	Low	High	Variety of herbaceous salt-adapted species	High
14	53/83/132/48	High	Very Low	Small patches of indigenous species imported by birds (e.g. Seaberry Saltbush) under planted trees; possibly some scattered trees also	Very Low
15	53	High	Low	Patches and scattered trees; co-dominated by Swamp Paperbark and Swamp Gum	Low
16	53/9/132_62	Moderate	Low	Co-dominated by Sea Rush and Australian Salt-grass	Low
17	53/132_62/656/934	Very High	Very Low	Dominated by Rushes	Very Low

Site No.	EVC/s	Weediness	Indigenous flora diversity	Flora notes	Quality
18	53/9/132_62	High	High	Dominated by Australian Salt-grass	Very Low
19	53	Low	Low	Dominated by Swamp Paperbark with some Blackwoods on an island within a dam (inaccessible)	Low
20	53	Low	Moderate	Co-dominated by Sea Rush and Beaded Glasswort with some Swamp Paperbark on slightly elevated ground	Moderate
21	53	High	Very Low	Scattered Swamp Paperbarks (possibly scattered trees) amongst weeds and planted trees	Very Low
22	8/53/136/710	High	High	Small indigenous herbs amongst weedy grasses	Low
23	53	High	Low	Dominated by Swamp Paperbark	Low
24	53	Moderate	Low	Dominated by Swamp Paperbark with Common Reed and Water Ribbons	Low
25	53/83	Low to Moderate	Moderate	Dam filled with Bulrush and surrounded by Swamp Gums and Swamp Paperbarks as well as planted trees and shrubs	Low
26	151	High	Moderate	Tall Spike-sedge in dam, surrounded by Swamp Gums and Swamp Paperbarks	Low
27	48	Low	Moderate to High	Dominated by Messmate Stringybark and Coast Manna-gum	Moderate to High
28	53/136	High	Very Low	One or more small patches of Rushes amongst weedy pasture grasses	Very Low
29	48	High	Low to Moderate	Dominated by Messmate Stringybark and Coast Manna-gum	Low
30	3/53/8/710	Very High	Very Low	Small patches and scattered trees; dominated by Swamp Gum and Swamp Paperbark	Very Low
31	53	High	Low	Dominated by Swamp Paperbark and Swamp Gum	Low
32	53	Very High	Very Low	Very small patches of Swamp Paperbark amongst weeds	Very Low
33	53	High	High	Multiple patches dominated by Swamp Paperbark with Common Reed and Bulrush	Very Low
34	48	Moderate to High	Low to Moderate	Multiple patches and scattered trees; dominated by Coast Manna-gum with Austral Bracken	Low

Site No.	EVC/s	Weediness	Indigenous flora diversity	Flora notes	Quality
35	48	Very High	Very Low	Multiple patches and scattered trees; dominated by Coast Manna-gum with Austral Bracken	Very Low
36	9/710/136	Very High	Very Low	Potentially one or more small patches dominated by Rushes	Very Low
37	53	Moderate to High	Moderate to High	Dominated by Swamp Paperbark and Swamp Gum	Moderate
38	151	Moderate to High	Moderate	Dominated by Yellow Stringybark and Southern Blue-gum with a variety of grasses, forbs, trees and shrubs in the understorey	Moderate to High
39	53	High	Low	Dam dominated by Bulrush with Swamp Paperbark surrounding the dam	Low
40	53	Moderate	Moderate	Dominated by Swamp Paperbark	Moderate
41	53	Moderate	Low to Moderate	Dominated by Swamp Paperbark and Swamp Gum	Moderate
42	53	High	Very Low	Multiple small patches; Swamp Paperbark within Blue Gum plantation	Very Low
43	53	Moderate to High	Low to Moderate	Multiple patches dominated by Swamp Paperbark	Low to Moderate
44	53/18/56/191	High	Moderate	Variety of planted indigenous trees and shrubs	Low to Moderate
45	53	Low to Moderate	Low to Moderate	Dominated by Swamp Gum with a variety of trees and shrubs such as Swamp Paperbark and Black Wattle	Low to Moderate
46	53/863	Moderate	Low	Co-dominated by Common Reed and Bulrush	Moderate
47	53/863	Very High	Very Low	Multiple patched including Common Reed amongst planted River Red-gums and Blackberry with some Swamp Gums	Very Low
48	53	Moderate	Low	Variety of indigenous shrubs	Low
49	53	Moderate	Low	Dense growth of Large Bindweed over some shrubs such as Swamp Paperbark	Low
50	48	Moderate	Moderate	Dominated by Coast Manna-gum	Low to Moderate
51	151	Low to	Moderate	Dominated by Yellow Stringybark	Moderate

Site No.	EVC/s	Weediness	Indigenous flora diversity	Flora notes	Quality
		Moderate			
52	151	Very High	Very Low	Scattered patches dominated by eucalypts amongst introduced pasture grasses	Very Low
53	151	Moderate	Moderate	Dominated by Yellow Stringybark with a variety of grasses, forbs, trees and shrubs in the understorey	High
54	53/863	Low	Low to Moderate	Dominated by Bulrush	Moderate
55	3, 8, 53, 136, 710	Low to Moderate	Moderate to High	Roadside vegetation; multiple patches dominated by various Eucalypts; array of indigenous grasses, forbs and shrubs in the understorey	Moderate
56	53	High	Very Low	Scattered Swamp Paperbark, rushes and Common Reed amongst weedy grasses and forbs; within inundated drainage line	Very Low
57	151	Moderate to High	Moderate	Grazed paddock with at least partially indigenous grassy ground cover	Low to Moderate
58	151	Moderate	High	Dominated by Blue Gum and Yellow Stringybark; heavily eroded drainage line; high structural diversity	Moderate to high
59	53	High	Moderate	Swamp Paperbark over Seaberry Saltbush, Cocksfoot, Blackberry and some small logs	Low to Moderate
60	53	Moderate to High	Low	Revegetation along teh Albert River; mostly planted trees and shrubs (e.g. Blue Gum, Swamp Gum and Wattles) over a mostly introduced ground layer	Low
61	53/863	Moderate to High	Moderate	Dense stands of Common Reed with other indigenous aquatic flora within the Jack River	Moderate
62	53	Low	Very Low	Fenced-off stands of Swamp Paperbark with few other indigenous species as well as weedy grasses and forbs	Low

5.4. Remnant patches

A total of 116 remnant patches (referred to herein as habitat zones) comprising the abovementioned EVCs were identified and assessed within or in close proximity to past and current development footprints.

The habitat hectare assessment results for these habitat zones are provided in Table 3 More detailed habitat scoring results are presented in Appendix 2. Habitat zones are briefly described in Table 4.

Table 3: Summary of habitat hectare assessment results

Habitat Zone	EVC no.	Area (ha)	Condition score (out of 100)
A	53	0.064	37
B	53	0.101	25
C	53	0.072	28
D	863	0.064	55
E	863	0.039	41
F	132_62	0.027	16
G	132_62	0.004	16
H1	53	0.009	25
H2	53	0.440	25
H3	53	0.113	25
H4	53	0.094	25
H5	53	0.118	25
H6	53	0.272	25
H7	53	0.010	25
H8	53	0.037	25
H9	53	0.011	25
H10	53	0.041	25
H11	53	0.014	25
H12	53	0.029	25
H13	53	0.194	25
H14	53	0.028	25
H15	53	0.163	25
H16	53	0.041	25
H17	53	0.158	25
H18	53	0.037	25
H19	53	0.103	28
H20	53	0.085	28
I	53	0.086	37
J	53	0.222	16
K	132_62	0.007	16

Habitat Zone	EVC no.	Area (ha)	Condition score (out of 100)
L	132_62	0.019	22
M	132_62	0.014	22
N	132_62	0.014	22
O	132_62	0.038	22
P1	653	0.056	49
P2	653	0.185	49
Q	653	3.756	49
R	653	0.005	49
S	653	0.007	49
T	132_62	0.050	22
U	132_62	0.015	20
V	53	0.041	22
W	53	0.036	24
X	132_62	0.047	16
Y	653	1.147	15
Z	53	0.404	21
AA	53	0.066	8
BB	53	1.474	37
CC	48	0.114	9
DD1	48	0.051	9
DD2	48	1.035	9
EE	48	0.017	45
FF1	53	0.149	30
FF2	53	0.031	30
FF3	53	0.016	30
FF4	53	0.025	30
FF5	53	0.007	30
FF6	53	0.004	30
GG1	8	0.011	15
GG2	8	0.017	15
GG3	8	0.039	15
HH1	53	0.172	17
HH2	53	0.037	17
HH3	53	0.260	17
II1	53	0.102	40
II2	53	0.158	40
II3	53	0.209	40
JJ	53	0.128	23

Habitat Zone	EVC no.	Area (ha)	Condition score (out of 100)
KK	53	0.104	23
1A	53	0.085	18
1B	53	0.078	27
1C	53	0.566	28
1D	53	0.595	28
1E	53	1.597	28
1F	53	0.864	28
1G	53	0.314	42
1H	53	0.033	35
1I	53	0.060	10
1J	53	0.035	25
1K	53	0.010	15
1L	53	0.119	35
1M	53	0.015	40
1N	132_62	0.177	20
1O	53	0.070	30
1P	53	0.097	30
1Q	3	0.110	41
1R	3	0.054	25
1S	3	0.128	26
1T	3	0.272	44
1U	3	0.074	23
1V	8	0.171	56
1W	8	0.601	52
1X	8	0.172	47
1Y	53	0.077	43
1Z	53	0.195	24
2A	53	1.173	20
2B	151	0.240	40
2C	151	0.046	42
2D	53	0.087	37
2E	53	0.052	37
2F	53	0.047	47
2G	53	0.087	47
2H	53	0.617	62
2I	53	0.230	25
2J	53	0.341	23
2K	53	0.072	23

Habitat Zone	EVC no.	Area (ha)	Condition score (out of 100)
2L	53	0.102	32
2M	53	0.053	20
2N	821	0.225	35
20	53	0.092	27
57	53	0.045	16
62	53	0.003	17
60a	53	0.093	25
46a	653	0.019	40
58a	53	0.104	41
60g	53	0.020	16
Total		**23.062**	

Table 4: Description of habitat zones in the study area

HZs	EVC no.	General quality	Description	Example photo
1U, 1R, 1S	3	Low	Damp Sands Herb-rich Woodland Structure simplified, diversity much depleted	
1Q, 1T	3	High	Damp Sands Herb-rich Woodland Some structural elements degraded or missing but otherwise intact	

HZs	EVC no.	General quality	Description	Example photo
GG1, GG2, GG3	8	Very low	Wet Heathland Structure and diversity much depleted; high weed cover	
1X, 1W, 1V	8	High	Wet Heathland Structure and diversity relatively intact; low weed cover	

HZs	EVC no.	General quality	Description	Example photo
CC, DD1, DD2	48	Very low	Heathy Woodland Fenced-off tree plantings (partly indigenous), understorey mostly of non-indigenous native, likely brought in by birds; very low native diversity, high weed cover	
EE	48	High	Heathy Woodland Vegetation overhanging study area; fire break along the edge of high-quality bushland; structure simplified from fire-reduction activity; high indigenous diversity	

HZs	EVC no.	General quality	Description	Example photo
AA, 1A, 1I, 1K, J, HH1, HH2, HH3, 62, 60a, 60g	53	Very low	Swamp Scrub Structure simplified, diversity much depleted, high weed cover	
B, C, V, W, Z, JJ, KK, H1, H2, H3, H4, H5, H6, H7, H8, H9, H10, H11, H12, H13, H14, H15, H16, H17, H18, H19, H20, 1B, 1C, 1D, 1E, 1F, 1J, 1Z, 2A, 2I, 2J, 2K, 2M, 2O	53	Low	Swamp Scrub Structure simplified, diversity much depleted	

HZs	EVC no.	General quality	Description	Example photo
A, BB, FF1, FF2, FF3, FF4, FF5, FF6, I, II1, II2, II3, 1H, 1L, 1M, 1O, 1P, 2D, 2E, 2L, 57, 58	53	Moderate	Swamp Scrub Moderate structural intactness and indigenous diversity;, low to high weed cover	
1G, 1Y, 2F, 2G, 2H	53	High	Swamp Scrub Structure relatively intact or high connectivity, high indigenous diversity, low weed cover	

HZs	EVC no.	General quality	Description	Example photo
2B, 2C	151	Moderate to high	Plains Grassy Forest Moderate to high structural intactness, high indigenous diversity, low to moderate weed cover	
Y	653	Low	Aquatic Herbland Structure simplified, diversity much depleted	

HZs	EVC no.	General quality	Description	Example photo
P1, P2, Q, R, S, 46a	653	High	Aquatic Herbland Structure and diversity relatively intact; low weed cover	
2N	821	Moderate	Tall Marsh Moderate structural intactness and indigenous diversity, low to high weed cover	

HZs	EVC no.	General quality	Description	Example photo
D, E	863	High	Floodplain Reedbed Moderate structural intactness and indigenous diversity, low to high weed cover	
F, G, K, X	132_62	Very low	South Gippsland Plains Grassland Stands of indigenous Rush amongst common pasture weeds	

HZs	EVC no.	General quality	Description	Example photo
L, M, N, O, T, U, 1N,	132_62	Low	South Gippsland Plains Grassland Structural diversity and indigenous diversity much depleted; high weed cover	

5.5. Scattered trees

Scattered trees recorded within, or in close proximity to past and current proposed development layouts would have once comprised the canopy component of Damp Sands Herb-rich Woodland (EVC 3), Heathy Woodland (EVC 48) and Swamp Scrub (EVC 53). A total of 40 scattered trees occurred in the study area (Figure 2 to Figure 20), ranging in DBH (diameter at breast height) between six and 97 centimetres. Details of the scattered trees recorded are listed in Appendix 3.

5.6. Flora species

5.6.1. Flora species recorded

During the assessments 267 plant species were recorded. Of these, 178 (67%) were indigenous and 89 (33%) were introduced or non-indigenous native in origin (Appendix 4).

5.6.2. Listed species

VBA records (VBA 2015) and the EPBC Protected Matters Search Tool (Department of the Environment 2015) indicated that within the search region there were records of, or there occurred potential suitable habitat for, nine species listed under the Commonwealth EPBC Act and seven listed under the state FFG Act, including seven listed under both Acts. No flora species listed under the EPBC Act or FFG Act were recorded during the field survey. Grey Mangrove, listed as rare on DELWP's Advisory List, was recorded

The likelihood of occurrence in the study area of species listed under the EPBC Act and FFG Act is addressed in Table 5. Species considered 'likely to occur' are those that have a very high chance of being in the study area based on numerous records in the search region and suitable habitat in the study area. Species considered to have the 'potential to occur' are those where suitable habitat exists, but recent records are scarce.

These likelihoods of occurrence were tested through the targeted flora surveys and none of the species/communities outlined below were recorded in the study area.

- Natural Damp Grassland of the Victorian Coastal Plains
- Clover Glycine
- Eastern Spider-orchid
- Maroon Leek-orchid
- Metallic Sun-orchid
- River Swamp Wallaby-grass
- Strzelecki Gum and
- Thick-lip Spider-orchid

Table 5: FFG Act and EPBC Act listed flora species and likelihood of occurrence

Common Name	Scientific name	EPBC	FFG	Habitat	Number of records	Date of last record	Likelihood of occurre
Clover Glycine	Glycine latrobeana	VU	L	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 12oo 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 Eucalyptus melliodora (Yellow Box), with scattered Acacia paradoxa (Hedge Wattle). Field layer comprises Austrodanthonia spp. (wallaby grasses) 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).	None	N/A	Habitat present within remn plains grassland to woodland on drier fertile groun **Potential to occur, but not r impact areas during targete**
Eastern Spider-orchid	Caladenia orientalis	EN	L	Heathland and Heathy Woodland in coastal areas between the Mornington Peninsula and Wilsons Promontory (Jeanes & Backhouse 2006).	None	N/A	Habitat present within Heat heathy woodland patches wi ground layer - **Potential to oc recorded in impact areas targeted surveys.**

Common Name	Scientific name	EPBC	FFG	Habitat	Number of records	Date of last record	Likelihood of occurre
Maroon Leek-orchid	Prasophyllum frenchii	EN	L	Favouring heathland and Grassland on black clays (Bates 1994).	2	1/09/2003	Habitat present within ro supporting a fertile, damp g herbaceous ground layer country – **Potential to occur, but not r impact areas during targete**
Matted Flax-lily	Dianella amoena	EN	L	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 2010).	None	N/A	Much degraded habitat p **Unlikely to occur**
Metallic Sun-orchid	Thelymitra epipactoides	EN	L	Primarily in mesic coastal heathlands, grasslands and woodlands, but also in drier inland heathlands, open forests and woodlands. (Backhouse & Jeanes 1995 in DSEWPC 2003).	1	9/12/1978	Habitat present within are relatively intact and diverse heathy understory - **Potentia but not recorded in impact a targeted surveys.**
River Swamp Wallaby-grass	Amphibromus fluitans	VU		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).	2	18/04/2007	Habitat present within dr channels, vegetated dar waterways – **Potential to occur, but not r impact areas during targete**
Strzelecki Gum	Eucalyptus strzeleckii	VU	L	Apparently endemic, confined to across the western section of the Strzelecki Range, from Neerim South in the north, south to Foster. Favours ridges, slopes and streambanks and deep fertile soils.	2	24/02/2012	Habitat present within Plai Forest – **Potential to occur, but not r impact areas during targete**
Swamp Everlasting	Xerochrysum palustre	VU	L	Sedge-rich swamps and wetlands, usually on black cracking clay soils (Walsh and Entwisle 1999). Scattered occurrences in Victoria range from the South Australian border in the west to the Cobberas, near Benambra, in the East (DSE 2008).	8	11/12/2007	No habitat present **Unlikely to occur**

Common Name	Scientific name	EPBC	FFG	Habitat	Number of records	Date of last record	Likelihood of occurre
Thick-lip Spider-orchid	Caladenia tessellata	VU		Coastal open woodlands, Lowland forest, heathy woodland (Entwisle 1994).	2	15/04/1992	Habitat present within forest woodland with intact groun **Potential to occur, but not r impact areas during targete**

Notes: **EPBC** = threatened species status under EPBC Act: EX = presumed extinct in the wild; CR = critically endangered; EN = endangered; VU = vulnerable;
FFG = threatened species status under the FFG Act: **L** = listed as threatened

5.7. Fauna habitats

The broader study area supported the six fauna habitat types listed below.

- Eucalypt Forest;
- Agricultural pastures;
- Native and introduced treed vegetation-rows;
- Heathy woodland;
- Saltmarsh and mangroves; and
- Aquatic habitats (drainage lines, creeks, rivers).

Eucalypt forest

This habitat type was predominately present in the outlying area in the north-west section of the broader study area (Alberton West State Forest). Species primarily comprised Yellow Stringy-bark, Mountain Grey Gum, Messmate, and Tasmanian Blue Gum, with an open understory of grasses and shrubs. Hollows that provide habitat for tree-dwelling fauna were present in some large trees. The ground layer comprised a mixture of weeds and native species. Leaf-litter and fallen timber were present throughout the forest, which provided suitable habitat for reptiles. As the forest sits just outside the broader study area, it has been included due to its direct proximity and its influence on the fauna of the broader study area.

Agricultural land

Grazing pastures were the dominant habitat type across most of the broader study area and primarily comprised introduced grass species. This habitat is largely devoid of native vegetation due to historic clearing for agriculture and the introduction of pasture grasses for dairy farms. Habitat components for ground dwelling fauna, such as leaf litter, rocks and woody debris, were scarce across the broader study area, however some artificial refuges was being utilised by some common reptile and frog species.

Native and introduced treed vegetation-rows

Linear patches of treed vegetation (tree-rows, wind breaks etc) along roadsides and rail-reserves in the broader study area, supported native and introduced plant species. Various eucalyptus species and swamp paperbark with the occasional she-oak species dominated this habitat. It provided foraging opportunities for a number of common and generalist fauna species.

Importantly, connectivity to similar habitats within the landscape, provided by linear strips of vegetated habitat, increased the value of habitats to fauna. The broader study area was connected to Alberton West State Forest to the north-west and the Hedley State Forest in the south. These large remnant forest blocks flanked the north-west and southern wind farm boundaries and formed a network of wider, regional value that provides dispersal, commuting routes, as well as foraging habitat for species that may move between forest blocks.

Heathy woodland

This habitat was located along the southern boundaries of the broader study area, in association with the Hedley State Forest. This habitat was dominated by Coast Manna

Gum, Messmate and Saw Banksia. Hedley State Forest is an intact remnant forest with a ground layer consisting of native grasses and a shrub layer dominated by grasstree species. As the woodland sits just outside the broader study area, it has been included due to its influence on the fauna of the broader study area. Additionally, due to the quality of habitat, it is likely to act as an attraction for fauna species as a place to feed and roost.

Saltmarsh and Mangroves

Some areas of saltmarsh and outlying pockets of mangroves occurred in the far south-east of the broader study area along the Albert River. These habitats were predominately made up of Beaded Glasswort, Salt Grass, sedges and rushes. The mangroves were dominated by Grey Mangrove. These areas were largely inaccessible to livestock due to exclusion fences, therefore disturbance has been somewhat controlled.

Due to this highly specific habitat, it is likely to act as an attraction for specific fauna species, particularly migratory species, as a place to feed and roost.

Aquatic habitats (drainage lines, creeks, rivers)

Aquatic habitats scattered across the broader study area consisted of the Albert River and its tributaries, drainage lines, ephemeral wetlands and farm dams.

The majority of farm dams were accessible to stock and supported little or no vegetation. Ephemeral drainage lines were common throughout the broader study area as a method of draining water from low-lying agricultural land. These were often in poor condition and dominated by native and weed species such as sedges and rushes. Although in poor condition, they provide habitat for several frog species and also migratory species such as Latham's Snipe and Eastern Great Egret.

Where more permanent water-bodies were allowed to flow naturally and excluded from grazing pressure, low and high marshes occurred, particularly in the north-east of the site in association with the Albert River. These marshes were dominated by reeds, rushes and sedges, providing good intact and connected vegetation cover. Consequently, they provided dispersal and foraging opportunities as well as critical refuges for a number of fauna species.

5.8. Fauna species

5.8.1. Fauna species recorded

During the field assessment 120 fauna species were recorded. This included 101 bird (10 introduced), 10 mammal (5 introduced), six reptile, three frog and an array of invertebrate species (Appendix 5).

5.8.2. Listed fauna species

The review of existing information indicated that 61 fauna species listed under the Commonwealth EPBC Act and the state FFG Act have previously been recorded within the search region in the last 35 years or for which potential habitat occurs according to the EPBC Act Protected Matters Search Tool (see also Figure 21). The likelihood of occurrence of these species in the study area was assessed and the results are presented in Table 6.

Species considered 'likely to occur' are those that have a very high chance of being in the study area given the existence of numerous records in the search region and suitable habitat in the study area. Using the precautionary approach, species considered to have the 'potential to occur' (at least occasionally) are those where suitable habitat exists or is situated close to the wind farm boundaries, but recent records are scarce.

This assessment of potential occurrence of listed fauna species excludes:

- Marine fauna (such as whales, dolphins and sea-lions etc) given that the study area is inland with no significant marine linkages; and
- Migratory oceanic bird species (such as albatrosses and petrels) given that the study area is inland.

The susceptibility of these species to impacts from development is discussed in Section 5.7.3.

Table 6: Listed fauna species from the search region and likelihood of occurrence in the study area.

Common Name	Scientific name	Conservation Status			Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M	FFG				
Birds								
Australasian Bittern	*Botaurus poiciloptilus*	EN		L	Terrestrial wetlands, including a range of wetland types but prefers permanent water bodies with tall dense vegetation, particularly those dominated by sedges, rush, reeds or cutting grass (Marchant and Higgins 1990).	None	N/A	Although there was some potential habitat in the broader study area this species is an uncommon visitor to the region and is considered **unlikely to occur**
Australian Painted Snipe	*Rostratula australis*	EN	M (CAMBA)	L	Lowlands on shallow freshwater swamps with emergent vegetation and flooded saltmarshes (Marchant and Higgins 1993).	None	N/A	Although suitable wetland habitat is present in the broader study area, sAs the nearest recent records are in wetland around Melbourne and at Sale and there are no records either in the VBA or in the Atlas of Australian Birds (http://birdata.com.au/homecontent., viewed 01/07/16), this species is **unlikely to occur.**
Baillon's Crake	*Porzana pusilla palustris*			L	Vegetated freshwater wetlands, swamps with emergent vegetation	None	N/A	**Recorded** in study area
Bar-tailed Godwit	*Limosa lapponica*	CR	M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Mainly coastal species, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (Higgins and Davies 1996).	1	27/2/2015	No suitable habitat. **Unlikely to occur.**
Black-faced Monarch	*Monarcha melanopsis*		M (Bonn Convention (A2H))		Rainforests, eucalypt woodlands, coastal scrub and damp gullies (Higgins et al. 2006)	None	N/A	Suitable forest and woodland habitat though lack of records, **potential to occur**
Black-tailed Godwit	*Limosa limosa*		M (JAMBA, CAMBA, Bonn Convention (A2H))		Mainly coastal species, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (Higgins and Davies 1996).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Caspian Tern	*Hydroprogne caspia*		M (JAMBA, CAMBA)	L	Sheltered coastal embayment, including harbours, lagoons, inlets, estuaries and river deltas, usually with sandy or muddy margins (Higgins and Davies 1996).	6	21/12/2009	No suitable habitat. **Unlikely to occur.**
Cattle Egret	*Ardea ibis*		M (JAMBA, CAMBA)		Wooded lands and terrestrial freshwater wetlands and pasture, in association with cattle (Marchant and Higgins 1990).	4	25/05/2001	Suitable habitat exists and recent records in the study area. **Likely to occur.**
Common Greenshank	*Tringa nebularia*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabits wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins and Davies 1996).	4	27/02/2015	No suitable habitat. **Unlikely to occur.**
Common Sandpiper	*Actitis hypoleucos*		M (JAMBA, CAMBA, ROKAMBA, Bonn (A2H)		Inhabits a wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins and Davies 1996).	2	4/03/1977	No suitable habitat. **Unlikely to occur.**

Common Name	Scientific name	Conservation Status			Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M	FFG				
Common Tern	*Sterna hirundo*		M (JAMBA, CAMBA, ROKAMBA)		Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	1	1/01/1977	No suitable habitat. **Unlikely to occur.**
Curlew Sandpiper	*Calidris ferruginea*	CR	M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabits wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins and Davies 1996).	4	3/03/1999	No suitable habitat. **Unlikely to occur.**
Double-banded Plover	*Charadrius bicinctus*		M (Bonn Convention (A2H))		Inhabits wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Marchant and Higgins 1993).	1	1/01/1977	No suitable habitat. **Unlikely to occur.**
Eastern Curlew	*Numenius madagascariensis*	CR	M (JAMBA, CAMBA, ROKAMBA, Bonn (A2H)		Inhabits sheltered coasts, especially estuaries, embayment, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats, often with beds of sea grass (Higgins and Davies 1996).	7	27/02/2015	No suitable habitat. **Unlikely to occur.**
Eastern Great Egret	*Ardea modesta*		M (JAMBA, CAMBA)	L	Occurs in a variety of wetlands including: permanent water bodies on flood plains; shallows of deep permanent lakes, either open or vegetated with shrubs or trees; semi-permanent swamps with tall emergent vegetation (e.g. bulrush) and herb dominated seasonal swamps with abundant aquatic flora (Marchant and Higgins 1990).	14	25/04/2004	**Recorded** in study area
Fairy Prion	*Pachyptila turtur*	VU			Marine bird; in subtropical and subantarctic seas (Marchant and Higgins 1990).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Fairy Tern	*Sternula nereis nereis*	VU		L	Sheltered coasts, on mainland and inshore and offshore islands. Occurs in embayment, such as harbours, inlets, bays, estuaries and lagoons and on ocean beaches. Also on lakes and salt ponds (Higgins and Davies 1996).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Fork-tailed Swift	*Apus pacificus*		M (JAMBA, CAMBA, ROKAMBA		Aerial over predominately open country.	None	N/A	**Recorded** in study area
Glossy Ibis	*Plegadis falcinellus*		M (CAMBA, Bonn (A2S))		Prefer freshwater inland wetlands, in particular, permanent or ephemeral water bodies and swamps with abundant vegetation (Marchant and Higgins 1990).	1	7/03/2001	May occasionally pass through the study area - **potential to occur**
Great Knot	*Calidris tenuirostris*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))	L	Inhabit sheltered coastal habitats with large intertidal mudflats or sandflats. Including inlets, bays, harbours, estuaries and lagoons; also ocean beaches (Higgins and Davies 1996).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**

Common Name	Scientific name	Conservation Status			Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M	FFG				
Greater Sand Plover	*Charadrius leschenaultii*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Entirely coastal; mainly on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks (Marchant and Higgins 1993).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Grey Goshawk	*Accipiter novae-hollandiae novae-hollandiae*			L	Inhabit rainforests, open forests, swamp forests, woodlands and plantations; most abundant where forest or woodland provide cover for hunting from perches (Marchant and Higgins 1993).	1	1/02/1922	Suitable habitat exists, but there are no recent records of the species in this part of South Gippsland in the Atlas of Australian Birds (http://birdata.com.au/homecontent., viewed 01/07/16) or in the VBA since 1922, therefore **unikely to occur.**
Grey Plover	*Pluvialis squatarola*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Entirely coastal, but occasionally inland. Mainly on marine shores, inlets, estuaries and lagoons where there are nearby large tidal mudflats for feeding and sandy beaches for roosting (Marchant and Higgins 1993).	1	1/01/1977	No suitable habitat and lack of recent records. **Unlikely to occur.**
Grey-tailed Tattler	*Tringa brevipes*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))	L	Usually found on sheltered coasts with reefs and rock platforms or with mudflats exposed at low tide and forage on wet mudflats and among rocks, and often roost on rocks (Higgins and Davies, 1996).	1	1/01/1977	No suitable habitat and lack of recent records. **Unlikely to occur.**
Gull-billed Tern	*Gelochelidon nilotica macrotarsa*			L	Shallow freshwater and saline wetlands; intertidal mudflats, also in sheltered inshore marine waters where they roost on sandbars and beaches (Higgins and Davies 1996).	3	1/01/1977	No suitable habitat and lack of recent records. **Unlikely to occur.**
Hooded Plover	*Thinornis rubricollis rubricollis*			L	Inhabits sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding. Widespread in all coastal waters of Victoria (Marchant and Higgins 1993).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Intermediate Egret	*Ardea intermedia*			L	It mainly inhabits terrestrial wetlands; only occasionally visit coastal wetlands and forages amongst aquatic vegetation in shallow water and requires trees for roosting and nesting. It often occurs in wetlands that contain vegetation, including bulrush (Marchant and Higgins 1990).	2	25/04/2004	Suitable habitat exists and recent records in the study area. **Likely to occur.**
Latham's Snipe	*Gallinago hardwickii*		M (JAMBA, CAMBA, ROKAMBA, Bonn A2H)		Occurs in wide variety of permanent and ephemeral wetlands; it prefers open freshwater wetlands with dense cover nearby, such as the edges of rivers and creeks, bogs, swamps, waterholes (Naarding 1983; Higgins and Davies 1996).	6	20/12/2012	**Recorded** in study area

Common Name	Scientific name	Conservation Status			Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M	FFG				
Lesser Sand Plover	*Charadrius mongolus*		M (JAMBA, CAMBA, ROKAMBA, Bonn (A2H)		Inhabits beaches of sheltered bays, harbours, and estuaries with large intertidal sandflats or mudflats (Marchant and Higgins 1993).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Little Egret	*Egretta garzetta nigripes*			L	It occurs in a range of coastal and terrestrial wetlands, including freshwater wetlands with vegetation such as bulrush and requires trees for roosting and nesting (Marchant and Higgins 1990).	3	25/05/2001	**Recorded** in study area
Little Tern	*Sternula albifrons sinensis*		M (JAMBA, CAMBA, ROKAMBA, Bonn (A2S))	L	Sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand spits (Higgins and Davies 1996).	1	1/01/1977	No suitable habitat and lack of recent records. **Unlikely to occur.**
Marsh Sandpiper	*Tringa stagnatilis*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabits sandy, muddy or rocky shores, usually coastal, rarely far inland. Often on beaches and mudflats, sandflats and occasionally rock shelves (Higgins and Davies 1996).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Orange-bellied Parrot	*Neophema chrysogaster*	CE	M (JAMBA)	L	Inhabits natural saltmarshes dominated by Beaded Glasswort and Shrubby Glasswort as well as associated grassy or weedy pastures (Commonwealth of Australia 2005).	None	N/A	There is limited suitable saltmarsh habitat within the broader study area and this species is an uncommon visitor to the region, **unlikely to occur.**
Osprey	*Pandion cristatus*		M (Bonn (A2S))		Rare vagrant to Victoria (Marchant & Higgins 1993). Littoral and coastal habitats and terrestrial wetlands. They are mostly found in coastal areas but occasionally travel inland along major rivers (Johnstone & Storr 1998; Marchant & Higgins 1993; Olsen 1995). They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins 1993).	None	N/A	No suitable habitat. **Unlikely to occur.**
Pacific Golden Plover	*Pluvialis fulva*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabits sandy, muddy or rocky shores, usually coastal, rarely far inland. Often on beaches and mudflats, sandflats and occasionally rock shelves (Marchant and Higgins 1993).	None	N/A	No suitable habitat and lack of records. **Unlikely to occur.**
Painted Honeyeater	*Grantiella picta*	VU		L	Inhabits box-ironbark forests and woodlands and mainly feeds on the fruits of mistletoe. Strongly associated with mistletoe around the margins of open forests and woodlands (Higgins et al. 2001; Tzaros 2005).	None	N/A	No suitable habitat. **Unlikely to occur.**
Pin-tailed Snipe	*Gallinago stenura*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	None	N/A	No suitable habitat. **Unlikely to occur.**

Common Name	Scientific name	Conservation Status			Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M	FFG				
Powerful Owl	*Ninox strenua*			L	Open and tall wet sclerophyll forests with sheltered gullies and old growth forest with dense understorey. They are also found in dry forests with box and ironbark eucalypts and River Red Gum. Large old trees with hollows are required by this species for nesting (Higgins 1999; Soderquist et al. 2002).	5	17/03/2008	Suitable forest and woodland habitat exists and recent records near the broader study area. **Likely to occur.**
Rainbow Bee-eater	*Merops ornatus*		M (JAMBA)		Usually in open or lightly timbered areas, often near water. Occur in partly cleared land such as farmland and in sand-dunes, both coastal and inland (Higgins 1999).	None	N/A	–No recent records in South Gippsland - **unlikely to occur**
Red Knot	*Calidris canutus*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H)		Inhabits intertidal mudflats, sandflats, and sandy beaches of sheltered coasts, in estuaries, bays, inlets, and lagoons (Higgins and Davies 1996).	2	27/02/2015	No suitable habitat. **Unlikely to occur.**
Red-necked Stint	*Calidris ruficollis*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	5	27/02/2015	May occasionally pass through/fly over the study area - **potential to occur**
Regent Honeyeater	*Anthochaera phrygia*	CR	M (JAMBA)	L	Inhabits dry box-ironbark eucalypt forests near rivers and creeks on inland slopes of the Great Dividing Range. It could also occur in small remnant patches or in mature trees in farmland or partly cleared agricultural land (Higgins et al. 2001).	None	N/A	No suitable habitat. **Unlikely to occur.**
Ruddy Turnstone	*Arenaria interpres*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	1	1/01/1977	No suitable habitat. **Unlikely to occur.**
Rufous Fantail	*Rhipidura rufifrons*		M (Bonn Convention (A2H))		Primarily found in dense, moist habitats. Less often present in dry sclerophyll forests and woodlands (Higgins et al. 2006).	2	29/01/1998	Suitable forest and woodland habitat exists and some records in the nearby search region. **Potential to occur.**
Sanderling	*Calidris alba*		M (JAMBA, CAMBA, ROKAMBA, Bonn (A2H))		Inhabits open sandy beaches exposed to sea-swells; also on exposed sandbars and spits (Higgins and Davies 1996).	None	N/A	No suitable habitat. **Unlikely to occur.**
Satin Flycatcher	*Myiagra cyanoleuca*		M (Bonn Convention (A2H))		Tall forests and woodlands in wetter habitats but not in rainforest (Higgins et al. 2006)	2	29/01/1998	May pass through the area during migration - **potential to occur**

Common Name	Scientific name	Conservation Status			Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M	FFG				
Sharp-tailed Sandpiper	*Calidris acuminata*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	None	N/A	No suitable habitat. **Unlikely to occur.**
Swift Parrot	*Lathamus discolor*	EN		L	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' (Emison et al. 1987; Higgins 1999; Kennedy and Tzaros 2005).	1	11/04/1991	Suitable woodland and forest habitat exists though recent and regular records are lacking in the study area - **potential to occur**
Terek Sandpiper	*Xenus cinereus*		M (JAMBA, CAMBA, ROKAMBA, Bonn (A2H))	L	Inhabits saline intertidal mudflats in sheltered estuaries, harbours and lagoons; on islets, mudbanks, sandbanks or spits (Higgins and Davies 1996).	None	N/A	No suitable habitat. **Unlikely to occur.**
Whimbrel	*Numenius phaeopus*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabit intertidal mudflats of sheltered coasts, harbours, lagoons, estuaries and river deltas. Prefer mudflats with mangrove, but also occur on open, unvegetated mudflats (Higgins and Davies 1996).	2	1/10/1983	No suitable habitat. **Unlikely to occur.**
White-bellied Sea-Eagle	*Haliaeetus leucogaster*			L	Maritime habitats, terrestrial large wetlands and coastal lands of tropical and temperate Australia and offshore islands, ranging far inland only over large rivers and wetlands (Marchant and Higgins 1993).	4	25/04/2004	Suitable habitat exists and recent records in the study area. **Likely to occur.**
White-throated Needletail	*Hirundapus caudacutus*		M (JAMBA, CAMBA, ROKAMBA)		Aerial, over all habitats, but probably more over wooded areas, including open forest and rainforest. Often over heathland and less often above treeless areas such as grassland and swamps or farmland (Higgins 1999).	9	29/02/2004	**Recorded** flying over the broader study area
Wood Sandpiper	*Tringa glareola*		M (JAMBA, CAMBA, ROKAMBA, Bonn Convention (A2H))		Inhabits well vegetated, shallow, freshwater wetlands, such as swamps, lakes, pools, and waterholes; typically with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reed (Higgins and Davies 1996).	None	N/A	Although there was some potential habitat in the broader study area this species is an uncommon visitor to the region and is considered **unlikely to occur**
Mammals								
Grey-headed Flying-fox	*Pteropus poliocephalus*	VU		L	Roosts in riverine habitat in Melbourne and forages widely in flowering eucalypts and fruit trees (Menkhorst 1995). A seasonal camp is located in Bairnsdale with up to 26,000 flying-foxes being documented by DELWP over the summer period, but then migrate elsewhere as the colder winter weather arrives.	None	N/A	No recent records in the search area and the Bairnsdale seasonal camp is approximately 125 kilometres from the proposed wind farm site - **unlikely to occur**

Common Name	Scientific name	Conservation Status			Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M	FFG				
Long-nosed Potoroo	*Potorous tridactylus*	VU		L	In Victoria – coastal heath and heathy woodland (Menkhorst 1995). Dominated by sandy loam vegetation species.	None	N/A	Suitable nearby habitat - **potential to occur**
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	EN		L	Heathy forest, heath and coastal scrub, open grassy woodlands and with dense intact understory (Menkhorst 1995).	None	N/A	Suitable nearby habitat - **potential to occur**
Smoky Mouse	*Pseudomys fumeus*	EN		L	Coastal heath, heathy woodland, sub-alpine heath, dry forest and gullies in wet forest (Menkhorst 1995).	None	N/A	Although potentially suitable habitat occurs, there are no nearby records - **unlikely to occur**
Swamp Antechinus	*Antechinus minimus maritimus*			L	Dense wet heath, tussock grassland, sedgeland heathy woodland and coastal heath and scrub (Menkhorst 1995).	1	1/05/1981	Suitable nearby habitat - **potential to occur**
White-footed Dunnart	*Sminthopsis leucopus*			L	Coastal tussock grassland and sedgeland, wet heath, and forest or woodland with a dense heathy understorey or mid-storey vegetation (Menkhorst 1995).	1	1/01/1976	Suitable nearby habitat - **potential to occur**
Frogs								
Growling Grass Frog	*Litoria raniformis*	VU		L	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).	None	N/A	Suitable habitat exists in the broader study area though lack of nearby records. **unlikely to occur.**
Fish								
Australian Grayling	*Prototroctes maraena*	VU		L	Large and small coastal streams and rivers with cool, clear waters with a gravel substrate and altering pools and riffles (Cadwallader and Backhouse 1983).	4	6/01/1982	Suitable habitat exists in the Alberton River though lack of recent and regular records in the search region. **Potential to occur.**
Dwarf Galaxias	*Galaxiella pusilla*	VU		L	Barwon River to Mitchell River. Vegetated margins of still water, ditches, swamps and backwaters of creeks, both ephemeral and permanent (Allen et al. 2002).	None	N/A	Suitable habitat exists in the broader study area although lack of records. **unlikely to occur.**

Notes: EPBC-T = threatened species status under EPBC Act:

EX = presumed extinct in the wild

CE = critically endangered

EN = endangered

VU = vulnerable

EPBC-M = migratory status under the EPBC Act:

Bonn Convention (A2H) - Convention on the Conservation of Migratory Species of Wild Animals – listed as a member of a family

Bonn Convention (A2S) - Convention on the Conservation of Migratory Species of Wild Animals - species listed explicitly

CAMBA - China- Australia Migratory Birds Agreement

JAMBA - Japan-Australia Migratory Birds Agreement

ROKAMBA - Republic of Korea Australia Migratory Birds Agreement

FFG = threatened species status under the FFG Act: **L** = listed as threatened

5.8.3. Susceptibility of listed fauna to impacts

The following analysis identifies the susceptibility of listed fauna species which may utilise the study area to the potential impacts of the proposed wind farm. This analysis includes consideration of the factors below.

- The mobility of the species; and
- The availability and extent of other suitable habitat in the region and the degree to which each species may rely on habitat in the study area.

Birds

Eight listed non-migratory bird species were recorded or are considered to have the potential to occur in the study area. The likelihood of occurrence in the study area and vulnerability of these species to possible impacts from the proposed development are discussed below.

- **Baillon's Crake** (FFG Act: Listed)
- **Eastern Great Egret** (FFG Act: Listed)
- **Intermediate Egret** (FFG Act: Listed)
- **Little Egret** (FFG Act: Listed)

  The above four species (with the exception of Intermediate Egret) were recorded during the current fauna survey, and are therefore known to utilise suitable habitats within the study area. Baillon's Crake was recorded from a dam north of Pound Road West, and Eastern Great Egret was recorded along Old Welshpool Road, east of proposed Turbine 27. These waterbird species are listed on the FFG Act and found in association with wetlands, creeks, rivers and farm dams.

  There is potential for direct impacts from strikes, although the number and frequency of occurrence of these species is on the site is low and the likelihood of turbine collision is considered very low. The low likelihood of collision with operating turbines makes a significant impact on these species from the project very unlikely. To avoid the direct loss of habitat for these species, it is recommended that turbines and associated infrastructure avoid drainage lines, ponds, dams, marshes and the Albert River and its tributaries by a wide a margin possible and by at least 100 metres (assuming turbine blade length up to 75 metres).

- **White-bellied Sea-Eagle** (FFG Act: Listed)

  This species is restricted to coastal habitats, but may occasionally travel inland along the river systems, including possibly the Albert River, whilst foraging or moving about its territory. This species has been recorded south of the broader study area boundaries, in association with its preferred habitat of coastal and estuarine ecosystems. Eagles are vulnerable to collision with operating turbines. No evidence was found for nesting near proposed turbine locations during site studies, however the species may occasionally fly across the wind farm site given its proximity to coastal habitats. This could put individuals at risk of occasionally colliding with operating wind turbines. The frequency of such collisions is likely to be very low so population consequences are not considered significant given the state population is estimated at 100 adult pairs plus sub-adults, with the Corner Inlet area in South Gippsland supporting approximately 25 of these pairs (DSE 2003). It will be

important to monitor for the presence of this species as part of any impact monitoring and mitigation plan and have a plan involving investigation and a targeted mitigation response should repeated collision be detected.

- **Powerful Owl** (FFG Act: Listed)

  This species has been historically recorded within habitats associated with the Alberton West State Forest to the north of the proposed wind farm site. Additionally, it has been seen within the northern section of the wind farm (local landholder *pers. comm.*). It is possible Powerful Owl may utilise some wooded areas of the study area and move occasionally into the southern forest at Hedley, where there are large hollow-bearing trees. The primary risk to this species is during nocturnal dispersive and foraging movements when they may potentially fly at RSA heights. Movements by the Powerful Owl are generally confined within forests habitats, which would therefore not involve any part of the proposed wind farm. Juvenile Owl dispersal from a breeding territory may result in a one-off flight across a gap between forest patches, such as north and south of the South Gippsland Highway between large nearby forest blocks, such as Alberton and Hedley. As no turbines are proposed between treed habitats at Hedley and the Alberton West State Forest at the narrowed gap between them, the likelihood of Powerful Owl being affected by nearby wind turbines is considered very low.

- **Swift Parrot** (EPBC Act: Critically Endangered; FFG Act: listed)

  This species has the potential to forage in indigenous and planted eucalypts in the study area. The Swift Parrot could occur occasionally during dispersive movements, particularly when in transit between large forested areas. This species has not been recorded in the area therefore it is expected that it would not occur regularly. The population of Swift Parrot likely to use the study area is very small relative to that using the larger forested blocks north of the Great Dividing Range or interstate. Therefore, this species is likely to experience minimal impact from the proposed wind farm.

Migratory Birds

Ten listed migratory bird species (excluding oceanic species and shorebirds) have been recorded or have the potential to occur in the study area based on the availability of suitable habitat.

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

- **Fork-tailed Swift** and **White-throated Needletail**

  Both species were recorded in the study area during BL&A Bird Utilisation Surveys. They are likely to occur over large areas of the proposed study area during the migratory dispersal period (mostly late spring and summer). They are aerial foragers, spending most of their time flying in search of aerial insect prey (Higgins 1999). Both species could therefore be susceptible to collisions with turbines and other structures as the species fly mostly at and above RSA height. The White-throated Needletail has been recorded colliding with wind turbines at a number of south-eastern Australian wind farms in recent years (BL&A, unpubl. data) and it is likely the occasional individual will be affected by the proposed project. The population of these species numbers 10,000 or more (Higgins 1999), so the loss of the occasional individual is expected to have negligible consequences for the species' populations.

- **Latham's Snipe**

  Latham's Snipe is a migratory species that visits south-eastern Australia from August to February. The species is a very agile and inconspicuous species and generally feeds in low light and throughout the night. Due to the presence of suitable aquatic habitat on the proposed wind farm site, including drainage lines and ephemeral wetlands, it is likely to occur occasionally in the study area. Most disturbance would occur to this habitat during the construction phase of the project, during which it would be able to move to alternative suitable habitat. Therefore, impacts would be minor and would not substantially modify its available habitat. The Latham's Snipe occasionally flies at turbine height but there are no known records of it colliding with wind turbines in Australia (BL&A unpubl. data). It is unlikely therefore that the project will represent a significant risk to the species' population.

- **Cattle Egret**

  This species is a summer visitor to southern Australia and feeds in pasture land. Given the large extent of pasture in the region and the ability of the species to move to alternative areas, the impacts to this species during construction are considered negligible. Risks during operation arise from the potential for collision with operating wind turbines. This is likely to be an infrequent event. Although this is a listed migratory species, it is nonetheless not threatened and occurs in thousands throughout eastern Australia. Therefore, the impacts on the overall population of an occasional turbine collision are considered negligible.

- **Glossy Ibis** and **Red-necked Stint**

  These two species are likely to occur in small numbers in ephemeral wetlands on the site in spring when these hold water or after heavy rainfall events. The likely low incidence of occurrence however makes it unlikely that the proposed wind farm will lead to a significant impact on their overall populations.

- **Black-faced Monarch**

  This species may occur in areas of remnant woodland during migratory dispersion. The proposed turbines are situated away from woodland and forest habitats to minimise risk to woodland bird species. The Black-faced Monarch usually confines to woodland habitats and is expected to fly below RSA. Therefore, this species is likely to experience minimal impact from the proposed wind farm.

- **Rufous Fantail**

  This species could occur in remnant areas of native vegetation in the broader study area. It is associated with rainforests and densely vegetated gullies. Similarly to Black-faced Monarch, it is expected to fly below RSA and generally confine its activities to wooded areas where no turbines are proposed to be built. Therefore, this species is likely to experience minimal impact from the proposed wind farm.

- **Satin Flycatcher**

  This species breeds in the cool temperate forests and woodlands in southern and mountain districts of Victoria and Tasmania, migrating north to New Guinea for winter (Higgins *et al*. 2006). The population of Satin Flycatcher likely to use the study area is very small relative to that occupying the larger forested blocks in the eastern highlands, Otway Range and Grampians and elsewhere in Victoria (Emison *et al*. 1987). It is expected to fly below RSA and generally confine its activities to wooded areas where no turbines are proposed to be built. Therefore, this species is likely to experience minimal impact from the proposed wind farm.

Mammals

Based on the assessment in Table 5, the following four listed ground-dwelling mammals have the potential to occur in suitable habitats within the study area and in adjacent remnant blocks of vegetation.

- **Southern Brown Bandicoot** (EPBC Act: endangered; FFG Act: Listed)
- **Long-nosed Potoroo** (EPBC Act: vulnerable; FFG Act: Listed)
- **Swamp Antechinus** (FFG Act: Listed)
- **White-footed Dunnart** (FFG Act: Listed)

  These species prefer habitat with dense vegetation cover (Menkhorst 1995). There are records of Swamp Antechinus and White-footed Dunnarts 30 years ago in close proximity to the wind farm boundary. These habitats provide a high level of constraint, and where possible, removal of vegetation in these areas should be avoided. Provided direct impacts on these habitats can be avoided no significant impacts are anticipated from the proposed wind farm.

Reptiles

No listed reptile species have the potential to occur in the study area.

Frogs

No listed frog species have the potential to occur on the proposed wind farm site. Frog species are not considered at risk from proposed wind farm developments because they generally occur on lowlands or near water bodies. Provided a suitable buffer of at least 50 metres is provided from waterways and wetland habitats impacts on frog habitat are not expected.

Fish

Two listed fish species are considered to have the potential to occur in the study area. The likelihood of occurrence in the study area and vulnerability of these species to possible impacts from the proposed development are discussed below.

- **Australian Grayling** (EPBC Act: vulnerable; FFG Act: Listed)

  Australian Grayling exists in large and small coastal streams and rivers with cool, clear waters with a gravel substrate and altering pools and riffles (Cadwallader and Backhouse 1983). Suitable habitat exists within the study area and there are historical records in the Albert River in the north-east of the study area. Provided there are no impacts on flows or water quality in the Albert River from construction

and operation of the proposed wind farm then impacts are not expected on this species. This can be assured by ensuring a minimum 30 metres separation between the development footprint (i.e. turbines, access tracks and power cabling) and the Albert River and any significant tributaries on the site.

- **Dwarf Galaxias** (EPBC Act: vulnerable; FFG Act: Listed)

  Dwarf Galaxias occur amongst marginal vegetation in still or gently flowing water of roadside ditches, swamps, and backwaters of creeks (Allen *et al*. 2002). Suitable habitat exists within the study area, particular with tributaries associated with the Albert and Jack Rivers in the north-east of the site. Provided there are no impacts on flows or water quality in the Albert River from construction and operation of the proposed wind farm then impacts are not expected on this species. This can be assured by ensuring a minimum 30 metres separation between the development footprint (i.e. turbines, access tracks and power cabling) and the Albert River and any significant tributaries on the site.

Invertebrates

No listed invertebrate species have recorded historically within the broader study area. There is potential for some listed invertebrate species to exist. During the fauna overview assessment for example, it was noted that many burrowing crayfish are present within wet habitats in the south-east of the study area, in association with the saltmarsh habitats linked with drainage lines. Provided these habitats can be avoided (see recommended separation of 30 metres from major waterway and wetland habitats above) significant impacts on such species, if present, are unlikely.

5.8.4. Susceptibility of non-listed fauna species to impacts

Koalas

A well known Koala population inhabits South Gippsland, the Strzelecki Ranges Koalas (probably around 500 animals). This non-threatened species in Victoria may occasionally visit the broader wind farm area. The 16 scattered trees proposed for removal include four Coast Mana-gum and 12 Swamp Paperbark trees. Pre-clearance surveys by a qualified zoologist should be undertaken for koalas for the Manna-gum trees as this is the preferred food tree of koalas. Should a koala be found in a tree proposed for removal, Wildlife Services should be called to relocate the koala to a different tree nearby that is going to be retained.

Wedge-tailed Eagles

The Wedge-tailed Eagle is considered to be a high profile species and one of the most vulnerable species to collision with operating turbines. This species was observed twice over the wind farm site but outside the formal BUS surveys. No evidence was found of eagles nesting within the wind farm boundary. Based on the above, the wind farm site is likely to be part of the territory of one pair of eagles that reside and probably breed in woodland outside the wind farm site. The pair is likely to forage over the wind farm site itself, although it was not observed regularly during the current survey (see also BL&A 2016a).

5.9. Listed ecological communities

Three ecological communities were modelled to potentially occur in the study area. Of these, the ecological communities below are considered to potentially occur in the study area due to the presence of loosely corresponding site characteristics and general species composition.

- Natural Damp Grassland of the Victorian Coastal Plains – listed as critically endangered under the EPBC Act (potential to occur in damp areas in the south-eastern corner of the broader study area). Areas of suitable habitat for this community occur within the proposed development footprint.

  The targeted surveys confirmed that this community is not present in the study area.

- Subtropical and Temperate Coastal Saltmarsh – listed as vulnerable under the EPBC Act (in areas of coastal saltmarsh, where tidal inundation is infrequent). Areas of suitable habitat for this community occur outside the proposed development footprint.

Based on an assessment of native vegetation in the study area against published descriptions and condition thresholds, the communities below were found not to occur in the study area based on the factors described below.

- Central Gippsland Plains Grassland Community - Native grasslands in the broader study area did not support the structure or floristic assemblage described in the FFG Act Action Statement (Craigie & Moorree 2003) and Characteristics of Threatened Communities description of this community (e.g. Dominance or presence of Kangaroo Grass and open to closed tussock grassland structure).

6. IMPACTS AND REGULATORY IMPLICATIONS

6.1. Proposed development

The proposed development will involve the construction of 34 wind turbines (each with an adjacent hardstand required for construction), access tracks, underground cabling, overhead powerlines and four work compounds.

The extent of the area of impact for the current proposal was considered to include the outer-most boundaries of the following:

- Access tracks – six metres wide;
- Underground cabling and associated trenching – three metres wide;
- Overhead transmission lines – 16 metres wide (complete removal along alignments assumed);
- 34 wind turbines –15 metre radii;
- One hardstand beside each wind turbine – 25 x 45 metres;
- Two small electrical substations – contained within the above impact areas
- One large electrical substation; and
- Four works compounds – 0.575 to 2.773 hectares (not all of these compounds will be used but impacts for all compounds have been assumed for this investigation).

Swept paths for site access points were not provided and were therefore not included in the current analysis.

6.2. Design response to mitigate impacts on flora and fauna

The project was designed to meet the strategies outlined in the Guidelines through the adoption of the specific design measures listed below.

- Where feasible, proposed access tracks follow existing, cleared farm tracks.
- The vast majority of the remaining development footprint has been sited within cleared agricultural land.
- Turbines T04, T05, T06 and T07 were moved approximately 150 metres west to their current locations. This measure was adopted to avoid impacts upon large, scattered trees and to reduce risks to avifauna moving in and about the state forest to the east.
- An access track was moved out of Birds Road (a narrow road lined on either side with diverse sedgy, shrubby and grassy vegetation as well as overhanging trees) and into the cleared private land to the east.
- Works compounds and electrical substations have been sited within cleared farm paddocks.
- A previously proposed turbine was eliminated from within a narrow band of cleared vegetation just north of the South Gippsland Highway, between Alberton West State Forest (to the north) and the aforementioned state forest (to the south). This turbine was considered to pose a high risk to avifauna moving between the two forests.

- Turbines T08, T10, T11, T13, T16 and T19 were moved approximately 100 metres north to their current locations. This measure was adopted to reduce risks to avifauna moving in and about the state forest to the south.
- Access tracks to Turbines T08, T10, T11, T13, T16 and T19 were rerouted to cleared land to avoid overhanging trees and tree lines supporting native canopy and/or understorey vegetation.
- An access track was rerouted into cleared land to avoid impacts upon Vegetation Sites 15h and 15i as well as to Habitat Zones A, B, C and I.
- A turbine previously proposed to the north-east of the intersection between Lanes Road and the South Gippsland Highway was eliminated, reducing impacts to native vegetation.
- The access tracks to Turbine T29 was rerouted out of the well-vegetated rail trail (to the north-west) into adjacent cleared farmland.
- Turbine T34 was moved slightly, out of native vegetation and into weed pasture.
- Access tracks to Turbine T34 were rerouted to reduce the extent of native vegetation impacts.
- Turbine T24 and associated access tracks were microsited to avoid impacts upon native vegetation.
- The access point to Turbines T20, T21 and T23 was relocated to avoid impacts upon the Jack River and native vegetation within.
- An access track was moved out of Old Alberton Road (a narrow road lined on either side with shrubby vegetation) and into the cleared private land.

All of the above changes resulted in considerable reductions in overall proposed native vegetation removal.

The proponent has indicated that, where feasible, further micrositing of infrastructure will occur during the construction stage, to further reduce impacts to native vegetation. The impacts presented in this report therefore present a conservative account of proposed impacts.

Further recommendations to mitigate impacts on flora and fauna are presented in Section 6.5.

6.3. Residual impacts of proposed development under state provisions

Residual impacts have been identified for the proposed development following implementation of the above mitigation measures in the design process. These impacts on ecological values are outlined below and shown in Figure 3.

6.3.1. Flora and native vegetation

The proposed development footprint will result in the impacts below.

- Potential impacts upon of the following EPBC and FFG Act listed threatened flora species were confirmed to be very unlikely, as targeted surveys found none of the species within the study area during seasonally appropriate (spring) surveys of the potential habitat affected by the development footprint:
    - Clover Glycine

- Eastern Spider-orchid
- Maroon Leek-orchid
- Metallic Sun-orchid
- River Swamp Wallaby-grass
- Strzelecki Gum
- Thick-lip Spider-orchid

- Removal of 1.195 hectares of remnant patch native vegetation and
- Removal of sixteen scattered trees.

6.3.2. Fauna species

The analysis of susceptibility of listed fauna species to impacts presented in Section 5.8.3 identified that the following bird species could be impacted by the proposed wind farm development in the study area, as they fly at RSA height are likely to forage over the study area:

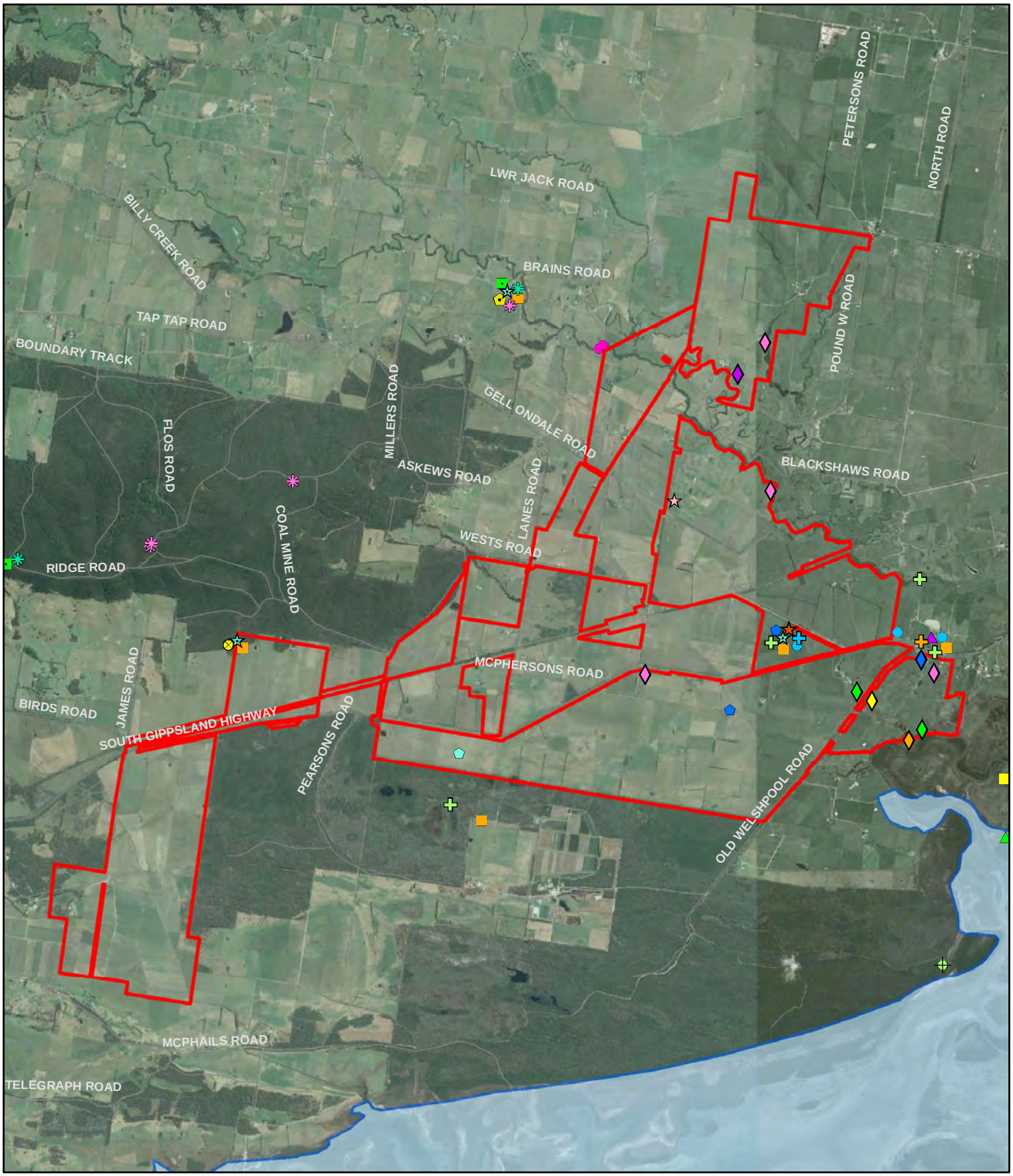
- Powerful Owl
- Fork-tailed Swift
- White-throated Needletail

Targeted surveys for Powerful Owl in areas of forest may well confirm their presence (already confirmed for the Alberton West state forest) but would not change conclusions in relation to the likelihood of impact, as discussed earlier in this report (see Section 5.8). The owl generally confines itself to forested habitats, none of which will have turbines built in them and dispersal of juvenile owls after breeding is finished would be a rare event most likely confined to the areas where treed habitats are closest. Where this occurs, either side of the South Gippsland Highway, no turbines are proposed to be constructed. The likelihood of an ongoing impact on this species is therefore considered to be very low.

Targeted surveys for the two swift species are not considered productive as these species are predominantly aerial foragers that move about the landscape at a continental scale over a range of habitats, from farmland and desert to dense forested mountains. Their movements are effectively random over time, depending on local and regional weather fronts, with occurrence in any part of the development footprint considered to have an equal likelihood.

Threatened ecological communities

Turbine T34 and associated access tracks were considered to potentially impact upon Natural Damp Grassland of the Victorian Coastal Plains, but targeted surveys confirmed that this ecological community does not occur within the proposed development footprint.



Legend

- Study area
- Ramsar site

Threatened Fauna - BL&A records

- Eastern Great Egret
- Latham's Snipe
- Little Egret
- Pacific Gull
- Royal Spoonbill
- Baillon's Crake

Threatened Fauna - VBA records

- Australian Grayling
- Cattle Egret
- Common Greenshank
- Common Sandpiper
- Eastern Great Egret
- Eastern Pygmy-possum
- Eastern Snake-necked Turtle
- Glossy Ibis
- Grey Goshawk
- Gull-billed Tern
- Latham's Snipe
- Little Egret
- Musk Duck
- Powerful Owl
- Rufous Fantail
- Satin Flycatcher
- Southern Toadlet
- White-bellied Sea-Eagle
- White-footed Dunnart
- White-throated Needletail

0 1 2 4 Kilometers

Figure 21: Threatened fauna records

Project: Alberton Wind Farm

Client: Synergy Wind Pty Ltd

Project No.: 14107	Date: 26/07/2016	Created By: M. Ghasemi / I. Kulik

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6.3.3. Risk based pathway

Extent Risk

The current development footprint will result in the loss of **2.321 hectares** of native vegetation. This is defined as the 'extent' of the native vegetation to be removed and comprised:

- 1.195 hectares of remnant patch native vegetation and
- 16 scattered trees.

It is understood that no native vegetation has been approved for removal on the properties for the current project within the last five years.

Example photographs of native vegetation proposed for removal are provided in Table 4.

Location Risk

The area of proposed native vegetation removal contained mapped areas of the following *location risk* categories:

- Location Risk A – covering the majority of this area;
- Location Risk B – in scattered locations, particularly about the base of the Strzelecki Ranges; and
- Location Risk C – associated with a highly localised area just south of the intersection between Coal Mine Road and the South Gippsland Highway (north-eastern corner of the unnamed state forest).

Risk based pathway

Based on the criteria outlined in Section 3.2.3 the Guidelines stipulate that the proposal will be assessed under the **high** risk assessment pathway.

6.3.4. Strategic biodiversity score

The strategic biodiversity score of each area of native vegetation loss has been determined using DELWP's EnSym Tool (see Appendix 5).

6.3.5. Important habitat

The current development footprint will not have a proportional impact on any rare or threatened species' habitats above the specific offset threshold as determined using DELWP's EnSym Tool and presented in Appendix 9.

6.3.6. Biodiversity Equivalence Score (BES) of vegetation proposed for removal

The Biodiversity Equivalence Score (BES) of the vegetation proposed for removal under the current development proposal is estimated to be a ***general* biodiversity equivalence score** (GBES) of **0.257.** This is calculated by multiplying the estimated losses from remnant patches and scattered trees in *habitat hectares* by the strategic biodiversity score, the latter generated using DELWP's EnSym Tool. Habitat scores for estimated native vegetation losses within the indirectly assessed study area were also obtained using EnSym.

6.4. Implications for the proposed development

6.4.1. Planning and Environment Act 1987

Local Provisions

Overlays

Environmental Significance Overlay – Schedule 1

A **permit is required** to remove, destroy or lop any vegetation, including dead vegetation. Before deciding on an application, the responsible authority must consider whether the proposal:

- Avoids and/or controls waste discharges to areas of high conservation significance.
- Protects sensitive coastal and foreshore vegetation, in particular heath-lands and dune vegetation, from clearing, pollution, grazing, and trampling.
- Emphasises the use of indigenous species in revegetation programs.
- Includes provision for the retention of vegetation and fauna habitat, the need to revegetate riparian buffers along waterways, gullies, ridge-lines, property boundaries and recharge areas, as well as site management measures to minimise the occurrence of salinity, erosion, groundwater and surface water problems for applications for agricultural development.

Environmental Significance Overlay – Schedule 2

A **permit is required** to remove, destroy or lop any vegetation, including dead vegetation. Before deciding on an application the responsible authority must consider:

- The integrity and long-term ecological and hydrological functioning of the wetland and areas surrounding the wetland.
- The contribution of the proposal towards the ecological restoration of the wetland, or the potential for the proposal to reduce the capability for ecological restoration of the wetland
- The benefit of requiring an agreement with the owner of the land under the Planning and Environment Act 1987, Wildlife Act 1975, Conservation, Forests and Lands Act 1987, or any other Act, to further protect or enhance the wetland and its flora and fauna.
- The benefit of a condition requiring:
    - The retention or planting of a buffer strip of native vegetation within a specified distance of the wetland.
    - The fencing of the wetland to exclude stock or vermin.
- The need for, or existence of, an appropriate land management plan and whether the proposed development is in accordance with such a plan.
- The views of DELWP

State provisions

A planning permit under Clause 52.17 of the Wellington Planning Scheme is required for the removal of native vegetation.

The current proposal would trigger a referral to DELWP as it meets the criteria specified in Section 3.2.3.

Offset requirements

Offsets required to compensate for the proposed removal of native vegetation from the study area have been determined using DELWP's EnSym Tool (see Appendix 9). A summary of the required offsets is presented in Table 7.

Table 7: Offset target

Offset type	Clearing site biodiversity equivalence score	Risk multipler	Offset requirements	
			Offset amount (BEU)	Offset attributes
General	0.257 GBES	1.5	0.386 general units	Offset must be within West Gippsland CMA or Wellington Shire Council Offset must have a minimum strategic biodiversity score of 0.286

Under the Guidelines *all* offsets must be secured prior to the removal of native vegetation.

Offset strategy

Offsets may include indigenous revegetation (generally woody vegetation only) and/or the management of one or more areas of existing native vegetation to improve its condition. Generally, revegetation may only be used to offset native vegetation removal which is assessed under the low risk assessment pathway (DEPI 2013b). Further, revegetation offsets may only utilise woody ecological vegetation types, as the success of non-woody revegetation is considered to be too uncertain.

All offsets must be protected using an appropriate security arrangement. All offsets must be managed for the first ten years of establishment to meet specific targets set out in an offset plan (which must meet DELWP guidelines) then managed in perpetuity to maintain those targets.

The offset target for the current proposal is likely to be achievable within the study area given the above requirements and the area of native vegetation to be retained.

For a site to be eligible as an offset, it must meet all of the requirements outlined below.

Offsets must be sited at least 150 metres away from any dwellings and associated buildings on the subject land or adjoining properties covered by a BMO, or at least 50 metres away from these structures on all other land occurring within Bushfire Prone Areas. They must also be set back at least six metres from property boundaries to allow for firebreaks, boundary fence maintenance, etc.

Offsets may not be located in areas subject to the following encumbrances or constraints, which impede the ability to achieve native vegetation management/revegetation objectives:

- Incompatible current and/or future land use (where known);
- Existing offsets or other existing agreements; or
- Identified threats to native vegetation condition.

Revegetation offsets must be at least one hectare in size; have an average width of at least 20 metres; and have a perimeter to area ratio of 1:20.

Offsite offsets can be identified through a native vegetation broker. For the planning permit application, the location of the offsets must be specified, they must meet the offset target and the offset site owner must have given permission for the offset to be placed on their property. A broker quote would be sufficient to satisfy this application requirement.

6.4.2. EPBC Act

Based on the relevant guidelines, the proposed development has negligible consequences for EPBC Act listed species and communities.

Impacts on the following species/communities were found to be very unlikely due to the fact they were not recorded in targeted surveys of the study area.

- Natural Damp Grassland of the Victorian Coastal Plains
- Clover Glycine
- Eastern Spider-orchid
- Maroon Leek-orchid
- Metallic Sun-orchid
- River Swamp Wallaby-grass
- Strzelecki Gum
- Thick-lip Spider-orchid

Although Subtropical and Temperate Coastal Saltmarsh is listed under the EPBC Act, Commonwealth approval is not required for actions that propose to significantly impact upon them due to their vulnerable ecological community status or extinct/conservation-dependent species status.

As a precaution, a Referral under the EPBC Act has been submitted in December 2016.

6.4.3. FFG Act

Targeted surveys have been undertaken for the following FFG Act listed flora species that have been considered to potentially occur within the wind farm area.

- Clover Glycine
- Eastern Spider-orchid
- Maroon Leek-orchid

- Metallic Sun-orchid
- Strzelecki Gum

None of these have been found within the surveyed impact areas (BL&A 2016b).

The following FFG Act listed fauna species was considered to be susceptible to impacts from the proposed wind farm.

- White-bellied Sea-Eagle

The frequency of collisions is likely to be very low so population consequences are not considered significant given the state population is estimated at 100 adult pairs plus sub-adults, with the Corner Inlet area in South Gippsland supporting approximately 25 of these pairs (DSE 2003). It will be important to monitor for the presence of this species as part of any impact monitoring and mitigation plan and have a plan involving investigation and a targeted mitigation response should repeated collision be detected.

6.4.4. EE Act

A Referral to the state Minister for Planning is not required under the EE Act as the effects of the project on the environment are below the biodiversity impact criteria of the Ministerial Guidelines on Referral under this Act. This is set out below:

- Potential clearing of 10 hectares or more of native vegetation – the project will remove an estimated 1.195 hectares of native vegetation plus 16 scattered trees, below the threshold for referral;
- Potential removal of one percent or more of the habitat of a state threatened species – the project will have no impact on the habitat of a threatened species;
- Potential long term change in the ecological character of a wetland listed under the Ramsar Convention or in the national directory of important wetlands – impacts on the nearby Nooramunga and Corner Inlet Marine and Wildlife Reserves (a Ramsar Wetland) will not be significant due to the distance separating the project from the upper shores of these wetland areas; and
- Extensive major impacts on the health and biodiversity of aquatic, estuarine or marine ecosystems - impacts on nearby aquatic, estuarine and marine ecosystems will not be significant due to the distance separating the project from the upper shores of these wetland areas.

6.4.5. CaLP Act

In accordance with the *Catchment and Land Protection Act 1994*, the noxious weed species listed as 'C' (Regionally Controlled Weeds) in Appendix 4, which were recorded in the study area, must be controlled.

Precision control methods that minimise off-target impacts (e.g. spot spraying) should be used in environmentally sensitive areas (e.g. within or near native vegetation, waterways, etc.).

6.5. Recommendations for further mitigation

Where feasible, rather than constructing new, parallel and adjacent transmission lines existing overhead power lines should be utilised. During the detailed design stage for overhead transmission lines, power poles, anchor-points and works access points should be sited outside native vegetation wherever feasible.

It is recommended that, if feasible, these changes be made to reduce impacts upon native vegetation, and potentially to listed threatened flora and ecological communities.

Implementation of a Bat and Avifauna Management Plan for the proposed wind farm will ensure that procedures and strategies exist to respond to any unanticipated impacts on the White-bellied Sea-eagle and the Powerful Owl.

Implementing these mitigation measures will ensure that obligations under relevant legislation and policies are adhered to, and that requirements to offset native vegetation removal are avoided or minimised. It will also ensure that the environmental footprint of the project is appropriately limited.

Best-practice development and construction recommendations are provided in Appendix 7. These should be considered to ensure impacts are minimised to flora, fauna and/or native vegetation.

7. REFERENCES

Allen, GR, Midgley, SH & Allen, M 2002, *Field Guide to the Freshwater Fishes of Australia*, Western Australian Museum, Perth.

Backhouse, GN & Jeanes, JA 1995, *The Orchids of Victoria*, The Meigunyah Press, Melbourne.

Bates, RJ 1994, 'Prasophyllum', in NG Walsh & TJ Entwisle (eds), *Flora of Victoria - Volume 2: Ferns and Allied Plants, Conifers and Monocotyledons*, Inkata Press, Melbourne, pp. 869-886.

BL&A 2016a, 'Alberton Wind Farm – Bird and Bat Surveys.' Consultant's Report to Synergy Wind Pty Ltd. Report 14107 (1.3).

BL&A 2016b, Alberton Wind Farm – Targeted Flora Survey. Consultant's Report to Synergy Wind Pty Ltd. Report 14107 (5.0).

Cadwallader, PL & Backhouse, GN 1983, *A Guide to the Freshwater Fish of Victoria*. F.D. Atkinson Government Printer, Melbourne.

Carter, O & Sutter, G 2010, *National Recovery Plan for the Clover Glycine* Glycine latrobeana, State of Victoria Department of Sustainability and Environment, East Melbourne.

Carter, O, 2010, *National Recovery Plan for the Matted Flax-lily* Dianella amoena, Department of Sustainability and Environment, East Melbourne.

Clemann N and Gillespie GR 2004. 'Recovery Plan for *Litoria raniformis* 2004 – 2008. Department of Environment and Heritage, Canberra.

Cogger, H 2000, *Reptiles and Amphibians of Australia,* Reed Books, Australia.

Craigie, V & Moorree, A 2003, *Flora and Fauna Guarantee Act 1988 Action Statement No. 182 - Central Gippsland, Plains Grassland, Forest Red Gum Grassy Woodland, Northern Plains Grassland, South Gippsland Plains Grassland, Western (Basalt) Plains Grassland*, Department of Sustainability and Environment, East Melbourne.

Department of Environment and Primary Industries (DEPI) 2013a, *Flora and Fauna Guarantee Act 1988 - Protected Flora List June 2013*, Department of Environment and Primary Industries (then DSE), East Melbourne, Victoria, viewed 17th March 2015, <http://www.depi.vic.gov.au

Department of Environment and Primary Industries (DEPI) 2013b, *Permitted clearing of native vegetation: Biodiversity assessment guidelines* (dated September 2013), Department of Environment and Primary Industries, East Melbourne, Victoria.

Department of Environment and Primary Industries (DEPI) 2014b, *Advisory List of Threatened Vertebrate Fauna in Victoria*. Department of Environment and Primary Industries (then DSE), East Melbourne, Victoria.

Department of Environment and Primary Industries (DEPI) 2014a, *Advisory List of Rare or Threatened Plants in Victoria,* Department of Environment and Primary Industries (then DSE), East Melbourne, Victoria.

Department of Environment and Primary Industries (DEPI) 2016, *Native Vegetation Information Management system*, Department of Environment and Primary Industries, East Melbourne, Victoria.

Department of Environment, Land, Water and Planning (DELWP) 2015a, *Flora and Fauna Guarantee 1988 Threatened List May 2015*, Department of Environment, Land, Water and Planning, East Melbourne, Victoria, viewed 17th March 2015, <http://www.depi.vic.gov.au/__data/assets/pdf_file/0008/279701/201410-FFG-threatened-list.pdf>

Department of Environment, Land, Water and Planning (DELWP) 2015b, *Ecological Vegetation Class (EVC) Benchmarks by Bioregion*, Department of Environment and Primary Industries (then DSE), East Melbourne, Victoria, viewed 17th March 2015, <http://www.depi.vic.gov.au>

Department of Environment, Land, Water and Planning (DELWP) 2015c, *Biodiversity Interactive Map 2.0*. Department of Environment and Primary Industries (then DSE), East Melbourne, Victoria, viewed 17th March 2015, <http://www.depi.vic.gov.au>

Department of Environment, Land, Water and Planning (DELWP) 2015d, *Permitted Clearing of Native Vegetation, Biodiversity Assessment Handbook, Version 1.0*, Department of Environment, Land, Water and Planning, East Melbourne, Victoria.

Department of Natural Resources and Environment (DNRE) 2002, *Victoria's Native Vegetation Management – a Framework for Action*, Department of Natural Resources and Environment, Victoria.

Department of Sustainability and Environment (DSE) 2003, 'Flora and Fauna Guarantee Action Statement #60 – White Bellied Sea-eagle. DSE, East Melbourne.

Department of Sustainability and Environment (DSE) 2004, *Native Vegetation: sustaining a living landscape, Vegetation Quality Assessment Manual – guidelines for applying the Habitat Hectare scoring method (Version 1.3)*. Department of Sustainability and Environment, East Melbourne, Victoria.

Department of Sustainability and Environment (DSE) 2006, *Ministerial Guidelines for Assessment of Environmental Effects under the Environment Effects Act 1978,* Department of Sustainability and Environment, East Melbourne, Victoria.

Department of Sustainability and Environment (DSE) 2008, *Flora and Fauna Guarantee 1988 Action Statement No. 229: Swamp Everlasting* Xerochrysum palustre, Department of Sustainability and Environment, Melbourne.

Department of Sustainability and Environment (DSE) 2010, *Native Vegetation – Technical information sheet: Degraded treeless vegetation, Best and remaining habitat determinations, Tree protection/retention requirements*, Department of Sustainability and Environment, East Melbourne, Victoria.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) 2003, *National Recovery Plan for twenty-five Threatened Orchid Taxa of Victoria, South Australia and New South Wales 2003 - 2007*, www.environment.gov.au.

Department of the Environment 2015, *EPBC Act Protected Matters Search Tool*. Department of the Environment, Canberra, viewed 9th November 2015, <http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999/protected>

Department of Transport, Planning and Local Infrastructure (DTPLI) 2015, *Planning Schemes Online* – Wellington *Planning Scheme*, Department of Transport,

Planning and Local Infrastructure, Melbourne, viewed 17th March 2015, http://planning-schemes.delwp.vic.gov.au/schemes/wellington

Emison, WB, Beardsell, CM, Norman, FI Loyn, RH, & Bennett, SC 1987, *Atlas of Victorian Birds*. Department of Conservation, Forests and Lands & Royal Australasian Ornithologists Union, Melbourne.

Entwisle, TJ 1994, 'Orchidaceae', in NG Walsh & TJ Entwisle (eds), *Flora of Victoria - Volume 2: Ferns and Allied Plants, Conifers and Monocotyledons*, Inkata Press, Melbourne, pp. 740-901.

Environment Protection Authority Victoria (EPAV) 1991, *Construction Techniques for Sediment Pollution Control*, Environment Protection Agency Victoria, Carlton.

Higgins, PJ & Davies, SJJF (eds) 1996, *Handbook of Australian, New Zealand & Antarctic Birds,* Volume 3 Snipe to Pigeons, Oxford University Press, Melbourne.

Higgins, PJ & Peter, JM (eds) 2002, *Handbook of Australian, New Zealand and Antarctic Birds*, Volume 6: Pardalotes to Shrike-thrushes, Oxford University Press, Melbourne.

Higgins, PJ (ed) 1999, *Handbook of Australian, New Zealand and Antarctic Birds*, Volume 4: Parrots to Dollarbird, Oxford University Press, Melbourne.

Higgins, PJ, Peter, JM & Steele, WK (eds) 2001, *Handbook of Australian, New Zealand and Antarctic Birds*, Volume 5: Tyrant-flycatchers to Chats, Oxford University Press, Melbourne.

Jeanes, J. and Backhouse, G. 2006, *Wild Orchids of Victoria, Australia*, Aquatic Photographics, Seaford.

Kennedy, SJ & Tzaros, CL 2005, 'Foraging ecology of the Swift Parrot *Lathamus discolor* in the Box-ironbark forests and woodlands of Victoria', *Pacific Conservation Biology* 11, 158 – 173.

Marchant, S & Higgins, PJ (eds) 1990, *Handbook of Australian, New Zealand and Antarctic Birds,* Volume 1: Ratites to Ducks', Oxford University Press, Melbourne.

Marchant, S & Higgins, PJ (eds) 1993, *Handbook of Australian, New Zealand and Antarctic Birds, Volume 2*, Raptors to Lapwings, Oxford University Press, Melbourne.

Menkhorst, P 1995, *Mammals of Victoria*, Oxford University Press, Melbourne.

Naarding, J.A. 1983. Latham's Snipe in Southern Australia. Wildlife Division Technical Report 83/1. Tasmania National Parks and Wildlife Service.

Parkes, D, Newell, G, & Cheal, D 2003, 'Assessing the Quality of Native Vegetation: The 'habitat hectares' approach'. *Ecological Management and Restoration*, vol. 4, supplement, pp. 29-38.

Scientific Advisory Committee (SAC) 2015, Flora and Fauna Guarantee Act 1988 – Threatened List: Characteristics of Threatened Communities, Department of Environment and Primary Industries (then DSE), East Melbourne, Victoria, viewed 17th March 2015, <http://www.depi.vic.gov.au/__data/assets/pdf_file/0005/229703/Flora-and-Fauna-Guarantee-Characteristics-of-Threatened-Communities-.pdf>

Soderquist, TR, Lowe, KW, Loyn, RH & Price R 2002, Habitat quality in Powerful Owl (*Ninox strenua*) territories in the Box-Ironbark forest of Victoria, Australia.' In, I Newton, R Kavanagh, J Olsen and I Taylor (eds), *Ecology and Conservation of Owls,* CSIRO Publishing, Melbourne, pp. 91-99.

Tidemann, C.R. and Nelson, J. 2004. Long-distance movements of the grey-headed flying fox (Pteropus poliocephalus). Journal of Zoology London 263: 141–146.

Tzaros, C 2005, *Wildlife of the Box-Ironbark Country*. CSIRO Publishing, Melbourne.

Victorian Biodiversity Atlas, © The State of Victoria, Department of Environment and Primary Industries (published [March, 2015])

Walsh, N.G. & Entwisle, T.J., 1999, *Flora of Victoria, Vol. 4: Dicotyledons: Cornaceae to Asteraceae*, Inkata Press, Melbourne."

Walsh, NG 1994, 'Poaceae', in NG Walsh & TJ Entwisle (eds), *Flora of Victoria - Volume 2: Ferns and Allied Plants, Conifers and Monocotyledons*, Inkata Press, Melbourne, pp. 356-627.

Wilson, S & Swan G 2003, *A Complete Guide to Reptiles of Australia*. Reed New Holland, Sydney.

Appendix 1: Details of investigated properties

Property No.*	Street address	Town/Suburb	Lot description	Land Designation (DTPLI 2015)	
				Zones	Overlays^
Private Land					
1	150 Todds Road	Hedley	Lot 1 PS51087	FZ	WMO, SLO3
2	169 Birds Road South	Hedley	Allot. 1 Sec. A Parish of Alberton West	FZ	WMO
3	6970 South Gippsland Highway	Hedley	Lot 1 TP110485	FZ	WMO
4	South Gippsland Highway	Hedley	Lot 1 TP578219	FZ	
5	South Gippsland Highway	Hedley	Lot 1 TP578908	FZ	
6	7085 South Gippsland Highway	Hedley	Lot 1 TP754717	FZ, PCRZ	WMO, ESO2
7	Coal Mine Road	Gelliondale	Lot 2 Lp92727	FZ	WMO, ESO2
8	67 Lanes Road	Gelliondale	Lot 2 PS50651	FZ	
9	South Gippsland Highway	Hedley	Allot. 53 Parish of Alberton West	FZ, IN1Z	
10	South Gippsland Highway	Hedley	Lot 2 PS404524	FZ	
11	7438 South Gippsland Highway	Hedley	Lot 1 PS40452	FZ	
12	7618 South Gippsland Highway	Gelliondale	Plan PC36214	FZ	
13	Lanes Road	Alberton West	Lot 1 TP88769	FZ	ESO2
14	115 Gelliondale Road	Gelliondale	Lot 63 LP315	FZ	ESO2
15	Gelliondale Road	Gelliondale	Lot 1 TP814120	FZ, PCRZ	ESO2
16	738 Pound Road West	Alberton West	Lot 1 PS61948	FZ, PCRZ	ESO2
17	47 Nicols Road	Devon North	Allot. 14A Parish of Yarram Yarram	FZ	
18	Nicols Road	Devon North	Allot. 14L Parish of Yarram Yarram	FZ	

Property No.*	Street address	Town/Suburb	Lot description	Land Designation (DTPLI 2015)	
				Zones	Overlays^
19	668 Pound Road West	Yarram	Lot 8 PS31552	FZ	
20	80 Crangs Road	Alberton West	Lot 1 PS61738	FZ	
21	212 Old Alberton West Road	Alberton	Lot 7 LP4703	FZ	
22	174 Old Alberton West Road	Alberton	Lot 1 PS71429	FZ	ESO2
23	Old Alberton West Road	Gelliondale	Lot 5 LP4703	FZ	
24	7913 South Gippsland Highway	Alberton	Lot 3 LP4703	FZ	
25	South Gippsland Highway	Gelliondale	Lot 1 TP864748	FZ	
26	7776 South Gippsland Highway	Gelliondale	Lot 1 TP109933	FZ	
27	7802 South Gippsland Highway	Gelliondale	Plan TP4297	FZ	
28	7890 South Gippsland Highway	Alberton	Lot 1 TP128952	FZ	
29	7996 South Gippsland Highway	Alberton	Lot 1 PS603015	FZ	ESO1
30	8028 South Gippsland Highway	Alberton	Lot 1 PS51087	FZ	
31	Ti Tree Road	Gelliondale	Allot. A Sec. 9 Alberton West	FZ	
32	7666 South Gippsland Highway	Gelliondale	Allot. 8a Parish of Alberton West	FZ	
33	555 Ti Tree Road	Hedley	Allot. 24c Sec. A Parish of Alberton West	PCRZ	ESO2
34	Wests Road	Alberton West	Lot 1 LP9272	FZ	
35	205 Lanes Road	Alberton West	Lot 1 TP83713	FZ	
36	Lanes Road	Alberton West	Lot 1 TP53216	FZ	
37	Lanes Road	Gelliondale	Allot. 44 Parish of Alberton West	FZ	ESO2 (does not cover study area)
38	68 James Road	North Hedley	Allot. 78 Parish of Alberton West	FZ	
39	South Gippsland Highway	Hedley	Allot. 62 Parish of Alberton West	FZ	

Property No.*	Street address	Town/Suburb	Lot description	Land Designation (DTPLI 2015)	
				Zones	Overlays^
40	806 Pound Road West	Alberton West	Lot 4 PS31552	FZ	ESO2 (does not cover study area)
41	Pound Road West	Alberton West	Allot. A11A Parish of Yarram Yarram	PCRZ	ESO2
42	Pound Road West	Alberton West	Allot. 2009 Parish of Yarram Yarram	FZ	
43	Pound Road West	Alberton West	Allot. 2010 Parish of Yarram Yarram	FZ	
44	179 Lower Jack Road	Jack River	Lot 1 LP14081	FZ	
45	Ross Road	Alberton West	Allot. A13A Parish of Yarram Yarram	PCRZ, FZ	
46	Pound Road West	Alberton West	Plan CP16737	PCRZ, FZ	
47	937 Pound Road West	Alberton West	Lot 1 LP143423	FZ	
48	1007 Pound Road West	Alberton West	Lot 1 TP56137	FZ	
49	246 Gelliondale Road	Alberton West	Lot 1 PS438124	FZ	
50	392a Old Alberton West Road	Alberton West	Lot 2 PS438124	FZ	
51	246 Gelliondale Road	Alberton West	Lot 1 PS620983	FZ	
52	1007 Pound Road West	Alberton West	Lot 1 TP561378	FZ	
53	1045 Pound Road West	Alberton West	Lot 1 TP375270	FZ	
54	370 Lanes Road	Alberton West	Lot 2 PS41020	FZ	
55	289 Gelliondale Road	Alberton West	Lot 1 PS41020	FZ	
Public Land					
NA	South Gippsland Highway		Road Reserve	RDZ1	
NA	Great Southern Rail Trail		Rail Reserve (disused)	PCRZ	
NA	Birds Road South		Road Reserve	FZ	
NA	Todds Road		Road Reserve	FZ	

Property No.*	Street address	Town/Suburb	Lot description	Land Designation (DTPLI 2015)	
				Zones	Overlays^
NA	Old Alberton West Road		Road Reserve	FZ	
NA	McPhersons Road		Road Reserve	FZ	
NA	Ti Tree Road		Road Reserve	FZ	
NA	Lanes Road		Road Reserve	FZ	
NA	Wests Road		Road Reserve	FZ	
NA	Great Southern Rail Trail (SOUTH GIPPSLAND HIGHWAY)		Rail Reserve (disused)	PCRZ	
NA	Coal Mine Road		Road Reserve	FZ	
NA	Old Alberton Road		Road Reserve	FZ	
NA	Simmons Street / Crangs Road		Road Reserve (paper road)	FZ	
NA	Pound Road West		Road Reserve	FZ	
NA	Gelliondale Road		Road Reserve	RDZ2	

* = BL&A property reference

^ = Only relevant overlays have been listed

FZ = Farming Zone

RDZ1 = Road Zone – Category 1

RDZ2 = Road Zone – Category 2

PCRZ = Public Conservation and Resource Zone

IN1Z = Industrial 1 Zone

ESO1 = Environmental Significance Overlay – Schedule 1

ESO2 = Environmental Significance Overlay – Schedule 2

SLO3 = Significant Landscapes Overlay – Schedule 3

Appendix 2: Detailed habitat hectare assessment results

Habitat Zone			A	B	C	D	E	F	G	H1
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**863**	**863**	**132_62**	**132_62**	**53**
Total area of Habitat Zone (ha)			0.064338	0.100545	0.071820	0.064443	0.039296	0.026550	0.003715	0.009432
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	0	0	0	N/A	N/A	N/A	N/A	3
	Lack of Weeds	/15	13	13	13	9	0	0	0	0
	Understorey	/25	15	5	5	25	25	5	5	5
	Recruitment	/10	0	0	0	0	0	3	3	6
	Organic Matter	/5	0	0	3	5	4	2	2	4
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.25	1.25	1.25	1.36	1.36	1.36	1.36	1.25
	Site Condition subtotal		*35*	*23*	*26*	*53*	*39*	*14*	*14*	*23*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	0	0	0	0	0	0	0	0
	Distance to Core	/5	1	1	1	1	1	1	1	1
Total Condition Score		**/100**	**37**	**25**	**28**	**55**	**41**	**16**	**16**	**25**
Condition score out of 1			0.37	0.25	0.28	0.55	0.41	0.16	0.16	0.25
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			H2	H3	H4	H5	H6	H7	H8	H9
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**53**	**53**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.439893	0.112898	0.094372	0.118159	0.271903	0.009654	0.037440	0.011400
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	3	3	3	3	3	3	3	3
	Lack of Weeds	/15	0	0	0	0	0	0	0	0
	Understorey	/25	5	5	5	5	5	5	5	5
	Recruitment	/10	6	6	6	6	6	6	6	6
	Organic Matter	/5	4	4	4	4	4	4	4	4
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	Site Condition subtotal		*23*	*23*	*23*	*23*	*23*	*23*	*23*	*23*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	0	0	0	0	0	0	0	0
	Distance to Core	/5	1	1	1	1	1	1	1	1
Total Condition Score		**/100**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**
Condition score out of 1			0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.007429	0.004917	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			H10	H11	H12	H13	H14	H15	H16	H17
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**53**	**53**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.040520	0.013507	0.029437	0.194263	0.027726	0.162791	0.041118	0.157929
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	3	3	3	3	3	3	3	3
	Lack of Weeds	/15	0	0	0	0	0	0	0	0
	Understorey	/25	5	5	5	5	5	5	5	5
	Recruitment	/10	6	6	6	6	6	6	6	6
	Organic Matter	/5	4	4	4	4	4	4	4	4
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	Site Condition subtotal		*23*	*23*	*23*	*23*	*23*	*23*	*23*	*23*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	0	0	0	0	0	0	0	0
	Distance to Core	/5	1	1	1	1	1	1	1	1
Total Condition Score		**/100**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**
Condition score out of 1			0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.000000	0.000000	0.000000	0.003409	0.000000	0.000000	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			H18	H19	H20	I	J	K	L	M
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**53**	**53**	**132_62**	**132_62**	**132_62**
Total area of Habitat Zone (ha)			0.036641	0.102818	0.084796	0.086068	0.222295	0.006982	0.019390	0.013672
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	3	3	3	0	0	N/A	N/A	N/A
	Lack of Weeds	/15	0	0	0	13	0	2	2	2
	Understorey	/25	5	5	5	15	5	5	5	5
	Recruitment	/10	6	6	6	0	3	0	3	3
	Organic Matter	/5	4	4	4	0	3	2	3	3
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.25	1.25	1.25	1.25	1.25	1.36	1.36	1.36
	Site Condition subtotal		*23*	*23*	*23*	*35*	*14*	*12*	*18*	*18*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	0	1	1	0	0	0	0	0
	Distance to Core	/5	1	3	3	1	1	3	3	3
Total Condition Score		**/100**	**25**	**28**	**28**	**37**	**16**	**16**	**22**	**22**
Condition score out of 1			0.25	0.28	0.28	0.37	0.16	0.16	0.22	0.22
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.000000	0.070741	0.001148	0.000000	0.000000	0.006442	0.000000	0.004594

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			N	O	P1	P2	Q	R	S	T
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**132_62**	**132_62**	**653**	**653**	**653**	**653**	**653**	**132_62**
Total area of Habitat Zone (ha)			0.014438	0.038226	0.056481	0.184685	3.756077	0.004952	0.006993	0.049900
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lack of Weeds	/15	2	2	13	13	13	13	13	2
	Understorey	/25	5	5	15	15	15	15	15	5
	Recruitment	/10	3	3	0	0	0	0	0	3
	Organic Matter	/5	3	3	5	5	5	5	5	3
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Site Condition subtotal		*18*	*18*	*45*	*45*	*45*	*45*	*45*	*18*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	0	0	0	0	0	0	0	0
	Distance to Core	/5	3	3	3	3	3	3	3	3
Total Condition Score		**/100**	**22**	**22**	**49**	**49**	**49**	**49**	**49**	**22**
Condition score out of 1			0.22	0.22	0.49	0.49	0.49	0.49	0.49	0.22
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.000000	0.002258	0.000000	0.000000	0.116074	0.000000	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			U	V	W	X	Y	Z	AA	BB
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**132_62**	**53**	**53**	**132_62**	**653**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.015321	0.041376	0.036150	0.046855	1.146997	0.404180	0.066075	1.474050
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	N/A	0	0	N/A	N/A	0	0	0
	Lack of Weeds	/15	2	6	6	0	0	4	0	4
	Understorey	/25	5	5	5	5	5	5	5	15
	Recruitment	/10	0	0	0	0	0	3	0	6
	Organic Matter	/5	5	3	5	4	3	3	0	3
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.36	1.25	1.25	1.36	1.36	1.25	1.25	1.25
	Site Condition subtotal		*16*	*18*	*20*	*12*	*11*	*19*	*6*	*35*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	0	0	0	0	0	0	0	0
	Distance to Core	/5	3	3	3	3	3	1	1	1
Total Condition Score		**/100**	**20**	**22**	**24**	**16**	**15**	**21**	**8**	**37**
Condition score out of 1			0.20	0.22	0.24	0.16	0.15	0.21	0.08	0.37
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.000000	0.000000	0.000000	0.000000	0.000070	0.004040	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			CC	DD1	DD2	EE	FF1	FF2	FF3	FF4
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**48**	**48**	**48**	**48**	**53**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.114089	0.050884	1.035370	0.016989	0.148646	0.031222	0.015563	0.024655
Site Condition	Large Old Trees	/10	0	0	0	10	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	0	0	0	3	0	0	0	0
	Lack of Weeds	/15	0	0	0	9	4	4	4	4
	Understorey	/25	0	0	0	15	5	5	5	5
	Recruitment	/10	0	0	0	6	6	6	6	6
	Organic Matter	/5	2	2	2	5	5	5	5	5
	Logs	/5	0	0	0	0	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.00	1.00	1.00	1.00	1.25	1.25	1.25	1.25
	Site Condition subtotal		*2*	*2*	*2*	*38*	*25*	*25*	*25*	*25*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	2	2	2	2	1	1	1	1
	Distance to Core	/5	4	4	4	4	3	3	3	3
Total Condition Score		**/100**	**9**	**9**	**9**	**45**	**30**	**30**	**30**	**30**
Condition score out of 1			0.09	0.09	0.09	0.45	0.30	0.30	0.30	0.30
Habitat Hectares in Habitat Zone#			**1.350**	**1.350**	**1.350**	**6.750**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			FF5	FF6	GG1	GG2	GG3	HH1	HH2	HH3
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**8**	**8**	**8**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.006698	0.004152	0.010681	0.017169	0.039438	0.172195	0.036708	0.259863
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	0	0	N/A	N/A	N/A	0	0	0
	Lack of Weeds	/15	4	4	0	0	0	0	0	0
	Understorey	/25	5	5	5	5	5	5	5	5
	Recruitment	/10	6	6	0	0	0	3	3	3
	Organic Matter	/5	5	5	2	2	2	3	3	3
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.25	1.25	1.36	1.36	1.36	1.36	1.36	1.36
	Site Condition subtotal		*25*	*25*	*10*	*10*	*10*	*15*	*15*	*15*
Landscape Context	Patch Size	/10	1	1	1	1	1	1	1	1
	Neighbourhood	/10	1	1	1	1	1	0	0	0
	Distance to Core	/5	3	3	3	3	3	1	1	1
Total Condition Score		**/100**	**30**	**30**	**15**	**15**	**15**	**17**	**17**	**17**
Condition score out of 1			0.30	0.30	0.15	0.15	0.15	0.17	0.17	0.17
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Area of Habitat Zone to be removed (ha)			0.002285	0.002963	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			II1	II2	II3	JJ	KK	1A	1B	1C
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**53**	**53**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.102497	0.158417	0.208613	0.128370	0.103619	0.084729	0.078037	0.565571
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	4	4	4	0	0	0	0	0
	Lack of Weeds	/15	0	0	0	6	6	0	11	0
	Understorey	/25	15	15	15	5	5	5	5	5
	Recruitment	/10	6	6	6	0	0	0	0	10
	Organic Matter	/5	3	3	3	3	3	4	3	5
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.36	1.36	1.36	1.25	1.25	1.25	1.25	1.25
	Site Condition subtotal		*38*	*38*	*38*	*18*	*18*	*11*	*24*	*25*
Landscape Context	Patch Size	/10	1	1	1	1	1			
	Neighbourhood	/10	0	0	0	1	1	3	0	0
	Distance to Core	/5	1	1	1	3	3	4	3	3
Total Condition Score		**/100**	**40**	**40**	**40**	**23**	**23**	**18**	**27**	**28**
Condition score out of 1			0.40	0.40	0.40	0.23	0.23	0.18	0.27	0.28
Habitat Hectares in Habitat Zone#			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.015**	**0.021**	**0.158**
Area of Habitat Zone to be removed (ha)			0.000000	0.004344	0.006297	0.000000	0.000000	0.000000	0.000064	0.109426

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			1D	1E	1F	1G	1H	1I	1J	1K
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**53**	**53**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.595197	1.597214	0.863953	0.313873	0.032872	0.059529	0.035095	0.010464
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	0	0	0	0	0	0	4	0
	Lack of Weeds	/15	0	0	0	0	0	0	0	0
	Understorey	/25	5	5	5	15	15	5	5	5
	Recruitment	/10	10	10	10	10	6	0	5	0
	Organic Matter	/5	5	5	5	5	4	0	3	4
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	Site Condition subtotal		*25*	*25*	*25*	*38*	*31*	*6*	*21*	*11*
Landscape Context	Patch Size	/10								
	Neighbourhood	/10	0	0	0	0	1	1	1	1
	Distance to Core	/5	3	3	3	4	3	3	3	3
Total Condition Score		**/100**	**28**	**28**	**28**	**42**	**35**	**10**	**25**	**15**
Condition score out of 1			0.28	0.28	0.28	0.42	0.35	0.10	0.25	0.15
Habitat Hectares in Habitat Zone#			**0.167**	**0.447**	**0.242**	**0.132**	**0.012**	**0.006**	**0.009**	**0.002**
Area of Habitat Zone to be removed (ha)			0.000000	0.056330	0.023712	0.012146	0.000000	0.000000	0.000000	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			1L	1M	1N	1O	1P	1Q	1R	1S
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**132_62**	**53**	**53**	**3**	**3**	**3**
Total area of Habitat Zone (ha)			0.118907	0.014857	0.176973	0.070075	0.096550	0.109558	0.053637	0.128338
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	0	0	0
	Tree Canopy Cover	/5	0	0	N/A	0	0	3	5	0
	Lack of Weeds	/15	0	4	0	11	11	4	0	7
	Understorey	/25	15	15	10	5	5	15	5	5
	Recruitment	/10	6	5	0	0	0	6	0	3
	Organic Matter	/5	4	5	2	5	5	5	5	5
	Logs	/5	N/A	N/A	N/A	N/A	N/A	2	4	0
	Site condition standardising multiplier*		1.25	1.25	1.36	1.25	1.25	1.00	1.00	1.00
	Site Condition subtotal		*31*	*36*	*16*	*26*	*26*	*35*	*19*	*20*
Landscape Context	Patch Size	/10								
	Neighbourhood	/10	1	1	1	1	1	2	2	2
	Distance to Core	/5	3	3	3	3	3	4	4	4
Total Condition Score		**/100**	**35**	**40**	**20**	**30**	**30**	**41**	**25**	**26**
Condition score out of 1			0.35	0.40	0.20	0.30	0.30	0.41	0.25	0.26
Habitat Hectares in Habitat Zone#			**0.042**	**0.006**	**0.035**	**0.021**	**0.029**	**0.045**	**0.013**	**0.033**
Area of Habitat Zone to be removed (ha)			0.000317	0.000000	0.002744	0.000616	0.004928	0.021406	0.029665	0.000000

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			1T	1U	1V	1W	1X	1Y	1Z	2A
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**3**	**3**	**8**	**8**	**8**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.271771	0.073948	0.171244	0.601363	0.171894	0.077291	0.194732	1.173056
Site Condition	Large Old Trees	/10	4	0	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	5	0	N/A	N/A	N/A	0	0	3
	Lack of Weeds	/15	13	4	11	11	7	0	7	0
	Understorey	/25	15	5	15	15	15	15	5	5
	Recruitment	/10	0	3	6	5	3	10	3	3
	Organic Matter	/5	5	5	5	3	5	5	3	4
	Logs	/5	0	0	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.00	1.00	1.36	1.36	1.36	1.25	1.25	1.25
	Site Condition subtotal		*38*	*17*	*50*	*46*	*41*	*38*	*23*	*19*
Landscape Context	Patch Size	/10								
	Neighbourhood	/10	2	2	2	2	2	1	0	0
	Distance to Core	/5	4	4	4	4	4	4	1	1
Total Condition Score		**/100**	**44**	**23**	**56**	**52**	**47**	**43**	**24**	**20**
Condition score out of 1			0.44	0.23	0.56	0.52	0.47	0.43	0.24	0.20
Habitat Hectares in Habitat Zone#			**0.120**	**0.017**	**0.096**	**0.313**	**0.081**	**0.033**	**0.047**	**0.235**
Area of Habitat Zone to be removed (ha)			0.000324	0.009107	0.013537	0.075430	0.023715	0.000000	0.013591	0.088889

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			2B	2C	2D	2E	2F	2G	2H	2I
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**151**	**151**	**53**	**53**	**53**	**53**	**53**	**53**
Total area of Habitat Zone (ha)			0.239983	0.046214	0.087455	0.052418	0.047202	0.087134	0.617425	0.229620
Site Condition	Large Old Trees	/10	5	9	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	2	2	0	0	0	0	5	0
	Lack of Weeds	/15	7	7	11	11	7	7	13	7
	Understorey	/25	15	15	5	5	15	15	15	5
	Recruitment	/10	6	6	5	5	5	5	6	3
	Organic Matter	/5	3	3	3	3	5	5	5	3
	Logs	/5	4	5	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.00	1.00	1.25	1.25	1.25	1.25	1.25	1.25
	Site Condition subtotal		*37*	*38*	*30*	*30*	*40*	*40*	*55*	*23*
Landscape Context	Patch Size	/10								
	Neighbourhood	/10	0	0	3	3	3	3	3	1
	Distance to Core	/5	3	4	4	4	4	4	4	1
Total Condition Score		**/100**	**40**	**42**	**37**	**37**	**47**	**47**	**62**	**25**
Condition score out of 1			0.40	0.42	0.37	0.37	0.47	0.47	0.62	0.25
Habitat Hectares in Habitat Zone#			**0.096**	**0.019**	**0.032**	**0.019**	**0.022**	**0.041**	**0.383**	**0.057**
Area of Habitat Zone to be removed (ha)			0.085926	0.012541	0.018663	0.001946	0.000000	0.000000	0.000000	0.011743

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			2J	2K	2L	2M	2N	2O
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**53**	**821**	**53**
Total area of Habitat Zone (ha)			0.341394	0.071791	0.101576	0.052993	0.225379	0.092189
Site Condition	Large Old Trees	/10	N/A	N/A	N/A	N/A	N/A	N/A
	Tree Canopy Cover	/5	0	0	0	0	N/A	0
	Lack of Weeds	/15	4	0	7	0	7	11
	Understorey	/25	5	5	5	5	15	5
	Recruitment	/10	3	6	6	5	0	0
	Organic Matter	/5	3	5	5	4	3	5
	Logs	/5	N/A	N/A	N/A	N/A	N/A	N/A
	Site condition standardising multiplier*		1.25	1.25	1.25	1.25	1.36	1.25
	Site Condition subtotal		*19*	*20*	*29*	*18*	*34*	*26*
Landscape Context	Patch Size	/10						
	Neighbourhood	/10	0	0	0	1	0	0
	Distance to Core	/5	4	3	3	1	1	1
Total Condition Score		**/100**	**23**	**23**	**32**	**20**	**35**	**27**
Condition score out of 1			0.23	0.23	0.32	0.20	0.35	0.27
Habitat Hectares in Habitat Zone#			**0.079**	**0.017**	**0.033**	**0.011**	**0.079**	**0.025**
Area of Habitat Zone to be removed (ha)			0.006415	0.012931	0.015351	0.010914	0.007064	0.003634

* Modified approach to habitat scoring - refer to Table 14 of DELWP's Vegetation Quality Assessment Manual (DSE, 2004); # Habitat hectares = habitat score/100 X area [ha])

Habitat Zone			57	62	60a	46a	58	60g
Bioregion			**GipP**	**GipP**	**GipP**	**GipP**	**GipP**	**GipP**
EVC Number			**53**	**53**	**53**	**653**	**53**	**53**
Total area of Habitat Zone (ha)			0.045	0.003	0.093	0.019	0.104	0.020
Site Condition	Large Old Trees	/10	0	0	0	0	0	0
	No. large trees in habitat zone							
	Bench No. Trees / hectare							
	Canopy health		30-70%	30-70%	30-70%	30-70%	30-70%	30-70%
	Tree Canopy Cover	/5	0	0	0	0	0	0
	Lack of Weeds	/15	4	4	4	7	4	0
	Understorey	/25	5	5	5	15	5	5
	Recruitment	/10	0	0	6	0	10	1
	Organic Matter	/5	0	3	3	5	3	3
	Logs	/5	0	0	0	0	0	0
	m small logs in hab zone							
	m large logs in hab zone							
	Bench m logs / 0.1 hectare							
	Site condition standardising multiplier*		1.25	1.25	1.25	1.36	1.25	1.25
	Site Condition subtotal		*11*	*15*	*23*	*37*	*28*	*11*
Landscape Context	Patch Size	/10	1	1	1	1	8	1
	Neighbourhood	/10	1	0	0	1	1	1
	Distance to Core	/5	3	1	1	1	4	3
Total Condition Score		**/100**	**16**	**17**	**25**	**40**	**41**	**16**
Condition score out of 1			0.16	0.17	0.25	0.40	0.41	0.16
Habitat Hectares in Habitat Zone#			**0.007**	**0.001**	**0.023**	**0.008**	**0.043**	**0.003**
Area of Habitat Zone to be removed (ha)								

Appendix 3: Scattered trees in the study area

Tree No.	Common name	Scientific Name	DBH (cm)	Habitat category	Radius of TPZ (m)	Remove/Retain	Notes
1	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	97	L	11.64	Removed	Dead stag
2	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	71	L	8.52	Removed	
3	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	81	L	9.72	Removed	
4	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	75	M	9	Removed	
5	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	87	L	10.44	Retained	
6	Swamp Gum	*Eucalyptus ovata var. ovata*	86	L	10.32	Retained	
7	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	81	L	9.72	Retained	
8	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	54	L	6.48	Retained	
9	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	64	M	7.68	Retained	
10	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	59	M	7.08	Retained	
11	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	50	M	6	Retained	Dead stag
12	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	59	L	7.08	Retained	
13	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	67	M	8.04	Retained	
14	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	64	L	7.68	Retained	
15	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	50	L	6	Retained	

Tree No.	Common name	Scientific Name	DBH (cm)	Habitat category	Radius of TPZ (m)	Remove/Retain	Notes
16	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*	68	M	8.16	Retained	
17	Swamp Paperbark	*Melaleuca ericifolia*	16	S	2	Retained	
18	Swamp Gum	*Eucalyptus ovata var. ovata*	14	M	2	Retained	
19	Swamp Gum	*Eucalyptus ovata var. ovata*	45	M	5.4	Retained	
20	Swamp Gum	*Eucalyptus ovata var. ovata*	73	M	8.76	Retained	
21	Swamp Paperbark	*Melaleuca ericifolia*	6	S	2	Removed	
22	Swamp Paperbark	*Melaleuca ericifolia*	7	S	2	Removed	
23	Swamp Paperbark	*Melaleuca ericifolia*	6	S	2	Removed	
24	Swamp Paperbark	*Melaleuca ericifolia*	7	S	2	Removed	
25	Swamp Paperbark	*Melaleuca ericifolia*	7	S	2	Removed	
26	Swamp Paperbark	*Melaleuca ericifolia*	6	S	2	Removed	
27	Swamp Paperbark	*Melaleuca ericifolia*	8	S	2	Removed	
28	Swamp Paperbark	*Melaleuca ericifolia*	10	S	2	Removed	
29	Swamp Paperbark	*Melaleuca ericifolia*	11	S	2	Removed	
30	Swamp Paperbark	*Melaleuca ericifolia*	9	S	2	Removed	
31	Swamp Paperbark	*Melaleuca ericifolia*	10	S	2	Removed	
32	Swamp Paperbark	*Melaleuca ericifolia*	8	S	2	Removed	
33	Swamp Paperbark	*Melaleuca ericifolia*	7	S	2	Retained	
34	Southern Blue Gum	*Eucalyptus globulus*	71	M	8.52	Retained	
35	Swamp Gum	*Eucalyptus ovata*	59	M	7.08	Retained	
36	Swamp Gum	*Eucalyptus ovata*	>90	L	15	Retained	
37	Swamp Gum	*Eucalyptus ovata*	LOT	L	15	Retained	
38	Swamp Gum	*Eucalyptus ovata*	103	L	12.36	Retained	
39	Swamp Gum	*Eucalyptus ovata*	92	L	11.04	Retained	
40	Swamp Gum	*Eucalyptus ovata*	88	L	10.56	Retained	

Notes: DBH = Diameter at breast height (130 cm from the ground); **TRZ** = Tree Retention Zone (see Appendix 6); **L** = Large, hollow-bearing trees (high habitat value); **M** = trees with intermediate habitat value; **S** = small trees with low habitat value

Appendix 4: Flora species recorded in the study area and threatened species known (or modelled) to occur in the search region

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Ace of Spades	*Epacris gunnii*			p					X
*	African Box-thorn	*Lycium ferocissimum*					C	WONS		X
*	African Love-grass	*Eragrostis curvula*					C		B	X
*	Agapanthus	*Agapanthus spp.*								X
*	Agapanthus	*Agapanthus praecox subsp. orientalis*							A	X
	Annual Fireweed	*Senecio glomeratus*			p					X
*	Annual Meadow-grass	*Poa annua*								X
	Austral Bracken	*Pteridium esculentum*								X
	Austral Grass-tree	*Xanthorrhoea australis*			p					X
	Australian Gipsywort	*Lycopus australis*								X
	Australian Salt-grass	*Distichlis distichophylla*								X
	Australian Sheep's Burr	*Acaena ovina*								X
	Australian Sweet-grass	*Glyceria australis*								X
*	Barley Grass	*Hordeum spp.*								X
	Beaded Glasswort	*Sarcocornia quinqueflora*								X
	Bent	*Agrostis s.s. spp.*								X
	Bidgee-widgee	*Acaena novae-zelandiae*								X
*	Bird's-foot Trefoil	*Lotus corniculatus*								X
*	Black Nightshade	*Solanum nigrum s.l.*								X
	Black Wattle	*Acacia mearnsii*			p					X
*	Blackberry	*Rubus fruticosus spp. agg.*					C	WONS		X
	Blackwood	*Acacia melanoxylon*								X
#	Blady Grass	*Imperata cylindrica*								X
Pl	Blue Box	*Eucalyptus baueriana*								X
	Blue Dampiera	*Dampiera stricta*								X
	Bog Gum	*Eucalyptus kitsoniana*				r				X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Bordered Panic	*Entolasia marginata*								X
	Bottle Daisy	*Lagenophora spp.*			p					X
	Bristly Wallaby-grass	*Rytidosperma setaceum*								X
	Broad-leaf Cumbungi	*Typha orientalis*								X
	Broad-leaf Rush	*Juncus planifolius*								X
	Broom Spurge	*Amperea xiphoclada var. xiphoclada*								X
	Brown-back Wallaby-grass	*Rytidosperma duttonianum*								X
*	Brown-top Bent	*Agrostis capillaris*							B	X
*	Buck's-horn Plantain	*Plantago coronopus*								X
*	Bulbous Rush	*Juncus bulbosus*								X
	Bulrush	*Typha spp.*								X
	Bush-pea	*Pultenaea spp.*								X
	Buttercup	*Ranunculus spp.*								X
	Button Everlasting	*Coronidium scorpioides s.s.*			p					X
*	Cape weed	*Arctotheca calendula*								X
*	Capitate Rush	*Juncus capitatus*								X
	Centella	*Centella cordifolia*								X
	Chaffy Saw-sedge	*Gahnia filum*								X
	Cherry Ballart	*Exocarpos cupressiformis*								X
*	Chickweed	*Stellaria media*								X
*	Cleavers	*Galium aparine*							B	X
	Clover Glycine	*Glycine latrobeana*	VU	L	p	v				
	Club Sedge	*Isolepis spp.*								X
*	Clustered Dock	*Rumex conglomeratus*								X
	Coarse Dodder-laurel	*Cassytha melantha*								X
	Coast Ballart	*Exocarpos syrticola*				r				
	Coast Beard-heath	*Leucopogon parviflorus*			p					X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Coast Boronia	*Boronia anemonifolia subsp. variabilis*			p	v				
	Coast Coral Heath	*Epacris microphylla var. microphylla*			p	v				
	Coast Fescue	*Poa billardierei*				r				
	Coast Manna-gum	*Eucalyptus viminalis subsp. pryoriana*								X
	Coast Tussock-grass	*Poa poiformis*								X
	Cobra Greenhood	*Pterostylis grandiflora*			p	r				
*	Cocksfoot	*Dactylis glomerata*							B	X
	Common Apple-berry	*Billardiera mutabilis*								X
*	Common Barb-grass	*Hainardia cylindrica*								X
	Common Blown-grass	*Lachnagrostis filiformis s.l.*								X
	Common Bog-sedge	*Schoenus apogon*								X
	Common Cassinia	*Cassinia aculeata subsp. aculeata*			p					X
	Common Cinnamon-wattle	*Acacia leprosa var. graveolens*			p	k				
	Common Duckweed	*Lemna disperma*								X
	Common Grass-sedge	*Carex breviculmis*								X
	Common Heath	*Epacris impressa*			p					X
	Common Rapier-sedge	*Lepidosperma filiforme*								X
	Common Reed	*Phragmites australis*								X
	Common Rice-flower	*Pimelea humilis*								X
	Common Sneezeweed	*Centipeda cunninghamii*			p					X
*	Common Sow-thistle	*Sonchus oleraceus*								X
	Common Spike-sedge	*Eleocharis acuta*								X
	Common Swamp Wallaby-grass	*Amphibromus nervosus*								X
	Common Tussock-grass	*Poa labillardierei var. labillardierei*								X
*	Common Water-starwort	*Callitriche stagnalis*								X
	Common Wheat-grass	*Anthosachne scabra s.l.*								X
	Common Woodruff	*Asperula conferta*								X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Common Woodruff	*Asperula conferta*								X
	Cotton Fireweed	*Senecio quadridentatus*			p					X
*	Couch	*Cynodon dactylon var. dactylon*							B	X
	Creeping Brookweed	*Samolus repens var. repens*								X
*	Creeping Buttercup	*Ranunculus repens*							B	X
	Creeping Raspwort	*Gonocarpus micranthus subsp. micranthus*								X
	Creeping Rush	*Juncus revolutus*				r				
*	Curled Dock	*Rumex crispus*								X
*	Drain Flat-sedge	*Cyperus eragrostis*								X
Pl	Drooping Sheoak	*Allocasuarina verticillata*								X
	Dusky Violet	*Viola fuscoviolacea*				r				
	Eastern Spider-orchid	*Caladenia orientalis*	EN	L	p	e				
	Eel Grass	*Vallisneria spp.*								X
*	Fiddle Dock	*Rumex pulcher subsp. pulcher*								X
*	Field Forget-me-not	*Myosotis arvensis*								X
	Finger Rush	*Juncus subsecundus*								X
*	Flatweed	*Hypochaeris radicata*								X
	Floating Pondweed	*Potamogeton tricarinatus s.l.*								X
	Forest Clematis	*Clematis glycinoides*								X
	Fringed Helmet-orchid	*Corybas fimbriatus*			p	r				
*	Garden Dandelion	*Taraxacum officinale spp. agg.*								X
	Gold Rush	*Juncus flavidus*								X
	Golden Wattle	*Acacia pycnantha*			p					X
*	Gorse	*Ulex europaeus*					C	WONS		X
	Grass Triggerplant	*Stylidium graminifolium s.l.*			p					X
	Grassy Club-sedge	*Isolepis hookeriana*								X
*	Great Brome	*Bromus diandrus*								X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
*	Greater Plantain	*Plantago major*								X
	Green Leek-orchid	*Prasophyllum lindleyanum*			p	v				
	Grey Mangrove	*Avicennia marina subsp. australasica*				r				X
	Groundsel	*Senecio spp.*			p					X
	Hairpin Banksia	*Banksia spinulosa var. cunninghamii*								X
*	Hairy Bird's-foot Trefoil	*Lotus subbiflorus*								X
*	Hairy Hawkbit	*Leontodon taraxacoides subsp. taraxacoides*								X
	Hairy Sheep's Burr	*Acaena agnipila*								X
*	Hastate Orache	*Atriplex prostrata*								X
	Hazel Pomaderris	*Pomaderris aspera*								X
	Heath Tea-tree	*Leptospermum myrsinoides*								X
*	Hemlock	*Conium maculatum*					C			X
	Hop Goodenia	*Goodenia ovata*								X
	Hop Wattle	*Acacia stricta*			p					X
	Ivy-leaf Violet	*Viola hederacea sensu Entwisle (1996)*								X
	Jagged Fireweed	*Senecio biserratus*			p					X
	Kidney-weed	*Dichondra repens*								X
*	Kikuyu	*Cenchrus clandestinus*							A	X
	Knob Sedge	*Carex inversa*								X
	Knotweed	*Persicaria spp.*								X
	Large Bindweed	*Calystegia sepium subsp. roseata*								X
*	Large Quaking-grass	*Briza maxima*							B	X
	Large White Spider-orchid	*Caladenia venusta*			p	r				
	Leafy Flat-sedge	*Cyperus lucidus*								X
*	Lesser Reed-mace	*Typha latifolia*							B	X
	Lizard Orchid	*Burnettia cuneata*			p	r				
	Long Purple-flag	*Patersonia occidentalis var. occidentalis*								X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Maroon Leek-orchid	*Prasophyllum frenchii*	EN	L	p	e				
	Marsh Saltbush	*Atriplex paludosa subsp. paludosa*				r				
	Mat Grass	*Hemarthria uncinata var. uncinata*								X
	Matted Flax-lily	*Dianella amoena*	EN	L	p	e				
	Matted St John's Wort	*Hypericum japonicum*								X
*	Meadow Fox-tail	*Alopecurus pratensis*								X
	Mentone Greenhood	*Pterostylis X toveyana*			p	v				
	Messmate Stringybark	*Eucalyptus obliqua*								X
	Metallic Sun-orchid	*Thelymitra epipactoides*	EN	L	p	e				
	Milky Beauty-heads	*Calocephalus lacteus*			p					X
*	Mirror Bush	*Coprosma repens*								X
*	Monterey Cypress	*Cupressus macrocarpa*								X
*	Montpellier Broom	*Genista monspessulana*					C	WONS		X
*	Moort	*Eucalyptus platypus subsp. platypus*								X
	Mountain Clematis	*Clematis aristata*								X
	Mud Dock	*Rumex bidens*								X
	Naked Crane's-bill	*Geranium sp. 5*								X
	Narrow-leaf Cumbungi	*Typha domingensis*								X
	Narrow-leaf Peppermint	*Eucalyptus radiata s.l.*								X
	Native Sea-spurrey	*Spergularia sp. 1*								X
	Nodding Saltbush	*Einadia nutans*								X
*	Onion Grass	*Romulea rosea*								X
	Orange-tip Finger-orchid	*Caladenia aurantiaca*			p	r				
	Pacific Azolla	*Azolla filiculoides*			p					X
	Pale Grass-lily	*Caesia parviflora*								X
	Pale Rush	*Juncus pallidus*								X
	Pale Swamp Everlasting	*Coronidium gunnianum*			p	v				X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Pale-fruit Ballart	*Exocarpos strictus*								X
	Panic	*Entolasia spp.*								X
*	Panic Veldt-grass	*Ehrharta erecta var. erecta*							B	X
	Parrot Pea	*Dillwynia spp.*								X
	Parsley Xanthosia	*Xanthosia leiophylla*				r				
*	Paspalum	*Paspalum dilatatum*							B	X
*	Perennial Rye-grass	*Lolium perenne*								X
*	Pine	*Pinus spp.*								X
	Pithy Sword-sedge	*Lepidosperma longitudinale*								X
*	Prairie Grass	*Bromus catharticus*								X
	Prickly Broom-heath	*Monotoca scoparia*			p					X
	Prickly Moses	*Acacia verticillata subsp. verticillata*			p					X
*	Prickly Paperbark	*Melaleuca styphelioides*								X
	Prickly Spear-grass	*Austrostipa stipoides*								X
	Prickly Tea-tree	*Leptospermum continentale*								X
*	Prostrate Knotweed	*Polygonum aviculare s.l.*								X
*	Prunus	*Prunus spp.*								X
	Purple Blown-grass	*Lachnagrostis punicea subsp. punicea*				r				
*	Purple Cudweed	*Gamochaeta purpurea s.l.*								X
	Rainforest Crane's-bill	*Geranium homeanum*								X
*	Rat-tail Grass	*Sporobolus africanus*								X
*	Red Clover	*Trifolium pratense*								X
	Red-fruit Saw-sedge	*Gahnia sieberiana*								X
	Reed Bent-grass	*Deyeuxia quadriseta*								X
*	Ribwort	*Plantago lanceolata*								X
*	River Oak	*Casuarina cunninghamiana subsp. cunninghamiana*								X
Pl	River Red-gum	*Eucalyptus camaldulensis*								X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	River Swamp Wallaby-grass	*Amphibromus fluitans*	VU							
*	Rough Dog's-tail	*Cynosurus echinatus*								X
	Rough Fireweed	*Senecio hispidulus s.l.*			p					X
*	Rough Sow-thistle	*Sonchus asper s.l.*								X
#	Rough-barked Honey-myrtle	*Melaleuca parvistaminea*								X
	Rush	*Juncus spp.*								X
#	Sallow Wattle	*Acacia longifolia subsp. longifolia*			p					X
	Salt Lawrencia	*Lawrencia spicata*				r				
	Salt Pratia	*Lobelia irrigua*								X
	Saw Banksia	*Banksia serrata*								X
*	Scarlet Pimpernel	*Lysimachia arvensis (Red-flowered variant)*								X
	Scented Paperbark	*Melaleuca squarrosa*								X
	Screw Fern	*Lindsaea linearis*			p					X
	Scrub Nettle	*Urtica incisa*								X
	Scrub Sheoak	*Allocasuarina paludosa*								X
	Sea Rush	*Juncus kraussii subsp. australiensis*								X
	Seaberry Saltbush	*Rhagodia candolleana subsp. candolleana*								X
*	Self-heal	*Prunella vulgaris*								X
	Shade Raspwort	*Gonocarpus humilis*								X
	Shady Wood-sorrel	*Oxalis exilis*								X
*	Sheep Sorrel	*Acetosella vulgaris*								X
	Shining Pennywort	*Hydrocotyle sibthorpioides*								X
	Shiny Swamp-mat	*Selliera radicans*								X
	Shrubby Fireweed	*Senecio minimus*			p					X
	Silky Guinea-flower	*Hibbertia sericea s.l.*								X
	Silver Banksia	*Banksia marginata*								X
	Silver Everlasting	*Argentipallium dealbatum*			p	r				

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Slender Bog-sedge	*Schoenus lepidosperma subsp. pachylepis*				r				
	Slender Knotweed	*Persicaria decipiens*								X
	Slender Leek-orchid	*Prasophyllum parviflorum*			p	v				
	Slender Tussock-grass	*Poa tenera*								X
	Slender Wallaby-grass	*Rytidosperma racemosum var. racemosum*								X
	Small Loosestrife	*Lythrum hyssopifolia*								X
	Small St John's Wort	*Hypericum gramineum spp. agg.*								X
	Small-flower Flax-lily	*Dianella brevicaulis*								X
	Small-leaf Bramble	*Rubus parvifolius*								X
	Smooth Pomaderris	*Pomaderris elliptica var. elliptica*								X
	Sneezeweed	*Centipeda spp.*			p					X
	Snowy Daisy-bush	*Olearia lirata*			p					X
*	Soft Brome	*Bromus hordeaceus subsp. hordeaceus*								X
	Soft Crane's-bill	*Geranium potentilloides*								X
#	Southern Blue-gum	*Eucalyptus globulus subsp. globulus*				r				
#	Southern Blue-gum	*Eucalyptus globulus*								X
	Southern Bristle-sedge	*Chorizandra australis*				k				
*	Sowbane	*Chenopodium murale*								X
*	Spanish Heath	*Erica lusitanica*								X
	Spear Grass-tree	*Xanthorrhoea resinosa*			p					X
*	Spear Thistle	*Cirsium vulgare*					C			X
	Spike Sedge	*Eleocharis spp.*								X
	Spike Wattle	*Acacia oxycedrus*			p					X
	Spiny-headed Mat-rush	*Lomandra longifolia*								X
	Spreading Guinea-flower	*Hibbertia procumbens*								X
	Spreading Rope-rush	*Empodisma minus*								X
	Spreading Sneezeweed	*Centipeda minima s.l.*			p					X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Spurred Helmet-orchid	*Corybas aconitiflorus*			p	r				
*	Squirrel-tail Fescue	*Vulpia bromoides*							B	X
*	St John's Wort	*Hypericum perforatum subsp. veronense*					C		B	X
*	St John's Wort	*Hypericum perforatum subsp. veronense*					C		B	X
	Star Cudweed	*Euchiton involucratus s.s.*			p					X
#	Sticky Wattle	*Acacia howittii*			p	r				X
	Streaked Arrowgrass	*Triglochin striata*								X
	Strzelecki Gum	*Eucalyptus strzeleckii*	VU	L	p	v				
	Summer Spider-orchid	*Caladenia flavovirens*			p	r				
	Sun Orchid	*Thelymitra spp.*			p					X
	Supple Spear-grass	*Austrostipa mollis*								X
	Swamp Crassula	*Crassula helmsii*								X
	Swamp Everlasting	*Xerochrysum palustre*	VU	L	p	v				
	Swamp Goodenia	*Goodenia humilis*								X
	Swamp Gum	*Eucalyptus ovata var. ovata*								X
#	Swamp Paperbark	*Melaleuca ericifolia*								X
	Swamp Selaginella	*Selaginella uliginosa*			p					X
*	Sweet Briar	*Rosa rubiginosa*					C			X
#	Sweet Pittosporum	*Pittosporum undulatum*								X
*	Sweet Vernal-grass	*Anthoxanthum odoratum*							B	X
*	Tall Fescue	*Festuca arundinacea*							B	X
	Tall Saw-sedge	*Gahnia clarkei*								X
	Tall Sedge	*Carex appressa*								X
	Tall Spike-sedge	*Eleocharis sphacelata*								X
	Tasman Flax-lily	*Dianella tasmanica*								X
	Tasman Pomaderris	*Pomaderris apetala subsp. maritima*				v				
	Tassel Sedge	*Carex fascicularis*								X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
	Thatch Saw-sedge	*Gahnia radula*								X
	Thick-lip Spider-orchid	*Caladenia tessellata*	VU		p	v				
	Tiny Arrowgrass	*Triglochin minutissima*				r				
	Toad Rush	*Juncus bufonius*								X
*	Toowoomba Canary-grass	*Phalaris aquatica*							B	X
	Tree Violet	*Melicytus dentatus s.s.*								X
	Tufted Lily	*Thelionema caespitosum*								X
	Tussock Grass	*Poa spp.*								X
	Twig Sedge	*Baumea spp.*								X
	Twiggy Daisy-bush	*Olearia ramulosa*			p					X
	Variable Stinkweed	*Opercularia varia*								X
	Varied Raspwort	*Haloragis heterophylla*								X
	Veined Spear-grass	*Austrostipa rudis*								X
	Wallaby Grass	*Rytidosperma spp.*								X
*	Water Buttons	*Cotula coronopifolia*								X
*	Water Couch	*Paspalum distichum*							B	X
	Water Milfoil	*Myriophyllum spp.*								X
	Water Plantain	*Alisma plantago-aquatica*								X
	Water Woodruff	*Asperula subsimplex*								X
*	Watercress	*Nasturtium officinale*								X
	Wattle Mat-rush	*Lomandra filiformis*								X
	Weeping Grass	*Microlaena spp.*								X
	Weeping Grass	*Microlaena stipoides var. stipoides*								X
	Weeping Wallaby-grass	*Rytidosperma penicillatum*								X
*	Weeping Willow	*Salix babylonica s.l.*								X
	Wetland Wallaby-grass	*Rytidosperma semiannulare*								X
*	White Arum-lily	*Zantedeschia aethiopica*							B	X

Origin	Common name	Scientific name	Conservation status				Weed status			Recorded
			EPBC-T	FFG-T	FFG-P	DELWP	CaLP Act	WONS	GS Target	
*	White Clover	*Trifolium repens var. repens*								X
*	Willow	*Salix spp.*					P	WONS		X
	Winged Water-starwort	*Callitriche umbonata*				r				
	Wiry Buttons	*Leptorhynchos tenuifolius*			p					X
PI	Yellow Box	*Eucalyptus melliodora*								X
	Yellow Sea-lavender	*Limonium australe var. australe*				r				
	Yellow Stringybark	*Eucalyptus muelleriana*								X
	Yertchuk	*Eucalyptus consideniana*								X
*	Yorkshire Fog	*Holcus lanatus*							b	X

Notes:

X = recorded in the study area
* = introduced to Victoria
# = Victorian native taxa occurring outside their natural range
PI = all individuals planted and managed without public funding

EPBC-T = threatened species status under EPBC Act:
EN = endangered
VU = vulnerable

FFG-T = threatened species status under the FFG Act: **L** = listed as threatened
FFG-P = protected species status under the FFG Act: **p** = listed as protected

DELWP = status under DELWP's Advisory List (DEPI 2014a):
x = presumed extinct in the wild
cr = critically endangered
e = endangered
v = vulnerable
r = rare
k = insufficiently known

CaLP Act = declared noxious weeds status under the CaLP Act:
S = State Prohibited Weeds (Any infestations are to be reported to DELWP. DELWP is responsible for control of State Prohibited Weeds)
P = Regionally Prohibited Weeds (Land owners must take all reasonable steps to eradicate regionally prohibited weeds on their land)
C = Regionally Controlled Weeds (Land owners have the responsibility to take all reasonable steps to prevent the growth and spread of Regionally controlled weeds on their land)
R = Restricted Weeds (Trade in these weeds and their propagules, either as plants, seeds or contaminants in other materials is prohibited)

WONS = Weeds of National Significance

Appendix 5: Vertebrate terrestrial fauna species recorded in the broader study area

Origin	Common name	Scientific name	Conservation status				Recorded
			EPBC-T	EPBC-M	FFG-T	DELWP	
Birds							
	Australasian Pipit	*Anthus novaeseelandiae*					X
	Australian Hobby	*Falco longipennis*					X
	Australian Magpie	*Gymnorhina tibicen*					X
	Australian Pelican	*Pelecanus conspicillatus*					X
	Australian Raven	*Corvus coronoides*					X
	Australian Shelduck	*Tadorna tadornoides*					X
	Australian White Ibis	*Threskiornis molucca*					X
	Australian Wood Duck	*Chenonetta jubata*					X
	Baillon's Crake	*Zapornia pusilla*			L	v	X
	Black Swan	*Cygnus atratus*					X
	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*					X
	Black-fronted Dotterel	*Elseyornis melanops*					X
	Black-shouldered Kite	*Elanus axillaris*					X
	Blue-winged Parrot	*Neophema chrysostoma*					X
	Brown Falcon	*Falco berigora*					X
	Brown Goshawk	*Accipiter fasciatus*					X
	Brown Songlark	*Cinclorhamphus cruralis*					X
	Brown Thornbill	*Acanthiza pusilla*					X
	Brown-headed Honeyeater	*Melithreptus brevirostris*					X
	Brush Bronzewing	*Phaps elegans*					X
	Chestnut Teal	*Anas castanea*					X
	Clamorous Reed Warbler	*Acrocephalus stentoreus*					X
*	Common Blackbird	*Turdus merula*					X
	Common Bronzewing	*Phaps chalcoptera*					X
*	Common Myna	*Acridotheres tristis*					X

Origin	Common name	Scientific name	Conservation status				Recorded
			EPBC-T	EPBC-M	FFG-T	DELWP	
*	Common Starling	*Sturnus vulgaris*					X
	Crimson Rosella	*Platycercus elegans*					X
	Dusky Moorhen	*Gallinula tenebrosa*					X
	Eastern Great Egret	*Ardea modesta*		M (JAMBA, CAMBA)	L	v	X
	Eastern Rosella	*Platycercus eximius*					X
	Eastern Yellow Robin	*Eopsaltria australis*					X
	Eurasian Coot	*Fulica atra*					X
	European Goldfinch	*Carduelis carduelis*					X
*	European Greenfinch	*Carduelis chloris*					X
*	European Skylark	*Alauda arvensis*					X
	Fairy Martin	*Hirundo ariel*					X
	Forest Raven	*Corvus tasmanicus*					X
	Fork-tailed Swift	*Apus pacificus*		M (JAMBA, CAMBA, ROKAMBA)			X
	Galah	*Eolophus roseicapilla*					X
	Golden Whistler	*Pachycephala pectoralis*					X
	Golden-headed Cisticola	*Cisticola exilis*					X
	Great Cormorant	*Phalacrocorax carbo*					X
	Grey Butcherbird	*Cracticus torquatus*					X
	Grey Currawong	*Strepera versicolor*					X
	Grey Fantail	*Rhipidura albiscarpa*					X
	Grey Shrike-thrush	*Colluricincla harmonica*					X
	Grey Teal	*Anas gracilis*					X
	Hoary-headed Grebe	*Poliocephalus poliocephalus*					X
*	House Sparrow	*Passer domesticus*					X

Origin	Common name	Scientific name	Conservation status				Recorded
			EPBC-T	EPBC-M	FFG-T	DELWP	
	Latham's Snipe	*Gallinago hardwickii*		M (JAMBA, CAMBA, ROKAMBA, Bonn A2H)		nt	X
	Laughing Kookaburra	*Dacelo novaeguineae*					X
	Lewin's Honeyeater	*Meliphaga lewinii*					X
	Little Black Cormorant	*Phalacrocorax sulcirostris*					X
	Little Egret	*Egretta garzetta nigripes*			L	e	X
	Little Grassbird	*Megalurus gramineus*					X
	Little Pied Cormorant	*Microcarbo melanoleucos*					X
	Little Raven	*Corvus mellori*					X
	Little Wattlebird	*Anthochaera chrysoptera*					X
	Magpie-lark	*Grallina cyanoleuca*					X
	Masked Lapwing	*Vanellus miles*					X
	Nankeen Kestrel	*Falco cenchroides*					X
	New Holland Honeyeater	*Phylidonyris novaehollandiae*					X
	Noisy Miner	*Manorina melanocephala*					X
	Pacific Black Duck	*Anas superciliosa*					X
	Peregrine Falcon	*Falco peregrinus*					X
	Purple Swamphen	*Porphyrio porphyrio*					X
	Rainbow Lorikeet	*Trichoglossus haematodus*					X
	Red Wattlebird	*Anthochaera carunculata*					X
	Red-browed Finch	*Neochmia temporalis*					X
	Red-rumped Parrot	*Psephotus haematonotus*					X
*	Rock Dove	*Columba livia*					X
	Royal Spoonbill	*Platalea regia*				nt	X
	Rufous Whistler	*Pachycephala rufiventris*					X
	Sacred Kingfisher	*Todiramphus sanctus*					X
	Silvereye	*Zosterops lateralis*					X

Origin	Common name	Scientific name	Conservation status				Recorded
			EPBC-T	EPBC-M	FFG-T	DELWP	
	Singing Honeyeater	*Lichenostomus virescens*					X
	Spotted Pardalote	*Pardalotus punctatus*					X
*	Spotted Turtle-Dove	*Streptopelia chinensis*					X
	Straw-necked Ibis	*Threskiornis spinicollis*					X
	Striated Fieldwren	*Calamanthus fuliginosus*					X
	Striated Pardalote	*Pardalotus striatus*					X
	Striated Thornbill	*Acanthiza lineata*					X
	Sulphur-crested Cockatoo	*Cacatua galerita*					X
	Superb Fairy-wren	*Malurus cyaneus*					X
	Swamp Harrier	*Circus approximans*					X
	Tree Martin	*Petrochelidon nigricans*					X
	Wedge-tailed Eagle	*Aquila audax*					X
	Welcome Swallow	*Petrochelidon neoxena*					X
	White-browed Scrubwren	*Sericornis frontalis*					X
	White-eared Honeyeater	*Lichenostomus leucotis*					X
	White-faced Heron	*Egretta novaehollandiae*					X
	White-fronted Chat	*Epthianura albifrons*					X
	White-naped Honeyeater	*Melithreptus lunatus*					X
	White-necked Heron	*Ardea pacifica*					X
	White-plumed Honeyeater	*Lichenostomus penicillatus*					X
	White-throated Needletail	*Hirundapus caudacutus*		M (JAMBA, CAMBA, ROKAMBA)		v	X
	White-throated Treecreeper	*Cormobates leucophaeus*					X
	Willie Wagtail	*Rhipidura leucophrys*					X
	Yellow-faced Honeyeater	*Lichenostomus chrysops*					X
	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*					X
	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*					X

Origin	Common name	Scientific name	Conservation status				Recorded
			EPBC-T	EPBC-M	FFG-T	DELWP	
Mammals							
	Black Wallaby	*Wallabia bicolor*					X
*	Cat	*Felis catus*					X
	Common Wombat	*Vombatus ursinus*					X
	Eastern Grey Kangaroo	*Macropus giganteus*					X
*	European Hare	*Lepus europeaus*					X
*	European Rabbit	*Oryctolagus cuniculus*					X
*	Hog Deer	*Cervus porcinus*					X
*	Red Fox	*Vulpes vulpes*					X
	Red-necked Wallaby	*Macropus rufogriseus*					X
	Short-beaked Echidna	*Tachyglossus aculeatus*					X
Reptiles							
	Easter Brown Snake	*Pseudonaja textilis*					X
	Eastern Three-lined Skink	*Acritoscincus duperreyi*					X
	Garden Skink	*Lampropholis guichenoti*					X
	Jacky Lizard	*Amphibolurus muricatus*					X
	Metallic Skink	*Niveoscincus metallicus*					X
	Tiger Snake	*Notechis scutatus*					X
Frogs							
	Common Froglet	*Crinia signifera*					X
	Pobblebonk Frog	*Limnodynastes dumerilii insularis*					X
	Spotted Marsh Frog	*Limnodynastes tasmaniensis*					X

Notes:

X = recorded in the study area
* = introduced to Victoria
# = Victorian native taxa occurring outside their natural range

EPBC-T = threatened species status under EPBC Act:

EX = presumed extinct in the wild
CE = critically endangered

EN = endangered
VU = vulnerable

EPBC-M = migratory status under the EPBC Act – **M** = listed migratory taxa:

Bonn Convention (A2H) - Convention on the Conservation of Migratory Species of Wild Animals – listed as a member of a family
Bonn Convention (A2S) - Convention on the Conservation of Migratory Species of Wild Animals - species listed explicitly
CAMBA - China- Australia Migratory Birds Agreement
JAMBA - Japan-Australia Migratory Birds Agreement
ROKAMBA - Republic of Korea Australia Migratory Birds Agreement

FFG-thrt = threatened species status under the FFG Act: **L** = listed as threatened

DELWP = status under DELWP's Advisory List (DEPI 2014c):

x = presumed extinct in the wild
cr = critically endangered
e = endangered
v = vulnerable
nt = lower risk near threatened
dd = data deficient

Appendix 6: Guidelines for impacts to trees

DELWP guidelines (DSE 2010) provide definitions regarding tree retention and losses. These are outlined below, and it is considered that they should be applied to scattered trees and edges of treed remnant patches when determining the proximity of development to retained native vegetation.

Any tree is deemed lost when:

- Earthworks encroach on more than 10% of its Tree Retention Zone (TRZ) during construction activities. Tree Retention Zones:
    - Are defined as the area from the respective tree within a radius of 12 times the DBH of the respective tree, including the area above and below ground, notwithstanding it can be a minimum of two metres and a maximum of 15 metres radius around the respective tree
    - Extend at least one metre outside the crown projection, if the tree is a Tree Fern (DSE 2010)
    - Must be securely fenced off with high-visibility temporary fencing and appropriately signed as "Tree Retention Zone – keep out"
- Directional drilling within its TRZ occurs at less than 600 millimetres below the surface, or is not confirmed to be appropriate (including considerations concerning bore hole width) by a qualified arborist
- Lopping removes more than 1/3 of its crown
- Its trunk is damaged
- It is likely to pose a risk to safety or property as a result of the proposed development/works (e.g. a dwelling is proposed to be constructed near a tree that a qualified arborist has deemed likely to pose a risk to the dwelling)

Appendix 7: General development recommendations

Consideration should be given to including the measures described below in a construction and operational environmental management plan for the project.

Pre-construction phase:

- Where feasible, development and associated works should be sited at least thirty metres away from rivers, creeks and significant drainage lines.
- 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 rivers, creeks and significant drainage lines.
- Construction contractors should be inducted into an environmental management program for construction works.
- All environmental controls should be checked for compliance on a regular basis.

Construction phase:

- Environmentally sensitive areas including retained native vegetation within 50 metres of works (including access points and routes) should be securely fenced at two metres from the perimeter and appropriately signed. All machinery, vehicles, equipment, personnel, waste materials/spoil and earthworks are to be excluded from these areas.
- Tree Retention Zones (TRZs) are to be established and maintained around all retained scattered trees within 50 metres of works (including access points and routes) for the duration of construction activities. Construction and construction-related activities are to be excluded from the TRZ. Encroachment into the TRZ (including earthworks such as trenching for pipelines or cabling, etc. that disturb the root zone) must not affect more than 10% of the total area of the TRZ. Directional drilling must not be undertaken within TRZs, unless:
    - The directional drilling bore is at least 600 millimetres deep; AND
    - A qualified arborist has confirmed in writing that the radius of the bore will not significantly damage the tree causing it to be lost in the future; AND
    - A qualified arborist has confirmed in writing that the use of directional drilling is appropriate for the specific project/works.
- Any pruning of native trees should be undertaken using a suitably qualified arborist and be carried out in accordance with *Australian Standard 4373 – 2007 Pruning of Amenity Trees* to the satisfaction of the Responsible Authority . An excavator, backhoe, bulldozer blade or loader should not be used to trim branches.
- A suitably qualified arborist (Level 5) should be on-site during all works within Tree Protection Zones of any native canopy tree located within five metres of the works to ensure all efforts are taken to avoid impacts on the root zones, to monitor root damage and carry out any amelioration to disturbed roots.
- Any stockpiling should 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 clean and free of weeds and pathogens (including seeds and other propagules).
- All machinery wash down, lay down and personnel rest areas should be defined (fenced) and located in disturbed areas.
- All works must be undertaken in a manner that will minimise soil erosion and adhere to Construction Techniques for Sediment Pollution Control (EPAV 1991).

Post-construction phase:

- Weed control, by an experienced bush regenerator, is to be carried out along disturbed areas after construction to control any weed outbreaks in farmland or native vegetation as well as along 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.

Decommissioning phase:

- As per construction phase.

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 3: Damp Sands Herb-rich Woodland

Description:
A low, grassy or bracken-dominated eucalypt forest or open woodland to 15 m tall with a large shrub layer and ground layer rich in herbs, grasses, and orchids. Occurs mainly on flat or undulating areas on moderately fertile, relatively well-drained, deep sandy or loamy topsoils over heavier subsoils (duplex soils).

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	70 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	*Eucalyptus viminalis* ssp. *pryoriana*	Rough-barked Manna Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	5	25%	MS
Small Shrub	3	5%	SS
Prostrate Shrub	1	1%	PS
Large Herb	2	5%	LH
Medium Herb	8	15%	MH
Small or Prostrate Herb	5	10%	SH
Large Tufted Graminoid	2	10%	LTG
Large Non-tufted Graminoid	1	1%	LNG
Medium to Small Tufted Graminoid	4	10%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Ground Fern	1	15%	GF
Bryophytes/Lichens	na	10%	BL

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EVC 3: Damp Sands Herb-rich Woodland - Gippsland Plain bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia mearnsii*	Black Wattle
T	*Acacia melanoxylon*	Blackwood
MS	*Epacris impressa*	Common Heath
MS	*Leptospermum continentale*	Prickly Tea-tree
MS	*Banksia marginata*	Silver Banksia
MS	*Leptospermum myrsinoides*	Heath Tea-tree
SS	*Leucopogon virgatus*	Common Beard-heath
SS	*Dillwynia glaberrima*	Smooth Parrot-pea
SS	*Amperea xiphoclada* var. *xiphoclada*	Broom Spurge
PS	*Astroloma humifusum*	Cranberry Heath
MH	*Gonocarpus tetragynus*	Common Raspwort
MH	*Drosera peltata* ssp. *auriculata*	Tall Sundew
MH	*Viola hederacea* sensu Willis (1972)	Ivy-leaf Violet
MH	*Geranium solanderi* s.l.	Austral Cranesbill
SH	*Hydrocotyle laxiflora*	Stinking Pennywort
SH	*Opercularia varia*	Variable Stinkweed
SH	*Dichondra repens*	Kidney-weed
SH	*Poranthera microphylla*	Small Poranthera
LTG	*Lomandra longifolia*	Spiny-headed Mat-rush
LTG	*Austrostipa mollis*	Supple Spear-grass
LNG	*Tetrarrhena juncea*	Forest Wire-grass
MTG	*Lepidosperma concavum*	Sandhill Sword-sedge
MTG	*Dianella revoluta* s.l.	Black-anther Flax-lily
MTG	*Lomandra filiformis*	Wattle-headed Mat-rush
MTG	*Poa sieberiana*	Grey Tussock-grass
MNG	*Microlaena stipoides* var. *stipoides*	Weeping Grass
GF	*Pteridium esculentum*	Austral Bracken

Recruitment:
Continuous

Organic Litter:
40 % cover

Logs:
15 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	*Hypochoeris radicata*	Cat's Ear	high	low
LTG	*Anthoxanthum odoratum*	Sweet Vernal Grass	high	high
LNG	*Holcus lanatus*	Yorkshire Fog	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 8: Wet Heathland

Description:
A low, generally treeless heathland although sometimes emergent eucalypts may be present. Occurs on lower slopes, flats or depressions, which are infertile and subjected to prolonged water logging. Understorey is often dominated by a range of sedges, grasses and shrubs.

Life Forms:

Life form	#Spp	%Cover	LF code
Medium Shrub	6	40%	MS
Small Shrub	3	5%	SS
Prostrate Shrub	1	1%	PS
Medium Herb	3	5%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	2	10%	LNG
Medium to Small Tufted Graminoid	2	5%	MTG
Medium to Tiny Non-tufted Graminoid	5	20%	MNG
Ground Fern	1	1%	GF
Bryophytes/Lichens	na	20%	BL

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Melaleuca squarrosa*	Scented Paperbark
MS	*Leptospermum continentale*	Prickly Tea-tree
MS	*Allocasuarina paludosa*	Scrub Sheoak
MS	*Sprengelia incarnata*	Pink Swamp-heath
SS	*Platylobium obtusangulum*	Common Flat-pea
SS	*Epacris obtusifolia*	Blunt-leaf Heath
SS	*Epacris gunnii*	Ace of Spades
MH	*Gonocarpus humilis*	Shade Raspwort
MH	*Gonocarpus tetragynus*	Common Raspwort
LNG	*Gahnia radula*	Thatch Saw-sedge
MTG	*Patersonia occidentalis*	Long Purple-flag
MNG	*Schoenus brevifolius*	Zig-zag Bog-sedge
MNG	*Schoenus lepidosperma*	Slender Bog-sedge
MNG	*Baumea juncea*	Bare Twig-sedge
MNG	*Leptocarpus tenax*	Slender Twine-rush
SC	*Cassytha glabella*	Slender Dodder-laurel
GF	*Lindsaea linearis*	Screw Fern

Recruitment:
Episodic/Fire. Desirable period between disturbances is 30 years.

Organic Litter:
20% cover

Weediness:
There are no consistent weeds in this EVC.

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 9: Coastal Saltmarsh

Description:
Occurs on and immediately above marine and estuarine tidal flats and contains distinct floristic communities as bands or zones in the same location, depending on the positioning of the various floristic communities in relation to the saline environment. Consists of a range of life forms including succulent herbs, low succulent shrubs, rushes and sedges.

Life Forms:

Life form	#Spp	%Cover	LF code
Medium Shrub	2	20%	MS
Small Shrub	1	1%	SS
Medium Herb	3	20%	MH
Small or Prostrate Herb	2	15%	SH
Large Non-tufted Graminoid	1	1%	LNG
Medium to Small Tufted Graminoid	1	5%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Soil Crust	na	10%	S/C
Total understorey projective foliage cover		**70%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Sclerostegia arbuscula*	Shrubby Glasswort
SS	*Suaeda australis*	Austral Seablite
MH	*Sarcocornia quinqueflora*	Beaded Glasswort
MH	*Samolus repens*	Creeping Brookweed
MH	*Hemichroa pentandra*	Trailing Hemichroa
SH	*Disphyma crassifolium ssp. clavellatum*	Rounded Noon-flower
MNG	*Triglochin striatum*	Streaked Arrowgrass
MNG	*Distichlis distichophylla*	Australian Salt-grass

Recruitment:
Continuous

Organic Litter:
10 % cover

Weediness:
There are no consistent weeds in this EVC.

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 18: Riparian Forest

Description:
A tall forest to 30 m tall along river banks and associated alluvial terraces with occasional occurrences in the heads of gullies leading into creeks and rivers. The soil is fertile alluvium, regularly inundated and permanently moist. Dominated by tall eucalypts but also has an open to sparse secondary tree layer of wattles and scattered dense patches of shrubs, ferns, grasses and herbs.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	80 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
40%	*Eucalyptus ovata*	Swamp Gum
	Eucalyptus radiata s.l.	Narrow-leaf Peppermint
	Eucalyptus obliqua	Messmate Stringybark
	Eucalyptus viminalis	Manna Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	15%	T
Medium Shrub	8	25%	MS
Small Shrub	1	5%	SS
Large Herb	3	5%	LH
Medium Herb	10	10%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	3	15%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	4	10%	MTG
Medium to Tiny Non-tufted Graminoid	3	10%	MNG
Ground Fern	3	15%	GF
Tree Fern	1	1%	TRF
Scrambler or Climber	2	5%	SC
Bryophytes/Lichens	na	20%	BL

EVC 18: Riparian Forest - Gippsland Plain bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia dealbata*	Silver Wattle
T	*Acacia melanoxylon*	Blackwood
MS	*Acacia verticillata*	Prickly Moses
MS	*Goodenia ovata*	Hop Goodenia
MS	*Ozothamnus ferrugineus*	Tree Everlasting
MS	*Leptospermum continentale*	Prickly Tea-tree
LH	*Senecio linearifolius*	Fireweed Groundsel
MH	*Acaena novae-zelandiae*	Bidgee-widgee
MH	*Viola hederacea sensu Willis (1972)*	Ivy-leaf Violet
SH	*Dichondra repens*	Kidney-weed
SH	*Oxalis corniculata s.l.*	Yellow Wood-sorrel
SH	*Galium propinquum*	Maori Bedstraw
SH	*Hydrocotyle hirta*	Hairy Pennywort
LTG	*Gahnia sieberiana*	Red-fruit Saw-sedge
LTG	*Lomandra longifolia*	Spiny-headed Mat-rush
LTG	*Carex appressa*	Tall Sedge
LNG	*Tetrarrhena juncea*	Forest Wire-grass
MTG	*Lepidosperma laterale*	Variable Sword-sedge
MTG	*Dianella tasmanica*	Tasman Flax-lily
MTG	*Poa australis spp. agg.*	Tussock Grass
MNG	*Poa tenera*	Slender Tussock-grass
MNG	*Microlaena stipoides var. stipoides*	Weeping Grass
MNG	*Echinopogon ovatus*	Common Hedgehog-grass
GF	*Pteridium esculentum*	Austral Bracken
GF	*Adiantum aethiopicum*	Common Maidenhair
GF	*Blechnum nudum*	Fishbone Water-fern
GF	*Blechnum minus*	Soft Water-fern
TRF	*Cyathea australis*	Rough Tree-fern
TRF	*Dicksonia antarctica*	Soft Tree-fern
SC	*Clematis aristata*	Mountain Clematis

Recruitment:
Continuous

Organic Litter:
50 % cover

Logs:
30 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Rubus fruticosus spp. agg.*	Blackberry	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Plantago lanceolata*	Ribwort	high	low
LH	*Cirsium vulgare*	Spear Thistle	high	high
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Prunella vulgaris*	Self-heal	high	low
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Anthoxanthum odoratum*	Sweet Vernal-grass	high	high
SC	*Galium aparine*	Cleavers	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 48: Heathy Woodland

Description:
Spans a variety of geologies but is generally associated with nutrient-poor soils including deep uniform sands (aeolian or outwash) and Tertiary sand/clay which has been altered to form quartzite gravel. Eucalypt-dominated low woodland to 10 m tall lacking a secondary tree layer and generally supporting a diverse array of narrow or ericoid-leaved shrubs except where frequent fire has reduced this to a dense cover of bracken. Geophytes and annuals can be quite common but the ground cover is normally fairly sparse.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	50 cm	15 / ha
Banksia serrata	40 cm	

Tree Canopy Cover:

%cover	Character Species	Common Name
10%	*Eucalyptus willisii*	Jimmy's Shining Peppermint
	Eucalyptus obliqua	Messmate Stringybark
	Eucalyptus radiata s.l.	Narrow-leaf Peppermint
	Eucalyptus viminalis ssp. *pryoriana*	Rough-barked Manna Gum
	Banksia serrata	Saw Banksia

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Medium Shrub	5	30%	MS
Small Shrub	5	20%	SS
Medium Herb	2	5%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	1	1%	LNG
Medium to Small Tufted Graminoid	1	5%	MTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Ground Fern	1	5%	GF
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	10%	S/C

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Epacris impressa*	Common Heath
MS	*Leptospermum myrsinoides*	Heath Tea-tree
MS	*Leptospermum continentale*	Prickly Tea-tree
MS	*Monotoca scoparia*	Prickly Broom-heath
SS	*Amperea xiphoclada* var. *xiphoclada*	Broom Spurge
SS	*Leucopogon virgatus*	Common Beard-heath
SS	*Dillwynia glaberrima*	Smooth Parrot-pea
LTG	*Gahnia sieberiana*	Red-fruit Saw-sedge
MTG	*Xanthorrhoea minor* ssp. *lutea*	Small Grass-tree
MNG	*Hypolaena fastigiata*	Tassel Rope-rush
SC	*Cassytha glabella*	Slender Dodder-laurel

Victoria The Place To Be

Recruitment:
Episodic/Fire. Desirable period between disturbances is 20 years.

Organic Litter:
40 % cover

Logs:
15 m/0.1 ha.

Weediness:
There are no consistent weeds in this EVC.

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 53_61: Swamp Scrub

Description:

Closed scrub to 8 m tall at low elevations on alluvial deposits along streams or on poorly drained sites with higher nutrient availability. The EVC is dominated by Swamp Paperbark *Melaleuca ericifolia* (or sometimes Woolly Tea-tree *Leptospermum lanigerum*) which often forms a dense thicket, out-competing other species. Occasional emergent eucalypts may be present. Where light penetrates to ground level, a moss/lichen/liverwort or herbaceous ground cover is often present. Dry variants have a grassy/herbaceous ground layer.

Canopy Cover:

% cover	Character Species	Common Name
50%	*Leptospermum lanigerum*	Woolly Tea-tree
	Melaleuca ericifolia	Swamp Paperbark

Understorey:

Life form	# Spp	% Cover	LF code
Medium Shrub	2	10%	MS
Small Shrub	2	1%	SS
Large Herb	2	5%	LH
Medium Herb	3	15%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	2	10%	LTG
Large Non-tufted Graminoid	3	10%	LNG
Medium to Small Tufted Graminoid	2	5%	MTG
Medium to Tiny Non-tufted Graminoid	2	15%	MNG
Ground Fern	1	5%	GF
Scrambler or Climber	1	1%	SC
Bryophytes/Lichens	na	20%	BL

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Coprosma quadrifida*	Prickly Currant-bush
MS	*Leptospermum continentale*	Prickly Tea-tree
LH	*Lycopus australis*	Australian Gipsywort
LH	*Lythrum salicaria*	Purple Loosestrife
LH	*Persicaria praetermissa*	Spotted Knotweed
MH	*Hydrocotyle pterocarpa*	Wing Pennywort
MH	*Stellaria angustifolia*	Swamp Starwort
MH	*Lobelia anceps*	Angled Lobelia
SH	*Crassula helmsii*	Swamp Crassula
LTG	*Juncus procerus*	Tall Rush
LTG	*Poa labillardierei*	Common Tussock-grass
LNG	*Gahnia radula*	Thatch Saw-sedge
LNG	*Phragmites australis*	Common Reed
LNG	*Baumea rubiginosa* s.l.	Soft Twig-rush
MTG	*Triglochin procerum* s.l.	Water Ribbons
MTG	*Juncus gregiflorus*	Green Rush
MNG	*Eleocharis acuta*	Common Spike-sedge
GF	*Blechnum cartilagineum*	Gristle Fern
SC	*Calystegia sepium*	Large Bindweed

Victoria The Place To Be

Recruitment:
Continuous

Organic Litter:
40 % cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	*Hypochoeris radicata*	Cat's Ear	high	low
LNG	*Holcus lanatus*	Yorkshire Fog	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 56: Floodplain Riparian Woodland

Description:
An open eucalypt woodland to 20 m tall over a medium to tall shrub layer with a ground layer consisting of amphibious and aquatic herbs and sedges. Occurs along the banks and floodplains of the larger meandering rivers and major creeks, often in conjunction with one or more floodplain wetland communities. Elevation and rainfall are relatively low and soils are fertile alluviums subject to periodic flooding and inundation.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	*Eucalyptus camaldulensis*	River Red-gum
	Eucalyptus tereticornis ssp. *mediana*	Gippsland Red Gum
	Eucalyptus ovata	Swamp Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	10%	T
Medium Shrub	5	15%	MS
Large Herb	7	15%	LH
Medium Herb	5	10%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	2	10%	LTG
Large Non-tufted Graminoid	1	10%	LNG
Medium to Small Tufted Graminoid	5	10%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Scrambler or Climber	2	5%	SC
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia implexa*	Lightwood
T	*Acacia melanoxylon*	Blackwood
MS	*Ozothamnus ferrugineus*	Tree Everlasting
MS	*Bursaria spinosa* ssp. *spinosa*	Sweet Bursaria
MS	*Hymenanthera dentata* s.l.	Tree Violet
LH	*Urtica incisa*	Scrub Nettle
LH	*Persicaria subsessilis*	Hairy Knotweed
LH	*Senecio quadridentatus*	Cottony Fireweed
MH	*Acaena novae-zelandiae*	Bidgee-widgee
MH	*Hydrocotyle hirta*	Hairy Pennywort
MH	*Stellaria pungens*	Prickly Starwort
MH	*Veronica plebeia*	Trailing Speedwell
SH	*Oxalis corniculata* s.l.	Yellow Wood-sorrel
SH	*Dichondra repens*	Kidney-weed
LTG	*Carex appressa*	Tall Sedge
LTG	*Poa labillardierei*	Common Tussock-grass
LNG	*Phragmites australis*	Common Reed
MTG	*Juncus amabilis*	Hollow Rush
MTG	*Cyperus* spp.	Flat-sedge
MNG	*Microlaena stipoides* var. *stipoides*	Weeping Grass
MNG	*Eleocharis acuta*	Common Spike-sedge
SC	*Calystegia sepium*	Large Bindweed

Victoria The Place To Be

Recruitment:
Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:
40 % cover

Logs:
30 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	*Crataegus monogyna*	Hawthorn	high	high
T	*Fraxinus* spp.	Ash	high	high
MS	*Solanum pseudocapsicum*	Madeira Winter-cherry	high	low
MS	*Prunus cerasifera*	Cherry Plum	high	high
MS	*Rubus fruticosus* spp. agg.	Blackberry	high	high
LH	*Rumex conglomeratus*	Clustered Dock	high	low
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Plantago lanceolata*	Ribwort	high	low
LH	*Rumex crispus*	Curled Dock	high	low
LH	*Rorippa palustris*	Marsh Yellow-cress	high	high
LH	*Helminthotheca echioides*	Ox-tongue	high	low
LH	*Verbena bonariensis* s.l.	Purple-top Verbena	high	high
LH	*Aster subulatus*	Aster-weed	high	low
MH	*Ranunculus repens*	Creeping Buttercup	high	high
MH	*Leontodon taraxacoides* ssp. *taraxacoides*	Hairy Hawkbit	high	low
MH	*Taraxacum officinale* spp. agg.	Garden Dandelion	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
SH	*Trifolium repens* var. *repens*	White Clover	high	low
SH	*Modiola caroliniana*	Red-flower Mallow	high	low
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Bromus catharticus*	Prairie Grass	high	low
MTG	*Ehrharta erecta* var. *erecta*	Panic Veldt-grass	high	high
MTG	*Cyperus eragrostis*	Drain Flat-sedge	high	high
MTG	*Paspalum dilatatum*	Paspalum	high	high
MTG	*Lolium perenne*	Perennial Rye-grass	high	low
MTG	*Agrostis capillaris* s.l.	Brown-top Bent	high	high
MNG	*Paspalum distichum*	Water Couch	high	high
SC	*Galium aparine*	Cleavers	high	low
SC	*Tradescantia fluminensis*	Wandering Jew	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 83: Swampy Riparian Woodland

Description:
Woodland to 15 m tall generally occupying low energy streams of the foothills and plains. The lower strata are variously locally dominated by a range of large and medium shrub species on the stream levees in combination with large tussock grasses and sedges in the ground layer.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	70 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	*Eucalyptus ovata*	Swamp Gum
	Eucalyptus radiata s.l.	Narrow-leaf Peppermint

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	4	30%	T
Medium Shrub	5	20%	MS
Small Shrub	1	1%	SS
Prostrate Shrub	1	1%	PS
Large Herb	3	5%	LH
Medium Herb	7	10%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	3	15%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	5	10%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Ground Fern	2	10%	GF
Scrambler or Climber	2	5%	SC
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia melanoxylon*	Blackwood
T	*Melaleuca ericifolia*	Swamp Paperbark
T	*Leptospermum lanigerum*	Woolly Tea-tree
MS	*Leptospermum continentale*	Prickly Tea-tree
MS	*Coprosma quadrifida*	Prickly Currant-bush
MS	*Bursaria spinosa*	Sweet Bursaria
LH	*Senecio minimus*	Shrubby Fireweed
MH	*Gonocarpus tetragynus*	Common Raspwort
MH	*Acaena novae-zelandiae*	Bidgee-widgee
MH	*Hydrocotyle hirta*	Hairy Pennywort
SH	*Dichondra repens*	Kidney-weed
LTG	*Carex appressa*	Tall Sedge
LTG	*Cyperus lucidus*	Leafy Flat-sedge
LTG	*Lepidosperma elatius*	Tall Sword-sedge
LTG	*Juncus procerus*	Tall Rush
LNG	*Phragmites australis*	Common Reed
MTG	*Themeda triandra*	Kangaroo Grass
MTG	*Lomandra filiformis*	Wattle Mat-rush
MNG	*Microlaena stipoides* var. *stipoides*	Weeping Grass
GF	*Pteridium esculentum*	Austral Bracken

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Recruitment:
Continuous

Organic Litter:
20 % cover

Logs:
20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Cirsium vulgare*	Spear Thistle	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Prunella vulgaris*	Self-heal	high	high
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Anthoxanthum odoratum*	Sweet Vernal-grass	high	high
MTG	*Briza maxima*	Large Quaking-grass	high	low

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 132_62: *South Gippsland* Plains Grassland

Description:

Treeless or with occasional scattered trees above a largely grassy understorey on grey silty-loamy soils, often seasonally water-logged. Shrubs may be also occasionally present.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	5	5%	LH
Medium Herb	12	5%	MH
Small or Prostrate Herb	6	5%	SH
Large Tufted Graminoid	3	10%	LTG
Medium to Small Tufted Graminoid	5	50%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		**95%**	

LF Code	Species typical of at least part of EVC range	Common Name
LH	*Tricoryne elatior*	Yellow Rush-lily
LH	*Leptorhyncos tenuifolius*	Wiry Buttons
LH	*Calocephalus lacteus*	Milky Beauty-heads
LH	*Haloragis heterophylla*	Varied Raspwort
MH	*Oxalis exilis*	Shady Wood-sorrel
MH	*Acaena novae-zelandiae*	Bidgee-widgee
SH	*Dichondra repens*	Kidney-weed
LTG	*Poa labillardierei*	Common Tussock-grass
LTG	*Lomandra longifolia*	Spiny-headed Mat-rush
MTG	*Themeda triandra*	Kangaroo Grass
MTG	*Lachnagrostis filiformis*	Common Blown-Grass
MTG	*Schoenus apogon*	Common Bog-sedge
MTG	*Austrodanthonia laevis*	Smooth Wallaby-grass
MNG	*Hemarthria uncinata var. uncinata*	Mat Grass
MNG	*Distichlis distichopylla*	Australian Salt-grass
SC	*Clematis microphylla*	Small-leaved Clematis

Recruitment:

Episodic/Fire or Grazing.

Organic Litter:

10 % cover

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Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
SS	*Galenia pubescens* var. *pubescens*	Galenia	high	high
LH	*Rumex conglomeratus*	Clustered Dock	high	low
LH	*Plantago lanceolata*	Ribwort	high	high
LH	*Senecio jacobaea*	Ragwort	high	high
LH	*Lepidium africanum*	Common Peppercress	high	low
LH	*Urtica dioica*	Giant Nettle	high	low
LH	*Cirsium vulgare*	Spear Thistle	high	low
LH	*Centaurium tenuiflorum*	Slender Centaury	high	low
MH	*Plantago coronopus*	Buck's-horn Plantain	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Cerastium glomeratum* s.l.	Common Mouse-ear Chickweed	high	low
MH	*Leontodon taraxacoides ssp. taraxacoides*	Hairy Hawkbit	high	high
SH	*Trifolium repens* var. *repens*	White Clover	high	high
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Anthoxanthum odoratum*	Sweet Vernal-grass	high	high
MTG	*Paspalum dilatatum*	Paspalum	high	high
MTG	*Sporobolus africanus*	Rat-tail Grass	high	high
MTG	*Bromus catharticus*	Prairie Grass	high	low
MTG	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Agrostis capillaris* s.l.	Brown-top Bent	high	high
MTG	*Vulpia bromoides*	Squirrel-tail Fescue	high	low
MTG	*Lolium rigidum*	Wimmera Rye-grass	high	low
MTG	*Lolium perenne*	Perennial Rye-grass	high	low
MTG	*Ehrharta erecta* var. *erecta*	Panic Veldt-grass	high	high
MTG	*Ehrharta longiflora*	Annual Veldt-grass	high	low
MTG	*Briza minor*	Lesser Quaking-grass	high	high
MNG	*Dactylis glomerata*	Cocksfoot	high	high

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 136: Sedge Wetland

Description:
Occupies seasonal wetlands and consists of generally treeless vegetation dominated by sedges. May contain a fringe of shrubs and isolated shrubs may also be present throughout. Usually of low diversity in central areas, but richer on verges and in some more ephemeral forms of the EVC. Frequently on soils of high organic content, in depressions within sandy terrain.

Life form:

Life form	#Spp	%Cover	LF code
Medium Shrub	1	5%	MS
Large Herb	1	5%	LH
Medium Herb	4	10%	MH
Large Tufted Graminoid	1	15%	LTG
Large Non-tufted Graminoid	2	30%	LNG
Medium to Small Tufted Graminoid	1	1%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		**85%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Allocasuarina misera/paradoxa*	Slender/Green Sheoak
LH	*Villarsia reniformis*	Running Marsh-flower
MH	*Utricularia australis*	Yellow Bladderwort
MH	*Goodenia humilis*	Swamp Goodenia
MH	*Centella cordifolia*	Centella
LTG	*Baumea articulata*	Jointed Twig-sedge
LNG	*Lepidosperma longitudinale*	Pithy Sword-sedge
LNG	*Baumea rubiginosa s.l.*	Soft Twig-rush
MTG	*Lepidosperma concavum*	Sandhill Sword-sedge
MNG	*Lepyrodia muelleri*	Common Scale-rush
MNG	*Isolepis fluitans*	Floating Club-sedge

Recruitment:
Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:
10 % cover

Weediness:
There are no consistent weeds in this EVC.

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 140: Mangrove Shrubland

Description:
Shrubland to 2m tall. Confined to protected low energy coastal environments where there is sufficient shelter from strong wave action and currents to allow the accumulation of fine sediments, generally on mud flats within the tidal zone.

Life Forms:

Life form	#Spp	%Cover	LF code
Medium Shrub	1	40%	MS
Medium to Tiny Non-tufted Graminoid	1	5%	MNG
Total understorey projective foliage cover		**25%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Avicennia marina ssp. australasica*	White Mangrove
MNG	*Zostera muelleri*	Dwarf Grass-wrack

Recruitment:
Continuous

Weediness:
There are no consistent weeds in this EVC.

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 151: Plains Grassy Forest

Description:
Open forest to 20 m tall often above a heathy shrub layer and a diverse grassy, sedgy and herbaceous ground layer. Occurs on lowland plains and old river terraces made up of gravelly sandy clays.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	70 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
30%	*Eucalyptus muelleriana*	Yellow Stringybark
	Eucalyptus bridgesiana s.l.	But But
	Eucalyptus polyanthemos	Red Box
	Eucalyptus macrorhyncha	Red Stringybark

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	3	15%	T
Medium Shrub	6	20%	MS
Small Shrub	3	5%	SS
Prostrate Shrub	2	5%	PS
Large Herb	3	5%	LH
Medium Herb	6	10%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	2	10%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	4	15%	MTG
Medium to Tiny Non-tufted Graminoid	2	1%	MNG
Ground Fern	2	10%	GF
Bryophytes/Lichens	na	10%	BL

EVC 151: Plains Grassy Forest - Gippsland Plain bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	*Allocasuarina littoralis*	Black Sheoak
T	*Acacia mearnsii*	Black Wattle
T	*Acacia implexa*	Lightwood
T	*Exocarpos cupressiformis*	Cherry Ballart
MS	*Leptospermum continentale*	Prickly Tea-tree
MS	*Banksia marginata*	Silver Banksia
MS	*Kunzea ericoides*	Burgan
MS	*Melaleuca parvistaminea*	Rough-barked Honey-myrtle
SS	*Pimelea humilis*	Common Rice-flower
SS	*Hibbertia riparia*	Erect Guinea-flower
SS	*Platylobium obtusangulum*	Common Flat-pea
SS	*Phyllanthus hirtellus*	Thyme Spurge
PS	*Acrotriche serrulata*	Honey-pots
PS	*Bossiaea prostrata*	Creeping Bossiaea
PS	*Astroloma humifusum*	Cranberry Heath
LH	*Tricoryne elatior*	Yellow Rush-lily
LH	*Wahlenbergia gracilis s.l.*	Sprawling Bluebell
MH	*Poranthera microphylla*	Small Poranthera
MH	*Hypericum gramineum*	Small St John's Wort
MH	*Hydrocotyle hirta*	Hairy Pennywort
MH	*Gonocarpus tetragynus*	Common Raspwort
SH	*Dichondra repens*	Kidney-weed
SH	*Oxalis corniculata s.l.*	Yellow Wood-sorrel
SH	*Opercularia varia*	Variable Stinkweed
LTG	*Xanthorrhoea minor ssp. lutea*	Small Grass-tree
LTG	*Lomandra longifolia*	Spiny-headed Mat-rush
LNG	*Gahnia radula*	Thatch Saw-sedge
MTG	*Themeda triandra*	Kangaroo Grass
MTG	*Poa australis spp. agg.*	Tussock Grass
MTG	*Lomandra filiformis*	Wattle Mat-rush
MTG	*Lepidosperma laterale*	Variable Sword-sedge
MNG	*Microlaena stipoides var. stipoides*	Weeping Grass
MNG	*Entolasia marginata*	Bordered Panic
GF	*Pteridium esculentum*	Austral Bracken

Recruitment:
Continuous

Organic Litter:
20 % cover

Logs:
20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Centaurium tenuiflorum*	Slender Centaury	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Centaurium erythraea*	Common Centaury	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 191: Riparian Scrub

Description:
A dense shrubland to 6 m tall with occasional eucalypt emergents growing on waterlogged substrates often with a peaty surface horizon. Emergent eucalypts may be occasionally present. The understorey is often species-poor and consists typically of sedges tolerant of seasonal waterlogging. Occurs along creeks and minor stream tributaries of the lowland plains.

Canopy Cover:

%cover	Character Species	Common Name
60%	*Melaleuca squarrosa*	Scented Paperbark
	Leptospermnum continentale	Prickly Tea-tree

Understorey:

Life form	#Spp	%Cover	LF code
Medium Shrub	3	10%	MS
Small Shrub	1	1%	SS
Medium Herb	1	1%	MH
Small or Prostrate Herb	1	1%	SH
Large Tufted Graminoid	1	10%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	1	1%	MTG
Medium to Tiny Non-tufted Graminoid	3	15%	MNG
Ground Fern	1	5%	GF
Scrambler or Climber	2	15%	SC
Bryophytes/Lichens	na	20%	BL
Total understorey projective foliage cover		**80%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Coprosma quadrifida*	Prickly Currant-bush
MS	*Ozothamnus ferrugineus*	Tree Everlasting
MS	*Acacia verticillata*	Prickly Moses
MS	*Ozothamnus rosmarinifolius*	Rosemary Everlastiong
SS	*Amperea xiphoclada* var. *xiphoclada*	Broom Spurge
MH	*Gonocarpus tetragynus*	Common Raspwort
MH	*Selaginella uliginosa*	Swamp Selaginella
LTG	*Gahnia sieberiana*	Red-fruit Saw-sedge
LNG	*Lepidosperma longitudinale*	Pithy Sword-sedge
MNG	*Baumea tetragona*	Square Twig-rush
MNG	*Schoenus brevifolius*	Zig-zag Bog-sedge
MNG	*Empodisma minus*	Spreading Rope-rush
GF	*Pteridium esculentum*	Austral Bracken
SC	*Gleichenia microphylla*	Scrambling Coral-fern
SC	*Billardiera scandens*	Common Apple-berry
SC	*Cassytha glabella*	Slender Dodder-laurel

Recruitment:
Continuous

Organic Litter:
40 % cover

Weediness:
There are no consistent weeds in this EVC.

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 653: Aquatic Herbland

Description:
Herbland of permanent to semi-permanent wetlands, dominated by sedges (especially on shallower verges) and/or aquatic herbs. Occurs on fertile paludal soils, typically heavy clays beneath organic accumulations.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	2	10%	LH
Medium Herb	3	20%	MH
Small or Prostrate Herb	3	15%	SH
Large Non-tufted Graminoid	2	20%	LTG
Medium to Small Tufted Graminoid	2	10%	MTG
Medium to Tiny Non-tufted Graminoid	1	5%	MNG
Total understorey projective foliage cover		**80%**	

LF Code	Species typical of at least part of EVC range	Common Name
LH	*Persicaria decipiens*	Slender Knotweed
MH	*Myriophyllum verrucosum*	Red Water-milfoil
MH	*Potamogeton pectinatus*	Fennel Pondweed
SH	*Lemna disperma*	Common Duckweed
SH	*Azolla filiculoides*	Pacific Azolla
SH	*Mimulus repens*	Creeping Monkey-flower
SH	*Wolffia australiana*	Tiny Duckweed
LNG	*Typha orientalis*	Broad-leaf Cumbungi
LNG	*Phragmites australis*	Common Reed
MTG	*Triglochin procerum s.l.*	Water Ribbons
MNG	*Bolboschoenus caldwellii*	Salt Club-sedge

Recruitment:
Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:
10% Cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Aster subulatus*	Aster-weed	high	low
MH	*Cotula coronopifolia*	Water Buttons	high	high

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 656: Brackish Wetland

Description:
Sedgeland or herbland, occasionally grassland, dominated by salt-tolerant species, but samphires, if present usually with low cover. Typically occurs on heavy, at least seasonally shallowly inundated to waterlogged soils, on a range of geologies. Common in estuaries, along the shorelines of saline/brackish lakes and along poorly defined drainage lines near the coast.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	1	5%	LH
Medium Herb	4	20%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	1	15%	LTG
Large Non-tufted Graminoid	1	10%	LNG
Medium to Small Tufted Graminoid	2	5%	MTG
Medium to Tiny Non-tufted Graminoid	3	15%	MNG
Scrambler or Climber	1	5%	SC
Total understorey projective foliage cover		**80%**	

LF Code	Species typical of at least part of EVC range	Common Name
LH	*Epilobium billardierianum*	Variable Willow-herb
MH	*Myriophyllum verrucosum*	Red Water-milfoil
MH	*Myriophyllum muelleri*	Hooded Water-milfoil
MH	*Lilaeopsis polyantha*	Australian Lilaeopsis
MH	*Samolus repens*	Creeping Brookweed
SH	*Mimulus repens*	Creeping Monkey-flower
SH	*Selliera radicans*	Shiny Swamp-mat
LTG	*Juncus kraussii ssp. australiensis*	Sea Rush
LNG	*Phragmites australis*	Common Reed
MTG	*Triglochin procerum s.l.*	Water Ribbons
MTG	*Poa poiformis*	Coast Tussock-grass
MNG	*Bolboschoenus caldwellii*	Salt Club-sedge
MNG	*Ruppia polycarpa*	Many-fruit Tassel
MNG	*Ruppia megacarpa*	Large-fruit Tassel
MNG	*Triglochin striatum*	Streaked Arrowgrass
SC	*Calystegia sepium*	Large Bindweed

Recruitment:
Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:
10% cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	*Cicendia filiformis*	Slender Cicendia	high	low
MH	*Anagallis arvensis*	Pimpernel	high	low
SH	*Anagallis minima*	Chaffweed	high	low
MTG	*Bromus hordeaceus ssp. hordeaceus*	Soft Brome	high	low
MTG	*Polypogon maritimus var. subspathaceus*	Coast Beard-grass	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Briza minor*	Lesser Quaking-grass	high	low
MNG	*Aira cupaniana*	Quicksilver Grass	high	low
TTG	*Cyperus tenellus*	Tiny Flat-sedge	high	low

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 710: Damp Heathland

Description:
Developed on sites of intermittent waterlogging, typically wet in winter and dry in summer, with low nutrient availability. Closed tall heathland, or scrub if long unburnt. There is a dense ground layer of rushes and sedges, and sometimes emergent eucalypts.

Understorey:

Life form	#Spp	%Cover	LF code
Medium Shrub	5	50%	MS
Small Shrub	5	10%	SS
Prostrate Shrub	1	1%	PS
Medium Herb	4	10%	MH
Small or Prostrate Herb	3	10%	SH
Large Tufted Graminoid	2	5%	LTG
Large Non-tufted Graminoid	1	1%	LNG
Medium to Small Tufted Graminoid	4	5%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Scrambler or Climber	3	5%	SC
Bryophytes/Lichens	na	20%	BL

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Leptospermum continentale*	Prickly Tea-tree
MS	*Allocasuarina paludosa*	Scrub Sheoak
MS	*Banksia marginata*	Silver Banksia
SS	*Hibbertia sericea s.l.*	Silky Guinea-flower
SS	*Platylobium obtusangulum*	Common Flat-pea
SS	*Pimelea humilis*	Common Rice-flower
SS	*Dillwynia glaberrima*	Smooth Parrot-pea
PS	*Acrotriche serrulata*	Honey-pots
MH	*Gonocarpus tetragynus*	Common Raspwort
MH	*Selaginella uliginosa*	Swamp Selaginella
MH	*Viola hederacea sensu Willis (1972)*	Ivy-leaf Violet
LTG	*Deyeuxia quadriseta*	Reed Bent-grass
LTG	*Xanthorrhoea minor ssp. lutea*	Small Grass-tree
LNG	*Lepidosperma longitudinale*	Pithy Sword-sedge
MTG	*Patersonia fragilis*	Short Purple-flag
MTG	*Lepidosperma concavum*	Sandhill Sword-sedge
MTG	*Burchardia umbellata*	Milkmaids
MNG	*Hypolaena fastigiata*	Tassel Rope-rush
MNG	*Baumea juncea*	Bare Twig-sedge
SC	*Cassytha pubescens s.s.*	Downy Dodder-laurel
SC	*Cassytha glabella*	Slender Dodder-laurel
SC	*Billardiera scandens*	Common Apple-berry

Recruitment:
Episodic/Fire. Desirable period between disturbances is 30 years.

Organic Litter:
20% cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	*Hypochoeris radicata*	Cat's Ear	high	low

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 821: Tall Marsh

Description:
Occurs on Quaternary sedimentary geology of mainly estuarine sands, soils are peaty, silty clays, and average annual rainfall is approximately 600 mm. It requires shallow water (to 1 m deep) and low current-scour, and can only tolerate very low levels of salinity. Closed to open grassland/sedgeland to 2-3 m tall, dominated by Common Reed and Cumbungi. Small aquatic and semi-aquatic species occur amongst the reeds.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	3	10%	LH
Medium Herb	2	5%	MH
Small or Prostrate Herb	6	10%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	2	40%	LNG
Medium to Tiny Non-tufted Graminoid	1	1%	MNG
Total understorey projective foliage cover		**70%**	

LF Code	Species typical of at least part of EVC range	Common Name
LH	*Myriophyllum verrucosum*	Red Water-milfoil
LH	*Myriophyllum salsugineum*	Lake Water-milfoil
LH	*Villarsia reniformis*	Running Marsh-flower
MH	*Rumex bidens*	Mud Dock
MH	*Lilaeopsis polyantha*	Australian Lilaeopsis
MH	*Lepilaena bilocularis*	Small-fruit Water-mat
SH	*Lemna disperma*	Common Duckweed
SH	*Azolla filiculoides*	Pacific Azolla
SH	*Wolffia australiana*	Tiny Duckweed
SH	*Mimulus repens*	Creeping Monkey-flower
LTG	*Triglochin procerum s.l.*	Water Ribbons
LTG	*Juncus ingens*	Giant Rush
LNG	*Schoenoplectus tabernaemontani*	River Club-sedge
LNG	*Phragmites australis*	Common Reed
LNG	*Typha domingensis*	Cumbungi
LNG	*Typha orientalis*	Broad-leaf Cumbungi
MNG	*Lepilaena cylindrocarpa*	Long-fruit Water-mat
MNG	*Eleocharis acuta*	Common Spike-sedge

Recruitment:
Episodic/Flood: desirable period of disturbance is every five years

Organic Litter:
10% cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	*Cotula coronopifolia*	Water Buttons	high	high
MNG	*Paspalum distichum*	Water Couch	high	high

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 821: Tall Marsh

Description:
Occurs on Quaternary sedimentary geology of mainly estuarine sands, soils are peaty, silty clays, and average annual rainfall is approximately 600 mm. It requires shallow water (to 1 m deep) and low current-scour, and can only tolerate very low levels of salinity. Closed to open grassland/sedgeland to 2-3 m tall, dominated by Common Reed and Cumbungi. Small aquatic and semi-aquatic species occur amongst the reeds.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	3	10%	LH
Medium Herb	2	5%	MH
Small or Prostrate Herb	6	10%	SH
Large Tufted Graminoid	1	5%	LTG
Large Non-tufted Graminoid	2	40%	LNG
Medium to Tiny Non-tufted Graminoid	1	1%	MNG
Total understorey projective foliage cover		**70%**	

LF Code	Species typical of at least part of EVC range	Common Name
LH	*Myriophyllum verrucosum*	Red Water-milfoil
LH	*Myriophyllum salsugineum*	Lake Water-milfoil
LH	*Villarsia reniformis*	Running Marsh-flower
MH	*Rumex bidens*	Mud Dock
MH	*Lilaeopsis polyantha*	Australian Lilaeopsis
MH	*Lepilaena bilocularis*	Small-fruit Water-mat
SH	*Lemna disperma*	Common Duckweed
SH	*Azolla filiculoides*	Pacific Azolla
SH	*Wolffia australiana*	Tiny Duckweed
SH	*Mimulus repens*	Creeping Monkey-flower
LTG	*Triglochin procerum s.l.*	Water Ribbons
LTG	*Juncus ingens*	Giant Rush
LNG	*Schoenoplectus tabernaemontani*	River Club-sedge
LNG	*Phragmites australis*	Common Reed
LNG	*Typha domingensis*	Cumbungi
LNG	*Typha orientalis*	Broad-leaf Cumbungi
MNG	*Lepilaena cylindrocarpa*	Long-fruit Water-mat
MNG	*Eleocharis acuta*	Common Spike-sedge

Recruitment:
Episodic/Flood: desirable period of disturbance is every five years

Organic Litter:
10% cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	*Cotula coronopifolia*	Water Buttons	high	high
MNG	*Paspalum distichum*	Water Couch	high	high

Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 863: Floodplain Reedbed

Description:
A closed to open grassland to 2–3 m tall, dominated by Common Reed. Small aquatic and semi-aquatic species occur amongst the reeds. It occurs on swamps on river plains, especially the lower reaches of the floodplain. Soils are Quaternary stream alluvium with floodplain and low level terrace deposits consisting of silt, clay and peat. Swamp Paperbark frequently fringes the margins of these reed beds.

Life Forms:

Life form	#Spp	%Cover	LF code
Medium Shrub	1	5%	MS
Large Herb	2	10%	LH
Medium Herb	2	5%	MH
Small or Prostrate Herb	2	5%	SH
Medium to Small Tufted Graminoid	1	5%	MTG
Large Non-tufted Graminoid	2	30%	LNG
Scrambler or Climber	1	1%	SC
Total understorey projective foliage cover		**60%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Solanum aviculare*	Kangaroo Apple
MH	*Myriophyllum crispatum*	Upright Water-milfoil
LH	*Lycopus australis*	Australian Gipsywort
LH	*Urtica incisa*	Scrub Nettle
SH	*Mimulus repens*	Creeping Monkey-flower
LNG	*Phragmites australis*	Common Reed
MTG	*Triglochin procerum* s.l.	Water Ribbons
SC	*Calystegia sepium*	Large Bindweed

Recruitment:
Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:
10% cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Aster subulatus*	Aster-weed	high	low
MH	*Cotula coronopifolia*	Water Buttons	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 914: Estuarine Flats Grassland

Description:
Closed to open grassland to 1.5 m tall with occasional shrubs occurring on estuarine flats often associated with current or old beach berms or sand sheets that are occasionally inundated by high tides. Occupies areas on marginally higher ground inland from Coastal Saltmarsh.

Life Forms:

Life form	#Spp	%Cover	LF code
Medium Shrub	2	5%	MS
Small Shrub	1	5%	SS
Large Herb	1	1%	LH
Medium Herb	3	15%	MH
Small Herb	4	15%	SH
Large Tufted Graminoid	2	15%	LTG
Medium to Small Tufted Graminoid	2	20%	MTG
Medium to Tiny Non-tufted Graminoid	3	15%	MNG
Total understorey projective foliage cover		**85%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Atriplex cinerea*	Coast Saltbush
MS	*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
SS	*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
LH	*Senecio pinnatifolius*	Variable Groundsel
MH	*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
MH	*Suaeda australis*	Austral Seablite
MH	*Samolus repens*	Creeping Brookweed
SH	*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
SH	*Selliera radicans*	Shiny Swamp-mat
SH	*Hemichroa pentandra*	Trailing Hemichroa
LTG	*Austrostipa stipoides*	Prickly Spear-grass
LTG	*Gahnia filum*	Chaffy Saw-sedge
MTG	*Poa poiformis*	Coast Tussock-grass
MTG	*Lachnagrostis billardierei* ssp. *billardierei*	Coast Blown-grass
MNG	*Spinifex sericeus*	Hairy Spinifex
MNG	*Distichlis distichophylla*	Australian Salt-grass
MNG	*Ficinia nodosa*	Knobby Club-sedge

Recruitment:
Continuous

Organic Litter:
10% Cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Chrysanthemoides monilifera* ssp. *monilifera*	Boneseed	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Conyza albida*	Tall Fleabane	high	low
MH	*Polycarpon tetraphyllum*	Four-leaved Allseed	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Anagallis arvensis*	Pimpernel	high	low
MNG	*Vulpia myuros*	Rat's-tail Fescue	high	low
MNG	*Lagurus ovatus*	Hare's-tail Grass	high	low

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 914: Estuarine Flats Grassland

Description:
Closed to open grassland to 1.5 m tall with occasional shrubs occurring on estuarine flats often associated with current or old beach berms or sand sheets that are occasionally inundated by high tides. Occupies areas on marginally higher ground inland from Coastal Saltmarsh.

Life Forms:

Life form	#Spp	%Cover	LF code
Medium Shrub	2	5%	MS
Small Shrub	1	5%	SS
Large Herb	1	1%	LH
Medium Herb	3	15%	MH
Small Herb	4	15%	SH
Large Tufted Graminoid	2	15%	LTG
Medium to Small Tufted Graminoid	2	20%	MTG
Medium to Tiny Non-tufted Graminoid	3	15%	MNG
Total understorey projective foliage cover		**85%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Atriplex cinerea*	Coast Saltbush
MS	*Rhagodia candolleana* ssp. *candolleana*	Seaberry Saltbush
SS	*Frankenia pauciflora* var. *gunnii*	Southern Sea-heath
LH	*Senecio pinnatifolius*	Variable Groundsel
MH	*Sarcocornia quinqueflora* ssp. *quinqueflora*	Beaded Glasswort
MH	*Suaeda australis*	Austral Seablite
MH	*Samolus repens*	Creeping Brookweed
SH	*Disphyma crassifolium* ssp. *clavellatum*	Rounded Noon-flower
SH	*Selliera radicans*	Shiny Swamp-mat
SH	*Hemichroa pentandra*	Trailing Hemichroa
LTG	*Austrostipa stipoides*	Prickly Spear-grass
LTG	*Gahnia filum*	Chaffy Saw-sedge
MTG	*Poa poiformis*	Coast Tussock-grass
MTG	*Lachnagrostis billardierei* ssp. *billardierei*	Coast Blown-grass
MNG	*Spinifex sericeus*	Hairy Spinifex
MNG	*Distichlis distichophylla*	Australian Salt-grass
MNG	*Ficinia nodosa*	Knobby Club-sedge

Recruitment:
Continuous

Organic Litter:
10% Cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Chrysanthemoides monilifera* ssp. *monilifera*	Boneseed	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Conyza albida*	Tall Fleabane	high	low
MH	*Polycarpon tetraphyllum*	Four-leaved Allseed	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Anagallis arvensis*	Pimpernel	high	low
MNG	*Vulpia myuros*	Rat's-tail Fescue	high	low
MNG	*Lagurus ovatus*	Hare's-tail Grass	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Gippsland Plain bioregion

EVC 934: Brackish Grassland

Description:
Grassland or sedgeland occurring on silts in low-lying areas within brackish floodplains. Often occurs in association with Brackish Wetland.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	1	1%	LH
Medium Herb	3	5%	MH
Small or Prostrate Herb	5	5%	SH
Large Tufted Graminoid	2	20%	LTG
Medium to Small Tufted Graminoid	4	20%	MTG
Medium to Tiny Non-tufted Graminoid	1	10%	MNG
Bryophytes/Lichens	na	10%	BL
Total understorey projective foliage cover		**70%**	

LF Code	Species typical of at least part of EVC range	Common Name
LH	*Senecio glomeratus*	Annual Fireweed
MH	*Sarcocornia quinqueflora*	Beaded Glasswort
MH	*Samolus repens*	Creeping Brookweed
MH	*Sebaea albidiflora*	White Sebaea
MH	*Calocephalus lacteus*	Milky Beuaty-heads
SH	*Selliera radicans*	Shiny Swamp-mat
SH	*Utricularia tenella*	Pink Bladderwort
LTG	*Gahnia filum*	Chaffy Saw-sedge
LTG	*Gahnia trifida*	Coast Saw-sedge
LTG	*Poa labillardierei*	Common Tussock-grass
MTG	*Poa poiformis*	Blue Tussock-grass
MTG	*Schoenus apogon*	Common Bog-sedge
MTG	*Austrodanthonia geniculata*	Kneed Wallaby-grass
MNG	*Distichlis distichophylla*	Australian Salt-grass

Recruitment:
Continuous

Organic Litter:
10% cover

Weediness:
There are no consistent weeds in this EVC.

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Appendix 8: EVC benchmarks

Gippsland Plain:

- Damp Sands Herb-rich Woodland (EVC 3)
- Wet Heathland (EVC 8)
- Coastal Saltmarsh (EVC 9)
- Riparian Forest (EVC 18)
- Heathy Woodland (EVC 48)
- Swamp Scrub (EVC 53)
- Floodplain Riparian Woodland (EVC 56)
- Swampy Riparian Woodland (EVC 83)
- South Gippsland Plains Grassland (EVC 132_62)
- Sedge Wetland (EVC 136)
- Mangrove Shrubland (EVC 140)
- Plains Grassy Forest (EVC 151)
- Riparian Scrub (EVC 191)
- Aquatic Herbland (EVC 653)
- Brackish Wetland (EVC 656)
- Damp Heathland (EVC 710)
- Tall Marsh (EVC 821)
- Floodplain Reedbed (EVC 863)
- Estuarine Flats Grassland (EVC 914)
- Brackish Grassland (EVC 934)

Appendix 9: Biodiversity impact and offset requirements report – (BIOR)

Biodiversity impact and offset requirements report

This report **does not represent an assessment by DELWP** of the proposed native vegetation removal. It provides additional biodiversity information to support moderate and high risk-based pathway applications for permits to remove native vegetation under clause 52.16 or 52.17 of planning schemes in Victoria.

Date of issue: **21/12/2016**
Time of issue: **9:22 am**

DELWP ref: BLA_0432

Project ID	BLA_14107_AlbertonWF

Summary of marked native vegetation

Risk-based pathway	**High**
Total extent	2.321 ha
Remnant patches	1.195 ha
Scattered trees	16 trees
Location risk	C

Strategic biodiversity score of all marked native vegetation	0.358

Offset requirements if a permit is granted

If a permit is granted to remove the marked native vegetation, a requirement to obtain a native vegetation offset will be included in the permit conditions. The offset must meet the following requirements:

Offset type	**General offset**
General offset amount (general biodiversity equivalence units)	0.386 general units
General offset attributes	
Vicinity	West Gippsland Catchment Management Authority (CMA) **or** Wellington Shire Council
Minimum strategic biodiversity score	0.286[1]

See Appendices 1 and 2 for details in how offset requirements were determined.

NB: values presented in tables throughout this document may not add to totals due to rounding

[1] Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

Next steps

Any proposal to remove native vegetation must meet the application requirements of the high risk-based pathway and it will be assessed under the high risk-based pathway.

If you wish to remove the marked native vegetation you are required to apply for a permit from your local council. Council will then refer your application to DELWP for assessment, as required. **This report is not a referral assessment by DELWP.**

The biodiversity assessment report from NVIM and this biodiversity impact and offset report should be submitted with your application for a permit to remove native vegetation you plan to remove, lop or destroy.

The Biodiversity assessment report generated by the tool within NVIM provides the following information:

- The location of the site where native vegetation is to be removed.
- The area of the patch of native vegetation and/or the number of any scattered trees to be removed.
- Maps or plans containing information set out in the *Permitted clearing of native vegetation – Biodiversity assessment guidelines*
- The risk-based pathway of the application for a permit to remove native vegetation

This report provides the following information to meet application requirements for a permit to remove native vegetation:

- Confirmation of the risk-based pathway of the application for a permit to remove native vegetation
- The strategic biodiversity score of the native vegetation to be removed
- Information to inform the assessment of whether the proposed removal of native vegetation will have a significant impact on Victoria's biodiversity, with specific regard to the proportional impact on habitat for any rare or threatened species.
- The offset requirements should a permit be granted to remove native vegetation.

Additional application requirements must be provided with an application for a permit to remove native vegetation in the moderate or high risk-based pathways. These include:

- A habitat hectare assessment report of the native vegetation that is to be removed
- A statement outlining what steps have been taken to ensure that impacts on biodiversity from the removal of native vegetation have been minimised
- An offset strategy that details how a compliant offset will be secured to offset the biodiversity impacts of the removal of native vegetation.

Refer to the *Permitted clearing of native vegetation – Biodiversity assessment guidelines* and for a full list and details of application requirements.

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

For more information contact the DELWP Customer Service Centre 136 186

Appendix 1 – Biodiversity impact of removal of native vegetation

Habitat hectares

Habitat hectares are calculated for each habitat zone within your proposal using the extent and condition scores in the GIS data you provided.

Habitat zone	Site assessed condition score	Extent (ha)	Habitat hectares
1-1-60g	0.160	0.020	0.003
2-1-57	0.160	0.045	0.007
3-1-60a	0.250	0.093	0.023
4-1-46a	0.400	0.019	0.007
5-1-62	0.170	0.003	0.001
6-1-3	0.200	0.070	0.014
7-1-4	0.200	0.070	0.014
8-1-14ia	0.240	0.000	0.000
9-1-14ib	0.240	0.000	0.000
10-1-2la	0.250	0.007	0.002
11-1-2lb	0.250	0.005	0.001
12-1-58a	0.410	0.053	0.022
13-1-58b	0.410	0.051	0.021
14-1-1B	0.270	0.000	0.000
15-1-1Ca	0.280	0.019	0.005
16-1-1Cb	0.280	0.000	0.000
17-1-1Cc	0.280	0.000	0.000
18-1-1Cd	0.280	0.090	0.025
19-1-1E	0.280	0.056	0.016
20-1-1F	0.280	0.024	0.007
21-1-1G	0.420	0.012	0.005
22-1-1L	0.350	0.000	0.000
23-1-1N	0.200	0.003	0.001
24-1-1O	0.300	0.001	0.000
25-1-1P	0.300	0.005	0.001
26-1-1Q	0.410	0.021	0.009
27-1-1R	0.250	0.030	0.007
28-1-1T	0.440	0.000	0.000
29-1-1U	0.230	0.009	0.002

Habitat zone	Site assessed condition score	Extent (ha)	Habitat hectares
30-1-1V	0.560	0.014	0.008
31-1-1W	0.520	0.075	0.039
32-1-1X	0.470	0.024	0.011
33-1-1Za	0.240	0.008	0.002
34-1-1Zb	0.240	0.005	0.001
35-1-21	0.200	0.070	0.014
36-1-22	0.200	0.070	0.014
37-1-23	0.200	0.070	0.014
38-1-24	0.200	0.070	0.014
39-1-25	0.200	0.070	0.014
40-1-26	0.200	0.070	0.014
41-1-27	0.200	0.070	0.014
42-1-28	0.200	0.070	0.014
43-1-29	0.200	0.070	0.014
44-1-2A	0.200	0.089	0.018
45-1-2Ba	0.400	0.011	0.004
46-1-2Ba	0.400	0.075	0.030
47-1-2C	0.420	0.013	0.005
48-1-2D	0.370	0.019	0.007
49-1-2E	0.370	0.002	0.001
50-1-2J	0.230	0.006	0.001
51-1-2K	0.230	0.013	0.003
52-1-2L	0.320	0.015	0.005
53-1-2M	0.200	0.011	0.002
54-1-2N	0.350	0.007	0.002
55-1-2O	0.270	0.004	0.001
56-1-30	0.200	0.070	0.014
57-1-31	0.200	0.070	0.014
58-1-32	0.200	0.070	0.014
59-1-FF5	0.300	0.002	0.001
60-1-FF6	0.300	0.003	0.001
61-1-H13	0.250	0.003	0.001
62-1-H19a	0.280	0.057	0.016

Habitat zone	Site assessed condition score	Extent (ha)	Habitat hectares
63-1-H19b	0.280	0.014	0.004
64-1-H20	0.280	0.001	0.000
65-1-H2a	0.250	0.005	0.001
66-1-H2b	0.250	0.002	0.001
67-1-H3a	0.250	0.003	0.001
68-1-H3b	0.250	0.002	0.000
69-1-II2	0.400	0.004	0.002
70-1-II3	0.400	0.006	0.003
71-1-K	0.160	0.006	0.001
72-1-M	0.220	0.005	0.001
73-1-O	0.220	0.002	0.000
74-1-Qa	0.490	0.024	0.012
75-1-Qb	0.490	0.029	0.014
76-1-Qc	0.490	0.064	0.031
77-1-Y	0.150	0.000	0.000
78-1-Za	0.210	0.002	0.000
79-1-Zb	0.210	0.002	0.000
80-1-1	0.200	0.070	0.014
81-1-2	0.200	0.070	0.014
TOTAL			**0.623**

Impacts on rare or threatened species habitat above specific offset threshold

The specific-general offset test was applied to your proposal. The test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the specific offset threshold. The threshold is set at 0.005 per cent of the total habitat for a species. When the proportional impact is above the specific offset threshold a specific offset for that species' habitat is required.

The specific-general offset test found your proposal does not have a proportional impact on any rare or threatened species' habitats above the specific offset threshold. No specific offsets are required. A general offset is required as set out below.

Clearing site biodiversity equivalence score(s)

The general biodiversity equivalence score for the habitat zone(s) is calculated by multiplying the habitat hectares by the strategic biodiversity score.

Habitat zone	Habitat hectares	Proportion of habitat zone with general offset	Strategic biodiversity score	General biodiversity equivalence score (GBES)
1-1-60g	0.003	100.000 %	0.640	0.002
2-1-57	0.007	100.000 %	0.668	0.005
3-1-60a	0.023	100.000 %	0.631	0.015
4-1-46a	0.007	100.000 %	0.564	0.004
5-1-62	0.001	100.000 %	0.600	0.000
6-1-3	0.014	100.000 %	0.349	0.005
7-1-4	0.014	100.000 %	0.577	0.008
8-1-14ia	0.000	100.000 %	0.100	0.000
9-1-14ib	0.000	100.000 %	0.100	0.000
10-1-2Ia	0.002	100.000 %	0.558	0.001
11-1-2Ib	0.001	100.000 %	0.563	0.001
12-1-58a	0.022	100.000 %	0.629	0.014
13-1-58b	0.021	100.000 %	0.637	0.013
14-1-1B	0.000	100.000 %	0.100	0.000
15-1-1Ca	0.005	100.000 %	0.100	0.001
16-1-1Cb	0.000	100.000 %	0.100	0.000
17-1-1Cc	0.000	100.000 %	0.100	0.000
18-1-1Cd	0.025	100.000 %	0.100	0.003
19-1-1E	0.016	100.000 %	0.411	0.006
20-1-1F	0.007	100.000 %	0.534	0.004
21-1-1G	0.005	100.000 %	0.531	0.003
22-1-1L	0.000	100.000 %	0.526	0.000
23-1-1N	0.001	100.000 %	0.298	0.000
24-1-1O	0.000	100.000 %	0.100	0.000
25-1-1P	0.001	100.000 %	0.100	0.000
26-1-1Q	0.009	100.000 %	0.712	0.006
27-1-1R	0.007	100.000 %	0.709	0.005
28-1-1T	0.000	100.000 %	0.709	0.000
29-1-1U	0.002	100.000 %	0.709	0.001
30-1-1V	0.008	100.000 %	0.709	0.005

Habitat zone	Habitat hectares	Proportion of habitat zone with general offset	Strategic biodiversity score	General biodiversity equivalence score (GBES)
31-1-1W	0.039	100.000 %	0.705	0.028
32-1-1X	0.011	100.000 %	0.703	0.008
33-1-1Za	0.002	100.000 %	0.100	0.000
34-1-1Zb	0.001	100.000 %	0.100	0.000
35-1-21	0.014	100.000 %	0.100	0.001
36-1-22	0.014	100.000 %	0.100	0.001
37-1-23	0.014	100.000 %	0.100	0.001
38-1-24	0.014	100.000 %	0.100	0.001
39-1-25	0.014	100.000 %	0.100	0.001
40-1-26	0.014	100.000 %	0.100	0.001
41-1-27	0.014	100.000 %	0.100	0.001
42-1-28	0.014	100.000 %	0.100	0.001
43-1-29	0.014	100.000 %	0.100	0.001
44-1-2A	0.018	100.000 %	0.617	0.011
45-1-2Ba	0.004	100.000 %	0.665	0.003
46-1-2Ba	0.030	100.000 %	0.684	0.021
47-1-2C	0.005	100.000 %	0.666	0.004
48-1-2D	0.007	100.000 %	0.743	0.005
49-1-2E	0.001	100.000 %	0.738	0.001
50-1-2J	0.001	100.000 %	0.298	0.000
51-1-2K	0.003	100.000 %	0.584	0.002
52-1-2L	0.005	100.000 %	0.584	0.003
53-1-2M	0.002	100.000 %	0.100	0.000
54-1-2N	0.002	100.000 %	0.100	0.000
55-1-2O	0.001	100.000 %	0.207	0.000
56-1-30	0.014	100.000 %	0.100	0.001
57-1-31	0.014	100.000 %	0.100	0.001
58-1-32	0.014	100.000 %	0.100	0.001
59-1-FF5	0.001	100.000 %	0.674	0.000
60-1-FF6	0.001	100.000 %	0.674	0.001
61-1-H13	0.001	100.000 %	0.307	0.000
62-1-H19a	0.016	100.000 %	0.674	0.011
63-1-H19b	0.004	100.000 %	0.674	0.003

Habitat zone	Habitat hectares	Proportion of habitat zone with general offset	Strategic biodiversity score	General biodiversity equivalence score (GBES)
64-1-H20	0.000	100.000 %	0.674	0.000
65-1-H2a	0.001	100.000 %	0.567	0.001
66-1-H2b	0.001	100.000 %	0.563	0.000
67-1-H3a	0.001	100.000 %	0.567	0.000
68-1-H3b	0.000	100.000 %	0.563	0.000
69-1-II2	0.002	100.000 %	0.536	0.001
70-1-II3	0.003	100.000 %	0.536	0.001
71-1-K	0.001	100.000 %	0.100	0.000
72-1-M	0.001	100.000 %	0.100	0.000
73-1-O	0.000	100.000 %	0.100	0.000
74-1-Qa	0.012	100.000 %	0.359	0.004
75-1-Qb	0.014	100.000 %	0.578	0.008
76-1-Qc	0.031	100.000 %	0.451	0.014
77-1-Y	0.000	100.000 %	0.582	0.000
78-1-Za	0.000	100.000 %	0.100	0.000
79-1-Zb	0.000	100.000 %	0.100	0.000
80-1-1	0.014	100.000 %	0.242	0.003
81-1-2	0.014	100.000 %	0.264	0.004

Mapped rare or threatened species' habitats on site

This table sets out the list of rare or threatened species' habitats mapped at the site beyond those species for which the impact is above the specific offset threshold. These species habitats do not require a specific offset according to the specific-general offset test.

Species number	Species common name	Species scientific name
10045	Lewin's Rail	Lewinia pectoralis pectoralis
10050	Baillon's Crake	Porzana pusilla palustris
10111	Gull-billed Tern	Gelochelidon nilotica macrotarsa
10149	Eastern Curlew	Numenius madagascariensis
10154	Wood Sandpiper	Tringa glareola
10170	Australian Painted Snipe	Rostratula benghalensis australis
10185	Little Egret	Egretta garzetta nigripes
10186	Intermediate Egret	Ardea intermedia
10187	Eastern Great Egret	Ardea modesta
10195	Australian Little Bittern	Ixobrychus minutus dubius
10197	Australasian Bittern	Botaurus poiciloptilus
10212	Australasian Shoveler	Anas rhynchotis
10214	Freckled Duck	Stictonetta naevosa
10215	Hardhead	Aythya australis
10216	Blue-billed Duck	Oxyura australis
10217	Musk Duck	Biziura lobata
10220	Grey Goshawk	Accipiter novaehollandiae novaehollandiae
10226	White-bellied Sea-Eagle	Haliaeetus leucogaster
10230	Square-tailed Kite	Lophoictinia isura
10238	Black Falcon	Falco subniger
10311	Ground Parrot	Pezoporus wallicus wallicus
10498	Chestnut-rumped Heathwren	Calamanthus pyrrhopygius
11280	Grey-headed Flying-fox	Pteropus poliocephalus
12283	Lace Monitor	Varanus varius
12407	Swamp Skink	Lissolepis coventryi
12683	Glossy Grass Skink	Pseudemoia rawlinsoni
13117	Brown Toadlet	Pseudophryne bibronii
13125	Southern Toadlet	Pseudophryne semimarmorata
13207	Growling Grass Frog	Litoria raniformis
4686	Australian Grayling	Prototroctes maraena

Species number	Species common name	Species scientific name
500786	Leafy Twig-sedge	Cladium procerum
501888	Salt Lawrencia	Lawrencia spicata
502390	Dune Wood-sorrel	Oxalis rubens
502709	Maroon Leek-orchid	Prasophyllum frenchii
504643	Grey Billy-buttons	Craspedia canens
505337	Austral Crane's-bill	Geranium solanderi var. solanderi s.s.
528553	Black-tailed Godwit	Limosa limosa

Appendix 2 – Offset requirements detail

If a permit is granted to remove the marked native vegetation the permit condition will include the requirement to obtain a native vegetation offset.

To calculate the required offset amount required the biodiversity equivalence scores are aggregated to the proposal level and multiplied by the relevant risk multiplier.

Offsets also have required attributes:

- General offsets must be located in the same Catchment Management Authority (CMA) boundary or Local Municipal District (local council) as the clearing and must have a minimum strategic biodiversity score of 80 per cent of the clearing.[2]

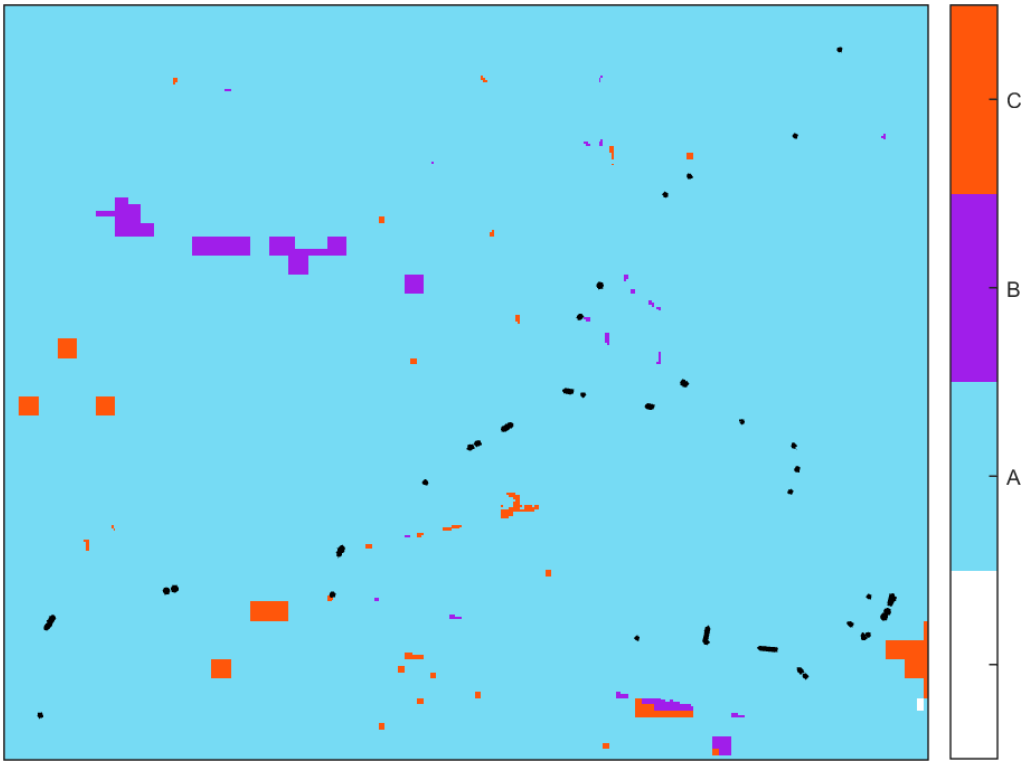
The offset requirements for your proposal are as follows:

Offset type	Clearing site biodiversity equivalence score	Risk multiplier	Offset requirements	
			Offset amount (biodiversity equivalence units)	Offset attributes
General	0.257 GBES	1.5	0.386 general units	Offset must be within West Gippsland CMA or Wellington Shire Council Offset must have a minimum strategic biodiversity score of 0.286

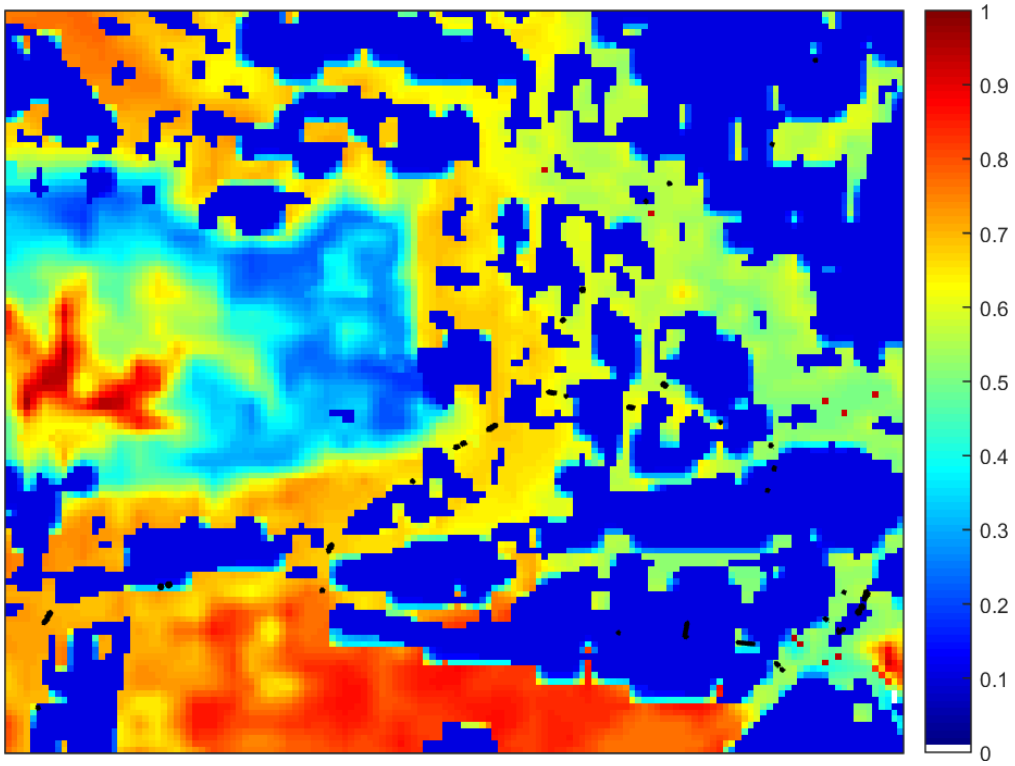
[2] Strategic biodiversity score is a weighted average across habitat zones where a general offset is required

Appendix 3 – Images of marked native vegetation

1. Native vegetation location risk map



2. Strategic biodiversity score map



3. Aerial photograph showing marked native vegetation

A

B

C

D

E

F

G

Glossary

Condition score

This is the site-assessed condition score for the native vegetation. Each habitat zone in the clearing proposal is assigned a condition score according to the habitat hectare assessment method. This information has been provided by or on behalf of the applicant in the GIS file.

Dispersed habitat

A dispersed species habitat is a habitat for a rare or threatened species whose habitat is spread over a relatively broad geographic area greater than 2,000 hectares.

General biodiversity equivalence score

The general biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to Victoria's biodiversity. The general biodiversity equivalence score is calculated as follows:

$$\boldsymbol{General\ biodiversity\ equivalence\ score} = \boldsymbol{habitat\ hectares} \times \boldsymbol{strategic\ biodiversity\ score}$$

General offset amount

This is calculated by multiplying the general biodiversity equivalence score of the native vegetation to be removed by the risk factor for general offsets. This number is expressed in general biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\boldsymbol{Risk\ adjusted\ general\ biodiversity\ equivalence\ score} = \boldsymbol{general\ biodiversity\ equivalence\ score\ clearing} \times \mathbf{1.5}$$

General offset attributes

General offset must be located in the same Catchment Management Authority boundary or Municipal District (local council) as the clearing site. They must also have a strategic biodiversity score that is at least 80 per cent of the score of the clearing site.

Habitat hectares

Habitat hectares is a site-based measure that combines extent and condition of native vegetation. The habitat hectares of native vegetation is equal to the current condition of the vegetation (condition score) multiplied by the extent of native vegetation. Habitat hectares can be calculated for a remnant patch or for scattered trees or a combination of these two vegetation types. This value is calculated for each habitat zone using the following formula:

$$\boldsymbol{Habitat\ hectares} = \boldsymbol{total\ extent}\ (\boldsymbol{hectares}) \times \boldsymbol{condition\ score}$$

Habitat importance score

The habitat importance score is a measure of the importance of the habitat located on a site for a particular rare or threatened species. The habitat importance score for a species is a weighted average value calculated from the habitat importance map for that species. The habitat importance score is calculated for each habitat zone where the habitat importace map indicates that species habitat occurs.

Habitat zone

Habitat zone is a discrete contiguous area of native vegetation that:

- is of a single Ecological Vegetation Class
- has the same measured condition.

Highly localised habitat

A highly localised habitat is habitat for a rare or threatened species that is spread across a very restricted area (less than 2,000 hectares). This can also be applied to a similarly limited sub-habitat that is disproportionately important for a wide-ranging rare or threatened species. Highly localised habitats have the highest habitat importance score (1) for all locations where they are present.

Minimum strategic biodiversity score

The minimum strategic biodiversity score is an attribute for a general offset.

The strategic biodiversity score of the offset site must be at least 80 per cent of the strategic biodiversity score of the native vegetation to be removed. This is to ensure offsets are located in areas with a strategic value that is comparable to, or better than, the native vegetation to be removed. Where a specific and general offset is required, the minimum strategic biodiversity score relates only to the habitat zones that require the general offset.

Offset risk factor

There is a risk that the gain from undertaking the offset will not adequately compensate for the loss from the removal of native vegetation. If this were to occur, despite obtaining an offset, the overall impact from removing native vegetation would result in a loss in the contribution that native vegetation makes to Victoria's biodiversity.

To address the risk of offsets failing, an offset risk factor is applied to the calculated loss to biodiversity value from removing native vegetation.

$$\boldsymbol{Risk\ factor\ for\ general\ offsets} = \mathbf{1.5}$$

$$\boldsymbol{Risk\ factor\ for\ specific\ offset} = \mathbf{2}$$

Offset type

The specific-general offset test determines the offset type required.

When the specific-general offset test determines that the native vegetation removal will have an impact on one or more rare or threatened species habitat above the set threshold of 0.005 per cent, a specific offset is required. This test is done at the permit application level.

A general offset is required when a proposal to remove native vegetation is not deemed, by application of the specific-general offset test, to have an impact on any habitat for any rare or threatened species above the set threshold of 0.005 per cent. All habitat zones that do not require a specific offset will require a general offset.

Proportional impact on species

This is the outcome of the specific-general offset test. The specific-general offset test is calculated across the entire proposal for each species on the native vegetation permitted clearing species list. If the proportional impact on a species is above the set threshold of 0.005 per cent then a specific offset is required for that species.

Specific offset amount

The specific offset amount is calculated by multiplying the specific biodiversity equivalence score of the native vegetation to be removed by the risk factor for specific offsets. This number is expressed in specific biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\boldsymbol{Risk\ adjusted\ specific\ biodiversity\ equivalence\ score} = \boldsymbol{specific\ biodiversity\ equivalence\ score\ clearing} \times \mathbf{2}$$

Specific offset attributes

Specific offsets must be located in the modelled habitat for the species that has triggered the specific offset requirement.

Specific biodiversity equivalence score

The specific biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to the habitat of the relevant rare or threatened species. It is calculated for each habitat zone where one or more species habitats require a specific offset as a result of the specific-general offset test as follows:

$$\textbf{Specific biodiversity equivalence score} = \textbf{habitat hectares} \times \textbf{habitat importance score}$$

Strategic biodiversity score

This is the weighted average strategic biodiversity score of the marked native vegetation. The strategic biodiversity score has been calculated from the *Strategic biodiversity map* for each habitat zone.

The strategic biodiversity score of native vegetation is a measure of the native vegetation's importance for Victoria's biodiversity, relative to other locations across the landscape. The *Strategic biodiversity map* is a modelled layer that prioritises locations on the basis of rarity and level of depletion of the types of vegetation, species habitats, and condition and connectivity of native vegetation.

Total extent (hectares) for calculating habitat hectares

This is the total area of the marked native vegetation in hectares.

The total extent of native vegetation is an input to calculating the habitat hectares of a site and in calculating the general biodiversity equivalence score. Where the marked native vegetation includes scattered trees, each tree is converted to hectares using a standard area calculation of 0.071 hectares per tree. This information has been provided by or on behalf of the applicant in the GIS file.

Vicinity

The vicinity is an attribute for a general offset.

The offset site must be located within the same Catchment Management Authority boundary or Local Municipal District as the native vegetation to be removed.

ALBERTON WIND FARM

BIRD AND BAT SURVEYS

Synergy Wind Pty Ltd

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Report No. 14107 (1.3)

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1. INTRODUCTION

Synergy Wind Pty Ltd engaged Brett Lane & Associates Pty Ltd (BL&A) to carry out pre-construction bird and bat surveys to understand risks and impacts to these animals from the development of the proposed Alberton Wind Farm in South Gippsland. This investigation was commissioned to provide baseline data on the pre-construction utilisation of the wind farm site by birds and bats as a basis for the development of any mitigation measures that may be necessary. In addition a migratory shorebird survey was undertaken along the coast of the Corner Inlet and Nouramunga Marine and Wildlife Reserves, whose main coastlines lie approximately three kilometres south of the proposed wind farm site.

In 2009, BL&A undertook a preliminary bird and bat utilisation survey for the then proposed Alberton and Yarram wind farms. Although field surveys were undertaken, the data were not analysed or presented in a report as the client at the time (ProWind Australia) decided not to proceed with the project. Synergy Wind has now decided to develop this project. The study area has increased from that surveyed in 2009; therefore updated bird and bat utilisation surveys were required to ensure an appropriate impact assessment.

The bird utilisation survey (BUS) scope was consistent with the requirements for a "Level One" bird risk assessment in accordance with 'Wind Farms and Birds - Interim Standards for Risk Assessment' issued by the then Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2013).

Bat surveys were undertaken in accordance with Clean Energy Councils' Best Practice Guidelines (2013) using bat detection systems to record the echolocation calls of bats. Records were made from five sites during February and March 2015. The sites included monitoring with two recorders at a wind mast with one microphone at 50 metres, and another at ground level (1-2 metres) at the same location. The survey sites represented the various habitat types within the wind farm with a focus on the possible presence of threatened species of bats.

This report is divided into the following sections:

Section 2 details the methods for the bird and bat surveys

Section 3 provides the results of the bird utilization survey,

Section 4 presents the results of bat surveys, and

Section 5 comprises the results of migratory bird survey.

This investigation was undertaken by a team from BL&A, comprising Khalid Al-Dabbagh (Senior Zoologist), Chris Doughty (Ornithologist), Inga Kulik (Senior Ecologist & Project Manager) and Brett Lane (Principal Consultant). The Bat call analysis was undertaken by Rob Gration from EcoAerial Pty Ltd.

2. METHODS

2.1. Bird Utilization Survey (BUS)

2.1.1. Fixed-point bird count method

The fixed-point bird count method used to collect bird utilisation data involved an observer stationed at a fixed survey point for 15 minutes a number of times over the survey period (see later). The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation surveys was investigated in an earlier study at another wind farm site (BL&A unpublished data). This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes used in the formal bird utilisation surveys was considered adequate to generate representative data on the bird species in the area during the survey.

During this period, all bird species and numbers of individual birds observed or heard within 200 metres were recorded. The species, the number of birds and the height of the bird when first observed were documented. For species of concern (threatened species, waterbirds and raptors), birds were recorded up to 500 metres from the observer.

The specific turbine option to be installed is still under consideration; however, for the purpose of this report, flight height relative to RSA height is presented as described below. Note that data have been recorded in 10 metre height intervals up to 60 metres and then in 20 metre intervals thereafter, and depending on the final turbine specification, this analysis can be refined.

- **A =** Below RSA (< 35 metres above ground)
- **B =** At RSA (35 – 140 metres above ground)
- **C =** Above RSA (> 140 metres above ground)

The summer bird utilisation surveys were undertaken over five days including from 21st to 25th February 2015. Table 1 indicates when each point was counted on each survey day. This schedule ensured that all points were visited equally at different times of day to allow for time-of-day differences in bird movements and activity. Every survey point was visited eight times over the survey period (Table 1).

Table 1: Times when points were counted for each fixed-point bird count survey day

Day/time	8:30	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30
1								B1	B2
2	B2	B3	B4	B5	B6	B7	B8	R1	R2
3	R2	B1	B2	B3	B4	B5	B6	B7	B8
4	B8	R1	R2	B1	B2	B3	B4	B5	B6
5	B6	B7	B8	R1	R2	B1	B2	B3	B4
	13:00	**13:30**	**14:30**	**14:30**	**15:00**	**15:30**	**16:00**	**16:30**	**17:00**
1	B3	B4	B5	B6	B7	B8	R1	R2	B1
2	B1	B2	B3	B4	B5	B6	B7	B8	R1
3	R1	R2	B1	B2	B3	B4	B5	B6	B7
4	B7	B8	R1	R2	B1	B2	B3	B4	B5
5	B5	B6	B7	B8	R1	R2			

2.1.2. Locations of survey points

Ten fixed survey points were established: eight impact points and two reference points. Impact points were located near proposed turbine locations and reference points were located at least 500 metres away from proposed turbine locations in areas of similar habitat.

The survey points were distributed as evenly as possible (subject to access constraints) across the proposed wind farm site to maximise coverage in areas where wind turbines will be located (Figure 1). Impact points were positioned on suitable ground allowing a clear view in all directions.

Table 2 below provides a description of the habitats associated with each impact and reference point.

Table 2: Habitat associated with each survey point

Survey point	Habitat
B1	Point located in middle of large open grazing paddock with few scattered trees and a line of introduced pine.
B2	In the middle of large cattle and sheep grazing paddocks; no trees within paddock, but few small dams. The paddock extends south for considerable distance and meets large coastal scrub woodland.
B3	Similar to B1, in a grazing paddock on one side and native vegetation on the other side. The area also contained a fairly large dam.
B4	Set in an ecotone between large grazing paddocks and eucalypt woodland. Birds of both open grasslands and bush shared the site.
B5	Edge of scrub (woodland) overlooking open grazing paddocks. The woodland was a mixture of eucalyptus and tea–trees. Bird life was rich as it represents a mixed habitat (ecotone).
B6	In the middle of paddocks and close to wide line of native trees including a mixture of tea–trees, acacia and eucalypts.
B7	In the middle of a grazing paddock but intersected by several lines of native vegetation.
B8	In the middle of very large dairy cattle grazing fields, no trees in the immediate area of bird count.
R1	Road junction with lines of native trees and bushes and large grazing paddocks.
R2	Similar to R1 located at another road junction with roadside large eucalypt trees and close to Alberton River.

2.1.3. Incidental observations

In addition to the observations during formalised, fixed-point or transect counts, incidental observations of birds of concern (threatened species, raptors, and waterbirds) were made whilst travelling throughout the proposed wind farm site. Notes were also made on birds observed in remnant woodlands and on any early morning and evening roosting movements. Emphasis was placed on observing birds that were moving through the site at RSA height.

2.1.4. Previous Bird Utilization Survey

An earlier BUS was undertaken in January 2009. The survey was a preliminary investigation of two areas, Yarram and the current Alberton location. Eight BUS points were sampled; five of which were at the Alberton section and three points at Yarram.

Currently the new wind farm layout has been changed and the Yarram section has been omitted from the study. The new layout is an expansion of the old Alberton section into similar habitat types.

The data collected in 2009 from the Alberton section was analysed and used to compare bird activity, diversity and use of the wind farm with the current 2015 survey covering the new layout of the proposed wind farm.

2.2. Bat surveys

Automated bat detectors that record the species-specific echolocation calls of free-flying bats were used at five sampling points that were representative of the habitats near wind turbine locations on the proposed wind farm site. At one site, two detectors were used at a meteorological tower, with one microphone at 50 metres and the other at ground level.

The location and characteristics of the recording sites are described below and shown in Figure 1.

Site A1: Installed in the middle of large dairy cattle grazing paddock; no trees close to the recording site.

Site A2: Similar to above, installed in middle of large grazing paddock, but close to a line (windbreak) of native scrub, mostly not suitable for bat roosting.

Site A3: Two detectors; the first installed at 50m height on the wind monitoring mast and the second at ground level underneath the wind mast. The wind mast itself is located in the middle of open grazing paddocks without trees.

Site A4: Located on side of a large dam and in a mixed area of open grazing paddock and edge of large coastal scrub including few eucalypt trees.

Site A5: Located on flat hill among scattered large and mature eucalypt trees with hollows and cleared understorey.

The recording sites represented the range of habitats, particularly in areas where the future wind turbines may be built.

Two models of the bat call ultrasonic detectors were used in the survey, Anabats (Titley Electronics, Ballina, NSW) and SongMeter SM2BAT+ (Wildlife Acoustics Inc., USA). The detectors were programmed to commence recording bat calls approximately 30 minutes before dusk, and to cease approximately 30 minutes after dawn.

Calls from the units were examined by Rob Gration from EcoAerial Pty Ltd, Victoria. Call identification was based on a comparison of the characteristics of bat calls with reference calls from known species recorded across Australia. Identification is largely based on changes to frequency patterns over time, especially as the characteristic frequency changes. Only those recordings that contained at least two definite and discrete calls were classified as bat calls. For most species, a call sequence of at least one second in duration (approximately 20 pulses in the sequence) is required before identification can be made confidently.

Legend

- Development footprint
- Ramsar wetland (Corner Inlet)
- Proposed turbines
- Wind mast
- Bird Ulitisation Survey sites
- Bat recording sites

Kilometers

0 0.5 1 2

Figure 1: Bird and Bat survey

Project: Alberton Wind Farm

Client: Synergy Wind Pty Ltd

Project No.: 14107	Date: 27/07/2016	Created By: M. Ghasemi / I. Kulik

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N

2.3. Timing of bird and bat surveys

The bird utilization survey was conducted over five days, between the 21st and 25th February, 2015. Weather was hot and suitable for birds.

The bat survey was conducted between 26th February and 11th of March 2015, allowing for 13 nights of recording. Due to shorter battery life at sites 2 and 5, recording lasted only 10 days.

2.4. Migratory bird surveys

The migratory bird surveys were conducted between 25th and 27th February, 2015. On the first day, surveys were undertaken by car and foot along the coastline from the land side, while on the second and third day, surveys were undertaken by boat along the edge of the coastline from the water.

2.5. Limitation

The purpose of the surveys was to collect a range of data, including usage of the site by migratory birds that may only occur at certain times of the year. During summer, birds such as magpies and ravens would mostly be moving in post breeding groups within the study area. Additionally, most migratory bird species, including the summer visitors, would be present in the region.

For these reasons, the utilisation rates and species abundances recorded during the current surveys are considered to be representative of the site during the time of likely highest bird activity. They are also considered to provide a reasonable basis on which to assess the bird risks associated with the proposed Alberton Wind Farm.

The bat survey was carried out in late summer (across February and early March 2014) and has captured the activity of the bats from representative habitats spread across the wind farm site.

The identification of echolocation calls from microbats in south-eastern Australia is facilitated by the fact that many calls are species-specific. However, a limitation of the method is that not all species can be consistently or reliably identified. There is a large overlap in the call characteristics of some species and many calls are attributable only to species “complexes” and not to single species.

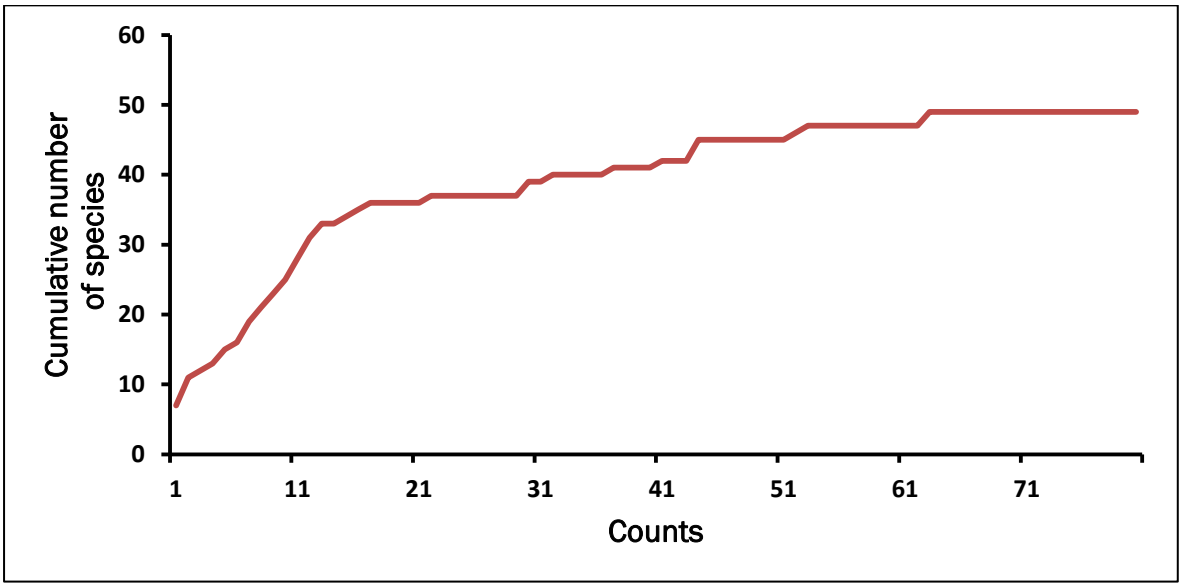
A further limitation in the use of this technique is that it is not possible to census bats accurately. That is, the bat recorder unit may record 10 calls of a particular species but it is not known if this represents 10 individuals or one individual flying past 10 times. Therefore, it is not possible to determine utilisation rates as it is for birds.

3. BIRD UTILISATION SURVEYS RESULTS

3.1. Survey suitability

The cumulative number of bird species observed from the consecutive fixed-point bird counts conducted at the observation points during the summer 2015 survey period has been plotted as shown in Figure 2. The shape of the curve showed that the number of species recorded largely levelled out after approximately 40 to 45 counts, suggesting that most of the bird species in the study area were recorded and that the surveys collectively provide a representative picture of the diversity of bird species regularly flying over the wind farm site during the survey period.

Figure 2: The cumulative number of species of birds recorded during consecutive counts at the impact points on the Alberton Wind Farm.



3.2. Species composition

A total of approximately 160 species of birds were likely to use the 10 km radius search region around the wind farm site (Victorian Biodiversity Atlas 2015); more than 50 of these species were strictly marine species and/or shorebirds and not likely to occur on the wind farm site. Species recorded during the formal 2015 bird utilisation survey from the 10 impact and reference sites included 52 species; 43 species at the impact and 27 species at the reference sites (Table 3).

Bird diversity was not significantly different from that recorded during the summer 2009 survey. The total number of bird species observed was similar (Table 3), but diversity was slightly different as some species recorded during 2009 were not seen in 2015. The habitat was mainly restricted to farmlands surrounded by remnant woodlands or coastal scrub, similar to the five impact points of the 2009 survey (see Appendix 1 for details). The species recorded were predominantly farmland and bushland species.

The number of species recorded at each impact survey point over the summer 2015 survey period ranged between 10 and 20; that of the summer 2009 survey ranged between 15 and 20 species. The distribution of the number of species among the various observation points was similar. However, there was a tendency for the number of species to be higher at points closer to vegetation, such as scattered trees or small

patches of remnant woodland.

Table 3: Numbers of species recorded at impact and reference sites during summer 2015 and summer 2009 bird utilization surveys

Season	Impact Sites	Reference Sites	Total number of species across impact and reference sites
summer BUS 2015	43	27	52
Summer BUS 2009	40	22	45
Combined	57	29	60

3.3. Abundance and height distribution of species

The species observed at the impact and reference points, and their abundance and height distribution during the summer 2015 and summer 2009 seasons of surveys are summarised in Table 4 and 5, with full details in Appendix 1. The total number of birds observed at each point is detailed in Table 6. In season 2009, only five impact points were surveyed at the Alberton section of the wind farm. These corresponded closely to those used in summer 2015.

The five most abundant species at the impact and reference survey points during summer 2015 survey are presented below.

Impact survey points	Reference survey points
Raven sp. (31.2%)	Common Starling (22.6%)
Australian Magpie (8.5%)	Raven spp. (13.7%)
Common Myna (8.5%)	Common Myna (10.9%)
Superb Fairywren (7.0%)	Australian Magpie (9.1%)
Common Starling (6.3%)	Magpie-lark (8.2%)

These species comprised 61.5% of all birds recorded at the impact survey points and 64.5% at the reference survey points.

Bird diversity was similar between the reference points and the impact points, with almost the same species dominating the list of birds but with variations in their ranking due to slight differences in habitat on the reference sites compared with the impact sites. The latter included a wider variety of sites given the larger number of points, ranging from open, treeless paddocks to sites adjacent to remnant woodlands and coastal scrub.

The five most abundant species during summer 2009 were:

Impact survey points	Reference survey points
Common Starling (17.2%)	Common Starling (27.5%)
Eurasian Skylark (8.8%)	House Sparrow (14.1%)
Superb Fairywren (6.2%)	Yellow-rumped Thornbill (7.2%)
European Goldfinch (6.0%)	Australian Magpie (6.9%)
Australian Magpie (5.8%)	Eurasian Skylark (5.6%)

These species comprised 44.0% of all birds recorded at the impact survey points and 61.3% at the reference survey points.

As was the case with the 2015 survey, the impact and reference sites in the 2009 survey were also very similar with almost the same species making up the first five most abundant birds.

The numbers of remaining species were relatively low and were not different between the 2015 and 2009 summer surveys. These species were mostly typical open farmland species or woodland birds that utilized habitats of mixed remnant woodlands and open grasslands.

Although the dominant species of birds were similar in the 2015 and 2009 surveys, with the Common Starling and Australian Magpie among the five most common species; the remaining dominant species showed some changes. Ravens and Common Myna were less abundant in 2009 but increased noticeably in 2015 to dominate the bird fauna. They both moved in large feeding flocks over the proposed wind farm site during summer 2015. Similarly, birds such as the Eurasian Skylark, House Sparrow and European Goldfinches (all exotic species), were less abundant in 2015 and were replaced by more common native birds, such as Superb Fairywren and Magpie-lark.

The mix of habitat surrounding the observation points varied. More birds were recorded at points where there were scattered trees or small woodland remnants, than at points where the habitat comprised cleared paddocks with very few or no trees.

In general, the number of birds recorded at each observation point (Table 6) was similar with little variation between the points, except when large flocks of birds were recorded during the formal count, such as records of flocks of Common Starling or passing flocks of Ravens.

Table 4: Number and height distribution of bird species at the impact survey points during summer 2015 and summer 2009 surveys

Species	Summer 2015 (8 observation points)					Summer 2009 (5 observation points)				
	A	B	C	Total	% imp.	A	B	C	Total	% imp.
Raven spp.	741	2	0	743	31.2	73	3	0	76	4.2
Australian Magpie	199	4	0	203	8.5	103	2	0	105	5.8
Common Myna	203	0	0	203	8.5	72	0	0	72	4.0
Superb Fairywren	166	0	0	166	7.0	112	0	0	112	6.2
Common Starling	145	6	0	151	6.3	302	10	0	312	17.2
Red Wattlebird	135	4	0	139	5.8	58	0	0	58	3.2
Red-browed Finch	86	0	0	86	3.6	36	0	0	36	2.0
House Sparrow	82	0	0	82	3.4	64	0	0	64	3.5
Brown Thornbill	68	0	0	68	2.9	42	0	0	42	2.3
Magpie-lark	58	6	0	64	2.7	59	0	0	59	3.3
Straw-necked Ibis	35	6	0	41	1.7	0	0	0	0	0.0
Yellow-faced Honeyeater	38	0	0	38	1.6	46	0	0	46	2.5
Australian White Ibis	36	2	0	38	1.6	2	3	0	5	0.3
Silvereye	36	0	0	36	1.5	50	0	0	50	2.8
White-eared Honeyeater	36	0	0	36	1.5	20	0	0	20	1.1
Grey Fantail	34	0	0	34	1.4	36	0	0	36	2.0
Crimson Rosella	28	0	0	28	1.2	28	0	0	28	1.5
Eastern Rosella	17	4	0	21	0.9	0	0	0	0	0.0
Willie Wagtail	20	0	0	20	0.8	17	0	0	17	0.9
Grey Butcherbird	19	0	0	19	0.8	0	0	0	0	0.0
Grey Shrike-thrush	16	0	0	16	0.7	13	0	0	13	0.7
Australasian Pipit	15	0	0	15	0.6	24	0	0	24	1.3
White-faced Heron	13	0	0	13	0.5	4	1	0	5	0.3
Nankeen Kestrel	8	3	0	11	0.5	0	0	0	0	0.0
European Goldfinch	10	0	0	10	0.4	108	0	0	108	6.0
Welcome Swallow	10	0	0	10	0.4	86	12	0	98	5.4
Yellow-rumped Thornbill	10	0	0	10	0.4	41	0	0	41	2.3
Noisy Miner	10	0	0	10	0.4	0	0	0	0	0.0
White-throated Needletail	0	10	0	10	0.4	0	0	0	0	0.0
Yellow-tailed Black Cockatoo	4	5	0	9	0.4	4	2	0	6	0.3
White-browed Srubwren	8	0	0	8	0.3	70	0	0	70	3.9
Common Blackbird	6	0	0	6	0.3	24	0	0	24	1.3
Grey Currawong	6	0	0	6	0.3	0	0	0	0	0.0
Pacific Black Duck	6	0	0	6	0.3	0	0	0	0	0.0
Striated Thornbill	6	0	0	6	0.3	0	0	0	0	0.0
Australian Shelduck	2	2	0	4	0.2	0	0	0	0	0.0
Laughing Kookaburra	4	0	0	4	0.2	0	0	0	0	0.0
Spotted Turtle Dove	2	0	0	2	0.1	10	0	0	10	0.6
Red-rumped Parrot	2	0	0	2	0.1	0	0	0	0	0.0
White-plumed Honeyeater	2	0	0	2	0.1	0	0	0	0	0.0
White-throated Treecreeper	2	0	0	2	0.1	0	0	0	0	0.0
Brown Goshawk	0	1	0	1	0.0	0	0	0	0	0.0

Species	Summer 2015 (8 observation points)					Summer 2009 (5 observation points)				
	A	B	C	Total	% imp.	A	B	C	Total	% imp.
Forked-tail Swift	0	1	0	1	0.0	0	0	0	0	0.0
Eurasian Skylark	0	0	0	0	0.0	150	9	0	159	8.8
Fairy Martin	0	0	0	0	0.0	60	10	0	70	3.9
Galah	0	0	0	0	0.0	12	0	0	12	0.7
Rufous Whistler	0	0	0	0	0.0	12	0	0	12	0.7
Blue-winged Parrot	0	0	0	0	0.0	7	0	0	7	0.4
Black Swan	0	0	0	0	0.0	0	3	0	3	0.2
Tree Martin	0	0	0	0	0.0	3	0	0	3	0.2
Australian Wood Duck	0	0	0	0	0.0	2	0	0	2	0.1
Masked Lapwing	0	0	0	0	0.0	2	0	0	2	0.1
Sulphur-crested Cockatoo	0	0	0	0	0.0	2	0	0	2	0.1
Australian Hobby	0	0	0	0	0.0	1	0	0	1	0.1
Brown Falcon	0	0	0	0	0.0	1	0	0	1	0.1
Total	2324	56	0	2380	100	1756	55	0	1811	100

A = below RSA height (<35m); B = at RSA height (35-140m); C = above RSA height (>140m);
% Imp. = Percentage importance
Points data is the sum total from 8 replicate counts

Table 5: Number and height distribution of bird species at the reference survey points during summer 2015 and summer 2009 surveys

Species	Summer 2015					Summer 2009				
	A	B	C	Total	% Imp.	A	B	C	Total	% Imp.
Common Starling	120	7	0	127	22.6	150	6	0	156	27.5
Raven spp.	73	4	0	77	13.7	18	0	0	18	3.2
Common Myna	58	3	0	61	10.9	8	2	0	10	1.8
Australian Magpie	51	0	0	51	9.1	39	0	0	39	6.9
Magpie-lark	46	0	0	46	8.2	8	0	0	8	1.4
Superb Fairywren	33	0	0	33	5.9	16	0	0	16	2.8
Galah	28	0	0	28	5.0	20	0	0	20	3.5
Grey Fantail	16	0	0	16	2.8	16	0	0	16	2.8
Crimson Rosella	16	0	0	16	2.8	0	0	0	0	0.0
Eastern Rosella	13	0	0	13	2.3	0	0	0	0	0.0
Willie Wagtail	12	0	0	12	2.1	1	2	0	3	0.5
Striated Thornbill	10	0	0	10	1.8	0	0	0	0	0.0
Noisy Miner	10	0	0	10	1.8	0	0	0	0	0.0
Red Wattlebird	8	0	0	8	1.4	28	0	0	28	4.9
Grey Butcherbird	8	0	0	8	1.4	0	0	0	0	0.0
Yellow-faced Honeyeater	6	0	0	6	1.1	22	0	0	22	3.9
Silvereye	6	0	0	6	1.1	10	0	0	10	1.8
Brown Thornbill	6	0	0	6	1.1	0	0	0	0	0.0
Yellow-rumped Thornbill	4	0	0	4	0.7	33	8	0	41	7.2
Common Blackbird	4	0	0	4	0.7	8	0	0	8	1.4
Australian Wood Duck	4	0	0	4	0.7	0	0	0	0	0.0
Black-shouldered Kite	0	4	0	4	0.7	0	0	0	0	0.0
White-plumed Honeyeater	4	0	0	4	0.7	0	0	0	0	0.0
Black-faced Cuckoo-shrike	2	0	0	2	0.4	0	0	0	0	0.0
Fairy Martin	0	2	0	2	0.4	0	0	0	0	0.0
Sulphur-crested Cockatoo	0	2	0	2	0.4	0	0	0	0	0.0
Australian Shelduck	0	2	0	2	0.4	0	0	0	0	0.0
House Sparrow	0	0	0	0	0.0	70	10	0	80	14.1
Eurasian Skylark	0	0	0	0	0.0	30	2	0	32	5.6
European Goldfinch	0	0	0	0	0.0	31	0	0	31	5.5
Welcome Swallow	0	0	0	0	0.0	10	6	0	16	2.8
Yellow-tailed Black Cockatoo	0	0	0	0	0.0	8	0	0	8	1.4
Australasian Pipit	0	0	0	0	0.0	2	0	0	2	0.4
Rufous Whistler	0	0	0	0	0.0	2	0	0	2	0.4
Spotted Turtle Dove	0	0	0	0	0.0	2	0	0	2	0.4
	538	24	0	562	100	532	36	0	568	100

A = below RSA height (<35m); B = at RSA height (35-140m); C = above RSA height (>140m)
% Imp. = Percentage importance,
Points data is the sum total from 8 replicate counts.

Table 6: Total number of birds counted at each survey points during summer 2015 and summer 2009 season surveys

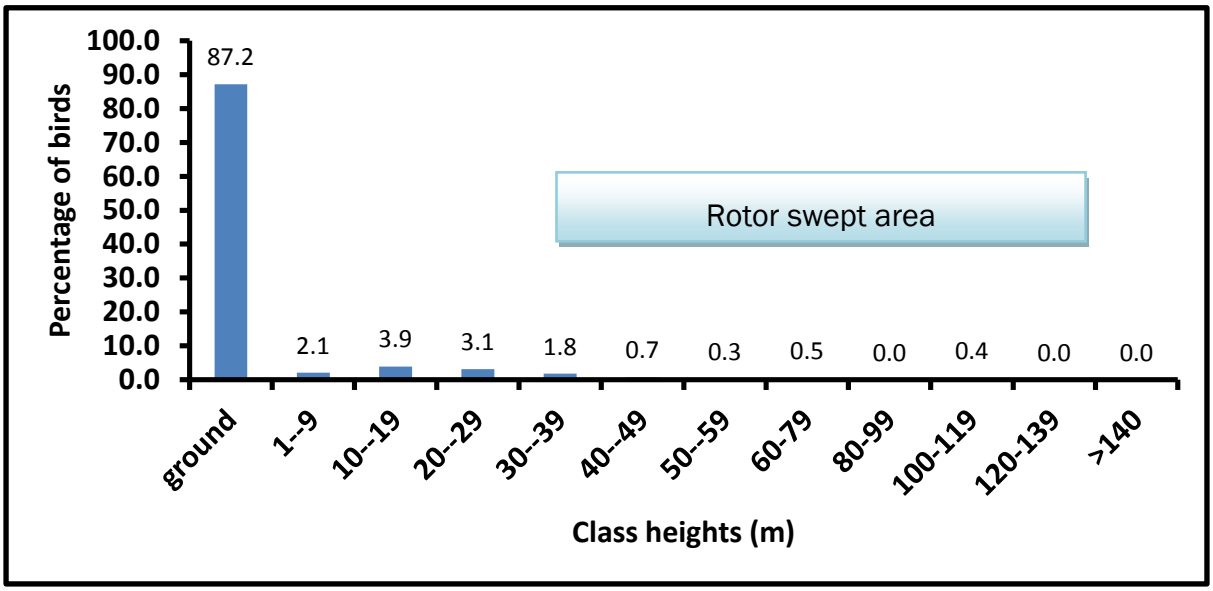
Observation points	Summer 2015 (8 impact points)						Summer 2009 (5 impact points)					
	A	B	C	Total	% Imp.	Density	A	B	C	Total	% Imp.	Density
Point 1	251	6	0	257	10.8	10.2	599	39	0	638	35.2	25.4
Point 2	200	0	0	200	8.4	8.0	238	10	0	248	13.7	9.86
Point 3	170	9	0	179	7.52	7.1	258	0	0	258	14.2	10.3
Point 4	317	10	0	327	13.7	13.0	457	4	0	461	25.5	18.3
Point 5	471	16	0	487	20.5	19.4	204	2	0	206	11.4	8.19
Point 6	221	0	0	221	9.29	8.8						
Point 7	351	7	0	358	15	14.2						
Point 8	343	8	0	351	14.7	14.0						
Total impact	2324	56	0	2380	100	11.8	1756	55	0	1811	100	72.0
R1	280	16	0	296	52.7	11.8	369	32	0	401	16.0	16.0
R2	258	8	0	266	47.3	10.6	163	4	0	167	6.6	6.6
Total Reference	538	24	0	562	100	11.2	532	36	0	568	11.3	11.3

Density = Number of birds/ha/hour
A = below RSA height (<35m); B = at RSA height (35-140m); C = above RSA height (>140m)

3.4. Birds at rotor swept area heights (RSA)

Bird flight heights were classified as being *below* RSA height (less than 35 metres), *at* RSA height (35–140 metres) and *above* RSA height (greater than 140 metres). The data from summer 2015 was used for height analysis as it was more representative of current conditions at the wind farm site. Results (from impact and reference observation points combined) indicated that the majority of birds (approximately 97 percent) were found below RSA heights, with approximately 3.0 percent found at RSA heights. No birds were recorded flying above RSA height, as shown in Figure 3. The results of the height analysis indicated that the large majority of birds using the wind farm site would not be exposed to a risk of collision with operating turbines.

Figure 3: The distribution of bird heights observed during summer 2015 bird utilisation surveys at Alberton Wind Farm.



Note: Impact and reference point's data combined

Table 7 shows the total number of individuals from different species observed flying at RSA height at all impact points during summer 2015 BUS. Some 56 birds from 14 different species were observed flying at RSA height at the impact points. This equated to approximately 2.7% of the total number of birds counted at the impact points.

During summer 2009, an almost equal proportion of birds (*c.* 3.0%) was observed flying at RSA heights.

The five most abundant species observed flying at RSA height were:

- White-throated Needletail
- Common Starling
- Magpie-lark
- Straw-necked Ibis
- Yellow-tailed Black Cockatoo

These five species accounted for almost 59.0% of the birds counted at RSA height, with White-throated Needletail comprising the bulk of these flights (17.9%). The five most common birds at RSA height were common species that were widespread across the

Alberton Wind Farm site and the wider region, except for the White-throated Needletail, which is a migratory species (summer visitor) listed on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Needletail spends only very limited time during the summer in or around the wind farm site, passing through irregularly. These birds are known to fly ahead of weather fronts while in south-eastern Australia. Another species listed on the EPBC Act as a migratory species was recorded: the Fork-tailed Swift, for which only one observation was made of a single bird flying at RSA heights. Both the swift and the Needletail are aerial species spending all their time in the air, feeding on the wing.

Starlings, cockatoos, ibises, magpies, ravens, magpie-larks, wattlebirds, and rosellas are resident birds usually more abundant in late summer, some of which (starling, raven, ibis, rosellas) move and forage in larger flocks.

The remaining birds at RSA heights comprised two birds of prey: Nankeen Kestrel and Brown Goshawk. Raptors usually fly at RSA heights when searching for food.

The distribution of birds flying at RSA heights at each of the eight impact points was random during all seasonal surveys. Birds were not recorded flying at RSA heights at any one survey point more than another, indicating that risk to birds is rather uniformly distributed over the Alberton Wind Farm. At the reference points, birds flying at RSA heights were on average less abundant than at the impact points.

Table 7: Species flying at rotor swept height (RSA) at the impact sites during summer 2015 BUS at Alberton Wind Farm

Species	Summer 2015 survey		% of flights at RSA	% of flights at RSA compared with all birds at RSA	% of flights recorded at RSA compared with all bird flights
	No. of flights at RSA*	Total no. of flights at all heights			
White-throated Needletail	10	10	100	17.9	0.4
Common Starling	6	151	4.0	10.7	0.3
Magpie-lark	6	64	9.4	10.7	0.3
Straw-necked Ibis	6	41	14.6	10.7	0.3
Yellow-tailed Black Cockatoo	5	9	55.6	8.9	0.2
Australian Magpie	4	203	2.0	7.1	0.2
Eastern Rosella	4	21	19.0	7.1	0.2
Red Wattlebird	4	139	2.9	7.1	0.2
Nankeen Kestrel	3	11	27.3	5.4	0.1
Australian White Ibis	2	38	5.3	3.6	0.1
Australian Shelduck	2	4	50.0	3.6	0.1
Raven spp.	2	743	0.3	3.6	0.1
Brown Goshawk	1	1	100	1.8	0.0
Fork-tailed Swift	1	1	100	1.8	0.0
Total of all birds	56	2380		100	2.4

* RSA height = 35 – 140 metres

3.5. Listed species

The majority of birds found to utilise the proposed wind farm site were common birds, however two species listed as migratory (not threatened) under the EPBC Act were recorded within the wind farm boundary during the surveys. These were:

- White-throated Needletail: The Needletail spends only very limited time during the summer in or around the wind farm site, and would pass through the wind farm irregularly. One flock of ten birds was recorded during the BUS counts.
- Fork-tailed Swift: Similar to the Needletail in its ecology and status. There was only one observation of a single bird flying at RSA heights.
- Several other listed migratory bird species characteristic of coastal and marine habitats were observed in the coastal area south of the wind farm site during the migratory bird surveys. None of these were observed to utilize the wind farm site as no habitat suitable for them exists here.

3.6. Raptors and waterbirds

The data from summer 2015 was used to evaluate the number of raptors and waterbirds utilizing the wind farm site.

Raptors

Raptors were uncommon at the wind farm site and only two species were recorded during the formal count (Table 8). None of the raptors observed at Alberton Wind Farm were threatened species, either under national or state conservation legislation. The raptors were generally recorded in low numbers (0.5% of all birds and only 0.2% of those flying at RSA heights). The raw data are presented in Appendix 1.

Nankeen Kestrel was the most abundant raptor species at Alberton Wind Farm (91% of all raptors recorded in 2015). The Brown Goshawk was recorded only once and constituted 8.3% of all raptors observed during formal counts. In 2009, neither of these species was recorded; raptors recorded then comprised one Australian Hobby and one Brown Falcon.

The Wedge-tailed Eagle is considered to be a high profile species and one of the most vulnerable species to collision with operating turbines. This species was observed twice over the wind farm site but outside the formal BUS surveys. No evidence was found of eagles nesting within the wind farm boundary. Based on the above, the wind farm site is likely to be part of the territory of one pair of eagles that reside and probably breed in woodland outside the wind farm site. The pair is likely to forage over the wind farm site itself, although it was not observed regularly during the current survey.

Waterbirds

The proposed Alberton Wind Farm site contained many small farm dams and one fairly large dam near observation point B4. The dams in the study area generally lacked aquatic vegetation and had bare edges trampled by stock. The large dam however included naturally occurring vegetation forming a semi-natural wetland.

Eight waterbird species were recorded during the surveys, comprising 4.3% of all birds observed during the formal counts (Table 8). None of the waterbirds observed were threatened species, either under national or state conservation legislation. Most of the waterbirds were recorded near impact point B1, which was one of the nearest points to the coastal area and the Alberton River.

Most waterbirds recorded were flying below RSA heights; this is not unusual since most of these birds fly at low heights when travelling between dams in the area. The Straw-necked and Australian White Ibises however, fly occasionally at RSA heights. Larger flocks of Straw-necked Ibis might pass across the wind farm site, but such flocks were not recorded during the current observations or in observations made at the coastal areas south of the wind farm site (see coastal and marine bird survey in this report).

Other waterbirds were also recorded utilising the wind farm site. The White-faced Heron was the most commonly recorded other waterbird, occasionally seen flying across open paddocks below RSA height.

Two duck species were also seen foraging at the farm dams and flying across open paddocks between the dams. The Australian Shelduck often flies at RSA heights.

The Australian Wood Duck is another very common farmland waterbird that usually roosts along the edges of farm dams and forages in farm dams and open paddocks next to dams during both day and night. They are gregarious birds, known to move and forage in flocks. Flocks of this species were observed at several farm dams throughout the proposed wind farm site but were not recorded at the observation points during formal counts. This species tends to fly close to the ground when moving between dams and was not observed flying at RSA heights.

Table 8: Raptor and waterbird species recorded at the impact survey points during summer 2015 surveys at Alberton Wind Farm

Species	Total raptors or waterbirds				% imp.	% of all Birds*	%birds at RSA	% of all RSA birds	% RSA birds of all birds
	A	B	C	Total					
Nankeen Kestrel	8	3	0	11	91.7	0.5	27.3	25.0	0.1
Brown Goshawk	0	1	0	1	8.3	0.0	100.0	8.3	0.0
Total raptors	**8**	**4**	**0**	**12**	**100**	**0.5**	**33.3**	**33.3**	**0.2**
Straw-necked Ibis	35	6	0	41	40.2	1.7	14.6	5.9	0.3
Australian White Ibis	36	2	0	38	37.3	1.6	5.3	2.0	0.1
White-faced Heron	13	0	0	13	12.7	0.5	0.0	0.0	0.0
Pacific Black Duck	6	0	0	6	5.9	0.3	0.0	0.0	0.0
Australian Shelduck	2	2	0	4	3.9	0.2	50.0	2.0	0.1
Total waterbirds	**92**	**10**	**0**	**102**	**100**	**4.3**	**9.8**	**9.8**	**0.4**

* Total birds of all species = 2380.
A=below rotor swept area (RSA) height (<35 m); **B=** at RSA height (35-140 m);
C= above RSA height (>140 m) * Total from 8 counts at each impact point.

3.7. Conclusions

The conclusions from the BUS of the Alberton Wind Farm are presented below:

- The study area consists largely of cleared flat areas supporting a low diversity and abundance of common, predominantly farmland birds.
- The study area supports very few raptors or waterbirds, groups considered vulnerable to collision with operating wind turbines. Raptors and waterbirds represented 0.5% and 4.3% respectively of all birds surveyed.

- The diversity of birds was similar across the observation points with common farmland birds dominating the species list. However, there was a tendency for points close to remnant woodland to have higher bird diversity.
- The species recorded flying at RSA heights were all considered common and/or widespread across the Alberton Wind Farm site and the wider region. Raptors were not common, with only 0.2% of all records being recorded at RSA heights. Similarly, few waterbirds were recorded flying at RSA height.
- Two species of listed migratory birds were recorded utilising the study area, the White-throated Needletail and the Fork-tailed Swift. Both are aerial species that fly mostly at and above RSA height, present at the wind farm occasionally.
- The use of the wind farm by birds during the summer 2015 survey was not greatly different from that recorded during the summer 2009 survey. Almost the same common, farmland birds were the dominant species.
- The dominance on the proposed wind farm site of bird species that are common and widespread in farmland landscapes in south eastern Australia makes it highly unlikely that the proposed Alberton Wind Farm will lead to bird impacts of conservation significance or population-scale concern.

4. BAT SURVEY RESULTS

4.1. Species recorded

Eight species of bats and three species complexes were recorded during the summer 2015 survey from five recording sites. The recorded species are listed in Table 10, including their conservation status and sites at which they were recorded.

The eight species identified at the wind farm site are known to be widespread and common. One species, the Eastern Falsistrellus is uncommon, although widespread in its distribution (Menkhorst 1995).

In addition to those bats identified to species level, three species complexes were recorded indicating calls that are indistinguishable between two or more species and could be either. The bat species complexes involved common and widespread species.

During the bat survey, no threatened bat species were recorded within the wind farm site.

The common species of bats were recorded from various sections of the wind farm and were not particularly restricted to certain habitats within the wind farm site. Site four however supported the highest number of species. This site was an ecotone between coastal scrub, open grazing paddock and a large, well vegetated farm dam. It seems likely that the open water of the dam was the major attraction for bats at this site.

Long-eared bats are difficult to distinguish to species level, and hence are grouped under their generic name as a species complex. The species that are likely to occur at the site are the Lesser Long-eared Bat *(Nyctophilus geoffroyi)* and Gould's Long-eared Bat *(N. gouldi)*.

Table 9: Bat species recorded at the Alberton Wind Farm during the summer 2015 survey

Common name	Scientific name	sites with records	Conservation status
White-striped Freetail Bat	*Tadarida australis*	2, 3, 4, 5,	Common & secured
Southern Freetail bat	*Mormopterus planiceps*	4	Common & secured
Eastern Freetail Bat	*Mormopterus ridei*	4	Common & secured
Gould's Wattled Bat	*Chalinolobus gouldi*	4, 5	Common & secured
Chocolate Wattled Bat	*Chalinolobus morio*	1, 2, 3, 4,	Common & secured
Eastern Falsistrellus	*Falsistrellus tasmaniensis*	4, 5	uncommon but secured
Large Forest Bat	*Vespadelus darlingtoni*	All sites	Common & secured
Little Forest Bat	*Vespadelus vulturnus*	1, 2, 3, 4	Common & secured
Species complexes			
Gould's Wattled Bat / Freetail Bat sp	*C. gouldi / Mormopterus sp2 & sp4*	All sites	
Long-eared Bat	*Nyctophilus sp*	1, 2, 3, 4	
Forest Bat sp	*V. darlingtoni / V. Regulus / V. vulturnus*	1, 2, 3, 5	

4.2. Bat activity

Bat activity at the proposed Alberton Wind Farm is similar to other wind farm sites located in comparable landscape settings in south-eastern Australia (BL&A unpubl. data). Bat activity during the nights of recording varied between the different species, time of recordings and the habitats at the recording sites. A summary of relative activity of the eight bat species and three species-complexes expressed as the total number of calls per site and average calls per night for each species from the five different sites are shown in Table 11.

The Large Forest Bat and Little Forest Bat were recorded most frequently, with their calls constituting about 49.4% and 25.0%, respectively of all bat calls. The remaining species were recorded less frequently, between 1 call (0.2%) for the Eastern Freetail Bat up to 42 calls (7.9%) for the Gould's Wattled Bat.

The nightly activity of each bat species varied widely without any obvious trends. The activity is probably the product of the site characteristics and the prevailing weather conditions on the day of recording. Weather was fine during most of the recording nights allowing bat activity most nights over the wind farm site.

Table 10: Summary of the average number of call per night recorded for the various bat species at each of the five recording sites at Alberton Wind Farm

Species	Site 1		Site 2		Site 3*		Site 4		Site 5		Total	Average/ night
	Total calls	Average/ night	Total calls	Average/ night	Total calls	Average/ night	Total calls	Average/ night	Total calls	Average/ night		
White-striped Freetail Bat	0	0.0	2	0.2	5	0.4	4	0.3	15	1.5	26	1.1
Southern Freetail bat	0	0.0	0	0.0	0	0.0	27	2.1	0	0.0	27	1.2
Eastern Freetail Bat	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	1	0.0
Gould's Wattled Bat	0	0.0	0	0.0	0	0.0	5	0.4	37	3.7	42	1.8
Chocolate Wattled Bat	1	0.1	2	0.2	3	0.2	27	2.1	0	0.0	33	1.4
Eastern Falsistrellus	0	0.0	0	0.0	0	0.0	5	0.4	2	0.2	7	0.3
Large Forest Bat	3	0.2	1	0.1	7	0.5	249	19.2	3	0.3	263	11.4
Little Forest Bat	4	0.3	5	0.5	34	2.6	90	6.9	0	0.0	133	5.8
Species complexes												
Gould's Wattled Bat / Mormopterus sp	5	0.4	8	0.8	22	1.7	518	39.8	7	0.7	560	24.3
Long-eared Bat	1	0.1	3	0.3	2	0.2	4	0.3	0	0.0	10	0.4
Forest Bat sp	7	0.5	4	0.4	12	0.9	80	6.2	0	0.0	103	4.5
Number of files	57		43		127		1864		192		2283	
Identified to species level	8		10		49		408		57		532	
Identified to call complex	13		15		36		602		7		673	
Unidentified (poor quality)	36		18		42		854		128		1078	

* Site 3 data are for the ground level only
The number of nights of recording was: site 1, 3, and 4 =13 nights; sites 2, 5 = 10 nights.

4.3. Bats flying at rotor swept height

The Anabat recorder which was installed at 50 metres above the ground on the wind mast (Site 3 at 50 m) failed to record any bat calls. The failure was probably technical due to failed microphone or loose connection when installed up the top of the wind mast; however, the machines did have a log file indicating that it was ready to receive bat calls. Hence it could also mean that no bats were flying at this height. The survey was planned to be repeated in late October 2015, but due to inclement weather no Anabat recorder could be installed at height.

At site 3 (ground), which was recording concurrently with the 50 m high recorder mostly forest bat calls were recorded, a species group that usually flies at low heights and rarely at 50 metres as well as a few calls from the White-striped Freetail Bat.

At other wind farm sites surveyed by BL&A, where bat call recordings have been made at heights of 50m above the ground using the wind mast, very few bat calls were recorded at this height comprising usually around 1 to 2 percent of total bat calls recorded (BL&A unpublished data). Most of the bat calls at height recorded at other wind farm sites were from the common White-striped Freetail Bat, a species known to fly at heights of 50m or more (Churchill 1998). This analysis confirms that only a small proportion of bats on the site would actually be exposed to collision risk with operating turbines and that the majority of these bats would be the White-striped Freetail Bat.

4.4. Conclusions

The findings from the summer bat utilisation surveys at the proposed Alberton Wind Farm site are as follows:

- Eight bat species and three species complexes were recorded from monitoring at five sites during the survey;
- None of the bats recorded is classified as threatened under national or state biodiversity legislation.
- Bat species were more frequently recorded at site 4 (408 identifiable bat calls). The site was located within a coastal scrub and grassland ecotone and a large, well vegetated farm dam with a large area of open surface water occurring nearby.
- There was much less bat activity in open, cleared paddocks (sites 1, 2 and 3).
- As open pasture is the most extensive habitat within the wind farm site and the habitat in which most turbines will be built, bat activity near proposed turbines is likely to be comparatively low.
- Numbers of bats using the bulk of the proposed site are considered comparatively low, resulting in a correspondingly low assessed collision risk.
- Based on the foregoing results, it is not anticipated that the proposed Alberton Wind Farm will have an impact on bats at a level that will be of any conservation concern.

5. MIGRATORY SPECIES SURVEYS

The proposed Alberton wind farm lies approximately three kilometres north of the potential migratory shorebird habitats in the Corner Inlet and Nooramunga Marine and Wildlife Reserves. Corner Inlet is a Ramsar Wetland listed under the EPBC Act (see Figure 2). A migratory bird survey has been undertaken of these habitats to ascertain the numbers and behaviour of any listed migratory shorebirds that use the area.

The listed migratory shorebird survey focussed on tidal wetlands south of the proposed wind farm site. The background paper for the EPBC Act draft policy statement regarding migratory shorebirds (DEWHA 2009) recommends four replicate surveys over the period when the majority of the shorebirds are present in the area and one winter survey. This first survey was undertaken in late February/early March 2015 to provide a first overview of migratory birds present in the nearby habitats.

5.1. Survey area and methods

The study area comprised all coastal habitats and seashores, including the intertidal area extending from Port Albert west to the northern shores of Sunday Island and Snake Island, and close to Port Welshpool (Figure 4).

The coastal area is approximately 3 to 5 km away at different points from the southern boundary of the proposed wind farm site.

The survey was undertaken at low tide by both walking through the coastal areas and mudflats and by boat. Coastal birds were watched at low and high tide to establish their pattern of movements and roosting sites.

The survey was carried out during the period 25th to 27th February 2015, a time when most migratory shorebird species were at peak numbers (the exception is the winter-visiting Double-banded Plover from New Zealand).

5.2. Results

The species, time when observed and conservation status of migratory birds recorded during February survey are listed in Table 11.

A summary of observations for each of the above birds is discussed below:

Pied and Sooty Oystercatchers (non-migratory): The most common species at the shores of the study area. When feeding or roosting they spread throughout the whole area.

Eastern Curlew: Similar to the oystercatcher, common and feed and roost throughout the whole of the study area.

Whimbrel: This species was found to feed as a flock, primarily at Lipscore Point on Sunday Island.

Bar-tailed Godwit: The species ecology is similar to the Whimbrel where they feed in flocks, primarily at Lipscore Point on Sunday Island.

Common Greenshank: Found to feed in flocks, mainly close to the jetty on Sunday Island.

Red Knot and Great Knot: Both found to feed within Bar-tailed Godwit flocks.

Red-necked Stint: Common shorebirds found feeding in the mudflats throughout the study area.

In addition other waterbirds were also recorded within the study area. These included:

Royal Spoonbill (non-migratory): A large flock of 100 birds was found at a high-tide roost at McMillons Beach at Port Albert.

Black-faced Cormorant (non-migratory): almost strictly marine species, common on the shores of the study area.

Little Egret (non-migratory): Rather common, usually found in association with wetlands, creeks and rivers and might occasionally feed in farm dams.

Gull-billed Tern: An uncommon tern along the shores of Port Albert and Port Welshpool. The birds observed were in full breeding plumage indicating that these birds may breed in the area.

White-billed Sea-Eagle: An uncommon eagle, usually found along the shores of southern Victoria. They are mainly restricted to the coastal habitats but might occasionally travel inland along large rivers.

White-throated Needletail: A summer visitor to the area. This bird was described above with other species in the BUS section of this report.

Table 11: Shorebird species recorded during 25th to 27th February 2015 survey at the coastal area south of Alberton Wind Farm.

Species	Number birds seen in February			Conservation status*
	25th	26th	27th	
Pied Oystercatcher		250	300	
Sooty Oystercatcher		46	58	NT (DEPI),
Eastern Curlew	11	22	12	VUL (DEPI), EPBC (m)
Whimbrel		30	28	VUL (DEPI), EPBC (m)
Bar-tailed Godwit		135	1124	EPBC (m)
Common Greenshank		11	12	EPBC (m)
Red Knot		0	18	EN (DEPI 13); EPBC (m)
Great Knot		0	2	EN (DEPI 13); EPBC (m)
Red-necked Stint		4	320	EPBC (m)
Other waterbirds				
Royal Spoonbill	100			NT (DEPI)
Black-faced Cormorant		30		NT (DEPI)
Little Egret			3	EN (DEPI 13)
White bellied Sea-eagle		1	1	VUL (DEPI);
Gull-billed Tern		2	9	EN (DEPI 13); EPBC (m)
White-throated Needletail		3		VUL (DEPI), EPBC (m)

EPBC (m) - protected under the Environmental Protection and Biodiversity Conservation Act 1999 as a migratory species.

DEPI - protected under Department of Environment and Primary Industries Advisory List of Threatened Vertebrate fauna in Victoria (2013).

5.3. Implications

Birds observed during the February survey in the coastal wetlands, mainly between three and five kilometres south of the wind farm site included threatened and listed migratory species. Some were threatened under the Victorian Threatened Vertebrate Fauna Advisory List (DEPI 2013), and almost all were protected under the EPBC Act 1999 as listed migratory species.

During the bird utilization survey undertaken during February 2015; none of these birds were recorded in or near the wind farm site, except for the White-throated Needletail and Fork-tailed Swift, which are not waterbirds but aerial species that fly over all habitats (for impacts on these species, see Section 3.5).

Bird species recorded in this survey were strictly intertidal shore or marine birds unlikely to fly inland and utilize dams or other wetlands within the wind farm site. Consequently none of the populations of the above birds would be impacted upon by the construction and operation of the proposed wind farm.

There is a possibility that, when migrating to and from the coastal habitats nearby, shorebirds may fly across the proposed Alberton Wind Farm site. Shorebird migration has been described by a number of authors (Lane & Jessop 1985; Piersma et al. 1990; Swennen 1992; Tulp et al 1994). These studies show that wherever it has been studied shorebird migratory departure has remarkably consistent characteristics, described below.

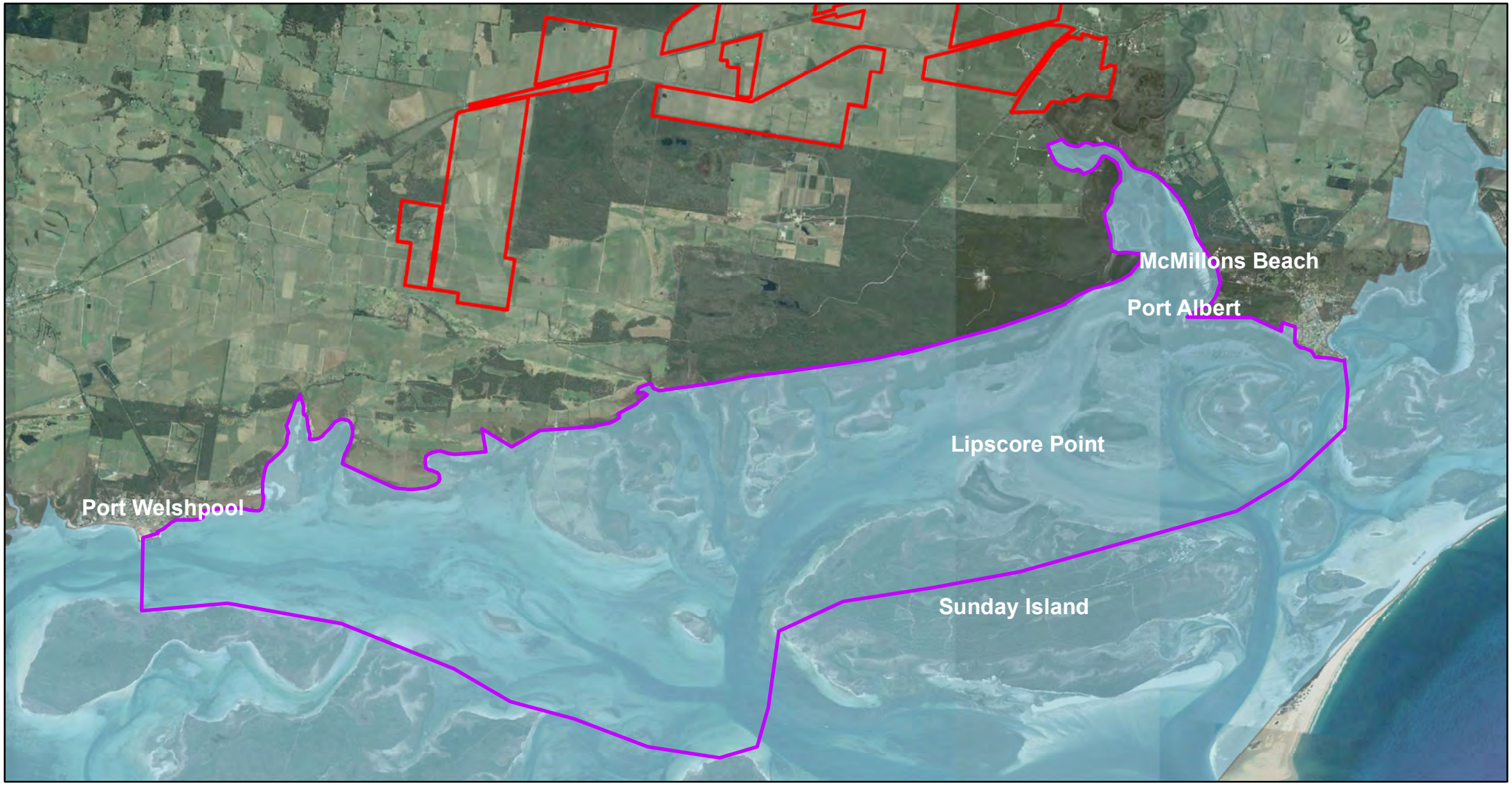
- Shorebirds depart in flocks of between 5 and 250 birds, with occasional observations of larger flocks (averages: 52, Lane & Jessop 1985; 10 – 151, depending on species, Piersma et al. 1990;127, Swennen 1992; 13 – 94, depending on species, Tulp et al. 1994).
- They fly in an elongated, shallow “V” formation, termed an “echelon” (see Piersma et al. 1990).
- Shorebirds are very vocal when they depart, calling unceasingly to one another rather loudly compared with their normal calling during flight.
- They ascend rapidly and steeply, and are usually still ascending when lost from sight by the observer. Estimates of climb rate vary, with larger, heavier species of shorebirds climbing at slower rates (Piersma et al. 1990, 1997). Rates of ascent for smaller shorebirds in West Africa were between 0.7 and 0.92 metres per second. Optimal climb rates of approximately twice this have been predicted for shorebirds by Hedenstrom and Alerstam (1994).
- Observations of flight altitude using weather radar show that during migration, shorebirds fly at between 0.5 and 6 kilometres (Williams et al. 1981; Piersma et al. 1990; Tulp et al. 1994). Altitudes of migration given in the last two studies are of birds still ascending when they disappeared from sight, often at altitudes of greater than one kilometre, and are therefore likely to be at the lower range of altitude estimates for level migratory flight. The first two studies used radar on oceanic islands to study shorebirds on long-distance, level, migratory flights. Altitudes in these circumstances ranged from 2.5 to 6 kilometres.

- Ground speeds for migrating shorebirds range between 20 km/h and 91 km/h (Lane & Jessop 1985; Tulp et al. 1994), although both studies were of birds climbing with varying strength winds affecting them.

Given the consistent behaviour of migratory shorebirds and their high rate of climb on departure, it is highly unlikely that shorebirds migrating northwards from the nearby intertidal habitats would be low enough by the time the crossed the proposed wind farm site to interact with operating wind turbines.

Observations at a wind farm in South Australia (BL&A, unpublished data) indicated that operating wind turbines sited within 300 metres of coastal shorebird habitats did not alter the distribution and abundance of shorebirds compared with their distribution and abundance before wind farm construction commenced.

In view of these findings, considering the main coastal habitats are located at least three kilometres from the boundary of the proposed Alberton Wind Farm and having regard to the observed movement of migratory species within but not beyond the coastal habitats during the current survey, the likelihood that the wind farm will have a significant impact on the migratory species in nearby habitats is considered very low. For this reason and again considering the distance from the shore, the project will not affect the ecological character of the Corner Inlet Ramsar Site.



Legend

- Shorebird survey study area
- Wind Farm boundary
- Ramsar wetland (Corner Inlet)

Kilometers
0 1 2 4

Figure 4: Shorebirds survey

Project: Alberton Wind Farm

Client: Synergy Wind Pty Ltd

Project No.: 14107	Date: 19/06/2015	Created By: M. Ghasemi / I. Kulik

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6. REFERENCES

Australian Wind Energy Association (AusWEA) 2005, Wind Farms and Birds: Interim Standards for Risk Assessment, Report prepared by: Brett Lane and Associates and AIRA Professional Services, Report No. 2003.35(2.2), July 2005.

Clean Energy Council 2013, Best Practice Guidelines – for implementation for wind energy projects in Australia. 2013.

Churchill, S 2008, *Australian Bats* (2nd. Ed.), Allen & Unwin, Crows nest, NSW.

DEPI (Department of Environment and Primary Industries) 2013, Advisory List of Threatened Vertebrate Fauna in Victoria. Department of Environment and Primary Industries (then DSE), East Melbourne, Victoria.

DEWHA (Department of the Environment, Water, Heritage and the Arts), 2009, Significant impact guidelines for 36 migratory shorebird species - Migratory species: EPBC Act policy statement 3.21 (Draft), 2009.

Hederstron, A and Alerstam, T (1994) Optimal climbing flight in migrating birds: predictions and observations of knot and turnstone. *Anim. Behav.* 48: 47-54.

Lane, B A and Jessop, A (1985) Tracking of migrating waders using in north-western Australia using meteorological radar. *Stilt* 6: 17-29.

Lane, B A (1987) 'Shorebirds in Australia.' Nelson, Melbourne.

Menkhorst, P. W. 1955, *Mammals of Victoria*, Oxford University Press, Melbourne.

Piersma, T; Zwarts, L and Bruggemann, J H (1990) Behavioural aspects of the departure of waders before long distance flights: flocking, vocalisations, flight paths and diurnal timing. *Ardea* 78: 157-184.

Piersma, T; Hedenstrom, A and Bruggemann, J H (1997) Climb and flight speeds of shorebirds embarking on an intercontinental flight; do they achieve the predicted optimal behaviour? *Ibis* 139: 299-304.

Richards, G, Hall, L and Parish, S 2012, *A natural history of Australian bats, Working the night shift*, CSIRO Publishing, Collinwood, Australia.

Swennen, C (1992) Observations on the departure of Knots from the Dutch Wadden Sea in spring. *Wader Study Group Bull.* 64, Suppl.: 87-90.

Tulp, I; McChesney, S and De Goeij, P (1994) Migratory departures of waders from north-western Australia: behaviour, timing and possible migration routes. *Ardea* 82: 201-221.

Williams, T C; Williams, J M; Ireland, L C and Teal, J M (1981) Autumnal bird migration over the western North Atlantic Ocean. *Amer. Birds*. 31: 251-267.

Williams, T C and Williams, J M (1988) Radar and visual observations of autumnal (southward) shorebird migration in Guam. *Auk* 107: 404-406.

Appendix 1: Details of bird utilization surveys during summer 2015

Note: A = below RSA; B = RSA height; C = above RSA

A - Summer 2015 impact points

Summer 2015	P 1			P 2			P 3			P 4			P 5			P 6			P 7			P 8			Total			
21 to 25 Feb 2015	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	Total
Australasian Pipit	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	15	0	0	15
Australian Hobby	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Australian Magpie	21	0	0	22	0	0	20	0	0	32	4	0	28	0	0	23	0	0	24	0	0	29	0	0	199	4	0	203
Australian White Ibis	16	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	36	2	0	38
Australian Wood Duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Australian Shelduck	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	2	0	4
Black Swan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black-faced Cuckoo-shrike	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black-shouldered Kite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue-winged Parrot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Falcon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Goshawk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1
Brown Thornbill	0	0	0	0	0	0	12	0	0	8	0	0	20	0	0	8	0	0	20	0	0	0	0	0	68	0	0	68
Common Blackbird	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	6	0	0	6
Common Myna	82	0	0	11	0	0	18	0	0	4	0	0	0	0	0	14	0	0	36	0	0	38	0	0	203	0	0	203
Common Starling	20	0	0	36	0	0	0	0	0	0	0	0	0	0	0	16	0	0	20	0	0	53	6	0	145	6	0	151
Crimson Rosella	2	0	0	0	0	0	7	0	0	4	0	0	10	0	0	0	0	0	5	0	0	0	0	0	28	0	0	28
Dusky Woodswallow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Rosella	3	0	0	0	0	0	6	0	0	4	0	0	0	4	0	0	0	0	4	0	0	0	0	0	17	4	0	21
Eurasian Skylark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
European Goldfinch	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10
Fairy Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fork-tailed Swift	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Galah	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gang-gang Cockatoo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Summer 2015	P 1			P 2			P 3			P 4			P 5			P 6			P 7			P 8			Total			
21 to 25 Feb 2015	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	Total
Grey Butcherbird	0	0	0	0	0	0	6	0	0	4	0	0	2	0	0	7	0	0	0	0	0	0	0	0	19	0	0	19
Grey Currawong	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
Grey Fantail	0	0	0	0	0	0	0	0	0	8	0	0	6	0	0	6	0	0	14	0	0	0	0	0	34	0	0	34
Grey Shrike-thrush	1	0	0	0	0	0	0	0	0	4	0	0	11	0	0	0	0	0	0	0	0	0	0	0	16	0	0	16
House Sparrow	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	0	0	82	0	0	82
Laughing Kookaburra	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
Magpielark	8	0	0	4	0	0	6	0	0	6	4	0	4	0	0	8	0	0	16	0	0	6	2	0	58	6	0	64
Masked Lapwing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nankeen Kestrel	6	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	3	0	11
Noisy Miner	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10
Pacific Black Duck	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
Raven spp.	49	0	0	85	0	0	39	0	0	132	2	0	146	0	0	92	0	0	100	0	0	98	0	0	741	2	0	743
Red Wattlebird	19	0	0	0	0	0	2	2	0	52	0	0	40	2	0	18	0	0	4	0	0	0	0	0	135	4	0	139
Red-browed Finch	0	0	0	0	0	0	0	0	0	0	0	0	66	0	0	20	0	0	0	0	0	0	0	0	86	0	0	86
Red-rumped Parrot	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Rufous Whistler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silvereye	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	36	0	0	36
Spotted Turtle Dove	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Straw-necked Ibis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	6	0	15	0	0	35	6	0	41
Striated Pardalote	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Striated Thornbill	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
Sulphur-crested Cockatoo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Superb Fairywren	0	0	0	0	0	0	41	0	0	24	0	0	66	0	0	5	0	0	30	0	0	0	0	0	166	0	0	166
Tree Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wedge-tailed Eagle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Welcome Swallow	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10
White-browed Srubwren	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8
White-eared Honeyeater	2	0	0	0	0	0	4	0	0	20	0	0	8	0	0	0	0	0	2	0	0	0	0	0	36	0	0	36
White-faced Heron	8	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	13	0	0	13

Summer 2015	P 1			P 2			P 3			P 4			P 5			P 6			P 7			P 8			Total			
21 to 25 Feb 2015	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	Total
White-plumed Honeyeater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	2
White-throated Needletail	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	10	0	10
White-throated Treecreeper	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Willie Wagtail	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	2	0	0	14	0	0	20	0	0	20
Yellow-faced Honeyeater	2	0	0	0	0	0	0	0	0	8	0	0	28	0	0	0	0	0	0	0	0	0	0	0	38	0	0	38
Yellow-rumped Thornbill	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	10	0	0	10
Yellow-tailed Black Cockatoo	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	5	0	9
Totals	251	6	0	200	0	0	170	9	0	317	10	0	471	16	0	221	0	0	351	7	0	343	8	0	2324	56	0	2380
No. species at points	18			10			15			18			20			13			19			11						

B - Reference points summer 2015

Summer 2015		R 1			R 2			Total		
21 to 25 Feb 2015	A	B	C	A	B	C	A	B	C	Total
Australasian Pipit	0	0	0	0	0	0	0	0	0	0
Australian Hobby	0	0	0	0	0	0	0	0	0	0
Australian Magpie	31	0	0	20	0	0	51	0	0	51
Australian White Ibis	0	0	0	0	0	0	0	0	0	0
Australian Wood Duck	0	0	0	4	0	0	4	0	0	4
Australian Shelduck	0	2	0	0	0	0	0	2	0	2
Black Swan	0	0	0	0	0	0	0	0	0	0
Black-faced Cuckoo-shrike	2	0	0	0	0	0	2	0	0	2
Black-shouldered Kite	0	0	0	0	4	0	0	4	0	4
Blue-winged Parrot	0	0	0	0	0	0	0	0	0	0
Brown Falcon	0	0	0	0	0	0	0	0	0	0
Brown Goshawk	0	0	0	0	0	0	0	0	0	0
Brown Thornbill	6	0	0	0	0	0	6	0	0	6
Common Blackbird	2	0	0	2	0	0	4	0	0	4
Common Myna	24	3	0	34	0	0	58	3	0	61
Common Starling	50	7	0	70	0	0	120	7	0	127
Crimson Rosella	16	0	0	0	0	0	16	0	0	16
Dusky Woodswallow	0	0	0	0	0	0	0	0	0	0
Eastern Rosella	7	0	0	6	0	0	13	0	0	13
Eurasian Skylark	0	0	0	0	0	0	0	0	0	0
European Goldfinch	0	0	0	0	0	0	0	0	0	0
Fairy Martin	0	2	0	0	0	0	0	2	0	2
Forked-tail Swift	0	0	0	0	0	0	0	0	0	0
Galah	28	0	0	0	0	0	28	0	0	28
Gang-gang Cockatoo	0	0	0	0	0	0	0	0	0	0
Grey Butcherbird	4	0	0	4	0	0	8	0	0	8
Grey Currawong	0	0	0	0	0	0	0	0	0	0
Grey Fantail	8	0	0	8	0	0	16	0	0	16
Grey Shrike-thrush	0	0	0	0	0	0	0	0	0	0
House Sparrow	0	0	0	0	0	0	0	0	0	0
Laughing Kookaburra	0	0	0	0	0	0	0	0	0	0
Magpie-lark	26	0	0	20	0	0	46	0	0	46
Masked Lapwing	0	0	0	0	0	0	0	0	0	0
Nankeen Kestrel	0	0	0	0	0	0	0	0	0	0
Noisy Miner	0	0	0	10	0	0	10	0	0	10
Pacific Black Duck	0	0	0	0	0	0	0	0	0	0
Raven spp.	30	0	0	43	4	0	73	4	0	77
Red Wattlebird	8	0	0	0	0	0	8	0	0	8
Red-browed Finch	0	0	0	0	0	0	0	0	0	0
Red-rumped Parrot	0	0	0	0	0	0	0	0	0	0
Rufous Whistler	0	0	0	0	0	0	0	0	0	0
Silvereye	0	0	0	6	0	0	6	0	0	6
Spotted Turtle Dove	0	0	0	0	0	0	0	0	0	0

Summer 2015		R 1			R 2			Total		
21 to 25 Feb 2015	A	B	C	A	B	C	A	B	C	Total
Straw-necked Ibis	0	0	0	0	0	0	0	0	0	0
Striated Pardalote	0	0	0	0	0	0	0	0	0	0
Striated Thornbill	0	0	0	10	0	0	10	0	0	10
Sulphur-crested Cockatoo	0	2	0	0	0	0	0	2	0	2
Superb Fairywren	22	0	0	11	0	0	33	0	0	33
Tree Martin	0	0	0	0	0	0	0	0	0	0
Wedge-tailed Eagle	0	0	0	0	0	0	0	0	0	0
Welcome Swallow	0	0	0	0	0	0	0	0	0	0
White-browed Srubwren	0	0	0	0	0	0	0	0	0	0
White-eared Honeyeater	0	0	0	0	0	0	0	0	0	0
White-faced Heron	0	0	0	0	0	0	0	0	0	0
White-plumed Honeyeater	0	0	0	4	0	0	4	0	0	4
White-throated Needletail	0	0	0	0	0	0	0	0	0	0
White-throated Treecreeper	0	0	0	0	0	0	0	0	0	0
Willie Wagtail	12	0	0	0	0	0	12	0	0	12
Yellow-faced Honeyeater	0	0	0	6	0	0	6	0	0	6
Yellow-rumped Thornbill	4	0	0	0	0	0	4	0	0	4
Yellow-tailed Black Cockatoo	0	0	0	0	0	0	0	0	0	0
Totals	280	16	0	258	8	0	538	24	0	562

C- Summer 2009 impact points

Summer 2009	P 1			P 2			P 3			P 4			P 5			Total			
4 to 9 / 01 / 2009	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	Total
Australasian Pipit	0	0	0	18	0	0	6	0	0	0	0	0	0	0	0	24	0	0	24
Australian Hobby	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Australian Magpie	22	0	0	13	0	0	26	0	0	18	2	0	24	0	0	103	2	0	105
Australian White Ibis	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	5
Australian Wood Duck	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Black Swan	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
Black-faced Cuckoo-shrike	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue-winged Parrot	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7
Brown Falcon	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Brown Goshawk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Thornbill	0	0	0	0	0	0	16	0	0	26	0	0	0	0	0	42	0	0	42
Common Blackbird	0	0	0	0	0	0	4	0	0	16	0	0	4	0	0	24	0	0	24
Common Myna	28	0	0	44	0	0	0	0	0	0	0	0	0	0	0	72	0	0	72
Common Starling	246	10	0	10	0	0	0	0	0	0	0	0	46	0	0	302	10	0	312
Crimson Rosella	0	0	0	0	0	0	14	0	0	14	0	0	0	0	0	28	0	0	28
Dusky Woodswallow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Rosella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eurasian Skylark	4	1	0	60	6	0	40	0	0	4	0	0	42	2	0	150	9	0	159
European Goldfinch	36	0	0	4	0	0	10	0	0	44	0	0	14	0	0	108	0	0	108
Fairy Martin	60	10	0	0	0	0	0	0	0	0	0	0	0	0	0	60	10	0	70
Galah	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	12	0	0	12
Gang-gang Cockatoo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grey Butcherbird	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grey Currawong	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grey Fantail	0	0	0	0	0	0	0	0	0	30	0	0	6	0	0	36	0	0	36
Grey Shrike-thrush	0	0	0	1	0	0	1	0	0	7	0	0	4	0	0	13	0	0	13
House Sparrow	36	0	0	28	0	0	0	0	0	0	0	0	0	0	0	64	0	0	64
Laughing Kookaburra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magpielark	20	0	0	12	0	0	21	0	0	0	0	0	6	0	0	59	0	0	59

Summer 2009	P 1			P 2			P 3			P 4			P 5			Total			
4 to 9 / 01 / 2009	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	Total
Masked Lapwing	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Nankeen Kestrel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pacific Black Duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raven spp.	11	0	0	31	3	0	6	0	0	10	0	0	15	0	0	73	3	0	76
Red Wattlebird	8	0	0	0	0	0	16	0	0	18	0	0	16	0	0	58	0	0	58
Red-browed Finch	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	36	0	0	36
Rufous Whistler	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	12	0	0	12
Silvereye	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	50	0	0	50
Spotted Turtle Dove	0	0	0	2	0	0	0	0	0	8	0	0	0	0	0	10	0	0	10
Straw-necked Ibis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Striated Pardalote	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Striated Thornbill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulphur-crested Cockatoo	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	2
Superb Fairywren	9	0	0	0	0	0	34	0	0	59	0	0	10	0	0	112	0	0	112
Tree Martin	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
Wedge-tailed Eagle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Welcome Swallow	66	12	0	0	0	0	16	0	0	0	0	0	4	0	0	86	12	0	98
White-browed Srubwren	0	0	0	0	0	0	14	0	0	52	0	0	4	0	0	70	0	0	70
White-eared Honeyeater	0	0	0	0	0	0	2	0	0	16	0	0	2	0	0	20	0	0	20
White-faced Heron	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	1	0	5
Willie Wagtail	15	0	0	0	0	0	0	0	0	2	0	0	0	0	0	17	0	0	17
Yellow-faced Honeyeater	0	0	0	0	0	0	4	0	0	35	0	0	7	0	0	46	0	0	46
Yellow-rumped Thornbill	27	0	0	0	0	0	14	0	0	0	0	0	0	0	0	41	0	0	41
Yellow-tailed Black Cockatoo	2	0	0	2	0	0	0	0	0	0	2	0	0	0	0	4	2	0	6
Totals	599	39	0	238	10	0	258	0	0	457	4	0	204	2	0	1756	55	0	1811
No. species at points	19			16			19			19			15						

D- Summer 2009 reference points

Summer 2009	R 1			R 2			Total			
4 to 9 / 01 / 2009	A	B	C	A	B	C	A	B	C	Total
Australasian Pipit	0	0	0	2	0	0	2	0	0	2
Australian Hobby	0	0	0	0	0	0	0	0	0	0
Australian Magpie	16	0	0	23	0	0	39	0	0	39
Australian White Ibis	0	0	0	0	0	0	0	0	0	0
Australian Wood Duck	0	0	0	0	0	0	0	0	0	0
Black Swan	0	0	0	0	0	0	0	0	0	0
Black-faced Cuckoo-shrike	0	0	0	0	0	0	0	0	0	0
Blue-winged Parrot	0	0	0	0	0	0	0	0	0	0
Brown Falcon	0	0	0	0	0	0	0	0	0	0
Brown Goshawk	0	0	0	0	0	0	0	0	0	0
Brown Thornbill	0	0	0	0	0	0	0	0	0	0
Common Blackbird	0	0	0	8	0	0	8	0	0	8
Common Myna	8	0	0	0	2	0	8	2	0	10
Common Starling	112	6	0	38	0	0	150	6	0	156
Crimson Rosella	0	0	0	0	0	0	0	0	0	0
Dusky Woodswallow	0	0	0	0	0	0	0	0	0	0
Eastern Rosella	0	0	0	0	0	0	0	0	0	0
Eurasian Skylark	28	2	0	2	0	0	30	2	0	32
European Goldfinch	17	0	0	14	0	0	31	0	0	31
Fairy Martin	0	0	0	0	0	0	0	0	0	0
Galah	20	0	0	0	0	0	20	0	0	20
Gang-gang Cockatoo	0	0	0	0	0	0	0	0	0	0
Grey Butcherbird	0	0	0	0	0	0	0	0	0	0
Grey Currawong	0	0	0	0	0	0	0	0	0	0
Grey Fantail	0	0	0	16	0	0	16	0	0	16
Grey Shrike-thrush	0	0	0	0	0	0	0	0	0	0
House Sparrow	70	10	0	0	0	0	70	10	0	80
Laughing Kookaburra	0	0	0	0	0	0	0	0	0	0
Magpie-lark	8	0	0	0	0	0	8	0	0	8
Masked Lapwing	0	0	0	0	0	0	0	0	0	0
Nankeen Kestrel	0	0	0	0	0	0	0	0	0	0
Pacific Black Duck	0	0	0	0	0	0	0	0	0	0
Raven spp.	12	0	0	6	0	0	18	0	0	18
Red Wattlebird	24	0	0	4	0	0	28	0	0	28
Red-browed Finch	0	0	0	0	0	0	0	0	0	0
Rufous Whistler	0	0	0	2	0	0	2	0	0	2
Silvereye	10	0	0	0	0	0	10	0	0	10
Spotted Turtle Dove	2	0	0	0	0	0	2	0	0	2
Straw-necked Ibis	0	0	0	0	0	0	0	0	0	0
Striated Pardalote	0	0	0	0	0	0	0	0	0	0
Striated Thornbill	0	0	0	0	0	0	0	0	0	0
Sulphur-crested Cockatoo	0	0	0	0	0	0	0	0	0	0
Superb Fairywren	6	0	0	10	0	0	16	0	0	16
Tree Martin	0	0	0	0	0	0	0	0	0	0
Wedge-tailed Eagle	0	0	0	0	0	0	0	0	0	0
Welcome Swallow	6	4	0	4	2	0	10	6	0	16
White-browed Srubwren	0	0	0	0	0	0	0	0	0	0
White-eared Honeyeater	0	0	0	0	0	0	0	0	0	0

Summer 2009	R 1			R 2			Total			
4 to 9 / 01 / 2009	A	B	C	A	B	C	A	B	C	Total
White-faced Heron	0	0	0	0	0	0	0	0	0	0
Willie Wagtail	1	2	0	0	0	0	1	2	0	3
Yellow-faced Honeyeater	0	0	0	22	0	0	22	0	0	22
Yellow-rumped Thornbill	21	8	0	12	0	0	33	8	0	41
Yellow-tailed Black Cockatoo	8	0	0	0	0	0	8	0	0	8
Totals	369	32	0	163	4	0	532	36	0	568

ALBERTON WIND FARM

REPORT ON MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

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APPENDICES

1. EXECUTIVE SUMMARY

This report has been prepared to supplement the flora and fauna report prepared by BL&A (2016) on the Alberton Wind Farm project. It aims to address specific concerns about the impacts of the project on matters of national environmental significance (MNES) protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). This is required as the Commonwealth Minister for the Environment has made the project a 'controlled action' under this Act.

The detailed analysis of available information on key MNES presented in this report has provided a basis for a more detailed assessment of the risks to these matters from the project. The conclusions from this analysis are summarised below.

A review of the project design and proposed environmental management measures against the Ramsar wetland significant impact guidelines (2013) indicated that the project is sufficiently distant from the **Corner Inlet Ramsar Site**, of low enough intensity and will be executed in an environmentally sensitive manner, ensuring that there will be no unacceptable residual risks of a serious impact on the ecological character of the Corner Inlet Ramsar site.

The assessment of impacts on the **Orange-bellied Parrot** (*Neophema chrysogaster*) from collision with wind turbines indicates that the likely frequency of collision is extremely low (i.e. less than once every 250 years). The species occurs infrequently east of Port Phillip Bay (3% of records and 1% of individuals) and even less frequently in Corner Inlet. For this reason, the risks to the Orange-bellied Parrot and its recovery from the proposed Alberton Wind Farm are not of conservation concern.

Based on the information presented herein about the distribution, abundance and habitat preference of the **Swift Parrot** (*Lathamus discolour*), and taking into consideration the lack of preferred mainland foraging tree species on and around the project site, and published wind farm collision risk modelling results for the species, no unacceptable risks to the Swift Parrot population are expected from the Alberton Wind Farm.

There have been no records of the **Growling Grass Frog** in the Corner Inlet region since 1995. In fact, apart from a record on Snake Island in 1995, the most recent records are from 1977. It is likely that the species is extinct in this region. The species will therefore not be adversely affected by the project.

For some wind farms, the number of **White-throated Needletail** carcasses found in some years indicates that more than 10 individuals may be affected by a project in a year. This is much less than an ecologically significant proportion of the population, defined as 0.1% of 10,000, or 100 birds by the DoE. With 34 turbines, the Alberton Wind Farm is smaller than many wind farms where estimates of impacts have been made (e.g. many more than 50 turbines), making it very unlikely that the proposed project will lead to an unacceptable risk to the needletail's population.

Based on an estimated population of 100,000 **Fork-tailed Swifts** (DoE 2015), impacts on an ecologically significant proportion of the population (i.e. 0.1%), would have to affect 1,000 birds per year, which will almost certainly not happen given the species occurs in the region much less frequently than the needletail. For this reason, it is considered that the Alberton Wind Farm will not lead to an unacceptable risk to this species' population that would be of conservation concern.

A thorough review of existing information is presented in this report on the distribution and abundance of **listed migratory shorebirds** in Corner Inlet and the Nooramunga. In addition,

in February 2015, summer shorebird surveys were undertaken within three to five kilometres of the proposed wind farm (i.e. the nearest marine habitats for this group to the proposed wind farm). The findings of this research indicate that risks to listed migratory shorebirds from the construction and operation of the proposed wind farm will be negligible.

In conclusion, the Alberton Wind Farm is not considered to have any unacceptable residual impacts or risks on any matter of national environmental significance.

2. INTRODUCTION

Synergy Wind Pty Ltd propose to develop a 34-turbine wind farm on farmland near Alberton in South Gippsland, Victoria. The project was Referred to the Commonwealth Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) on 23rd December 2016. The Minister has decided that the project is a controlled action and requires assessment and approval under the Act. This assessment is to be undertaken via a Victorian permitting process (yet to be decided) under the active EPBC Act bilateral assessment agreement between the Commonwealth and Victorian governments.

The controlling provisions were:

- Ramsar wetlands (Sections 16 and 17B);
- Listed threatened species (Sections 18 and 18A); and
- Listed migratory species (Sections 20 and 20A).

This assessment is to be undertaken via a Victorian permitting process (yet to be decided) under the EPBC Act bilateral assessment agreement between the Commonwealth and Victorian governments.

The key concerns in the Reasons for Decision were related to the potential for significant impacts on:

- The Corner Inlet Ramsar Site, and in particular on small tributaries within the wind farm site that flow into the Albert River, which flows into the Ramsar Site;
- The nationally Critically Endangered Orange-bellied Parrot (*Neophema chrysogaster*) and Swift Parrot (*Lathamus discolor*);
- The nationally Vulnerable Growling Grass Frog; and
- The listed migratory White-throated Needletail (*Hirundapus caudacutus*) and Fork-tailed Swift (*Apus pacificus*).

The Referral included detailed information on the potential for significant impacts on listed migratory species and in particular on the important populations of several species of migratory shorebirds that use the marine wetland habitats of the Corner Inlet Ramsar site.

This report provides additional information on the status, behaviour and likely impacts of the project on matters of national environmental significance, including the matters raised in the Commonwealth's Reasons for Decision (see Appendix 1). Additionally, it consolidates this with information prepared for the Referral and provides conclusions in relation to the acceptability of any risks and impacts from the project on all matters of national environmental significance.

This report is divided into the sections described below.

Section 3 presents information on the potential impacts of the project on the Corner Inlet Ramsar site.

Section 4 provides information on the effects of the project on the Orange-bellied Parrot;

Section 5 considers the impacts on the Swift Parrot;

Section 6 describes impacts on the Growling Grass Frog;

Section 7 discusses the impacts of the project on the White-throated Needletail;

Section 8 consider the impacts of the project on the Fork-tailed Swift; and

Section 9 describes impacts on listed migratory shorebirds in Corner Inlet.

This report was prepared by a team comprising Khalid Al-Dabbagh (Zoologist), Inga Kulik (Senior Ecologist and Project Manager) and Brett Lane (Principal Consultant.

3. CORNER INLET RAMSAR SITE

The coastal wetlands and shallow marine waters of the Corner Inlet and Nooramunga area, north and east of Wilson's Promontory are nominated under the Convention on Wetlands (the 'Ramsar' Convention) as a wetland of international importance. The boundary of the site is shown, together with the proposed wind farm, in Figure 1. This indicates that the proposed wind farm will be constructed mostly well away from the Ramsar site (i.e. greater than one kilometre).

Two turbines and associated access tracks and underground power cabling will be located between 500 metres and one kilometre from the Ramsar site boundary at the very eastern end of the project. Land within this area is currently ploughed and cropped regularly, or is used as marginal grazing land due to occasional saline tidal influence. The distance to the edge of the wetland from the construction site is such that any runoff from the construction site will dissipate within the 250 metres of grassed and cropped land before it reaches an open waterway. This is ample distance for any entrained sediment and associated pollutants to settle before any runoff reaches an open waterway.

Notwithstanding this, construction environmental management measures will be implemented, consistent with the Victorian Environment Protection Authority's *Environmental Guidelines for Major Construction Sites* (EPA 1996). These measures will include but not be limited to those described in Section 4 of these guidelines, including:

- *Minimising erosion* in works areas through careful staging and rehabilitation of works areas;
- *Stormwater management* to divert upslope flows around works sites and capture and treat runoff from these areas through appropriately designed *sediment controls* before it reaches any nearby waterways;

DoE (2013) has provided guidelines on impacts of concern on Ramsar sites and Table 1 below described mitigation measures to avoid any impacts of concern from the proposed Alberton Wind Farm on the Corner Inlet Ramsar site based on these guidelines then assesses the acceptability of the residual risk to the site.

The responses in Table 1, indicate that the project is sufficiently distant from the Ramsar site, of low enough intensity and will be executed in an environmentally sensitive manner, ensuring that there will be acceptable residual impacts on and risks to the Corner Inlet Ramsar site.

Table 1: Assessment of the impact of the Alberton Wind Farm on the Corner Inlet Ramsar site.

Potential impact	Mitigation measure	Residual risks
Areas of the wetland being destroyed or substantially modified	▪ The construction footprint completely avoids the Ramsar Wetland by at least 500 metres.	No risk of a reduction in area of the Ramsar Wetland.
A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland	▪ The footprint of the wind farm represents a very small proportion of the catchment to the Albert River which flows into the Ramsar Site. ▪ Apart from the turbine footing (less than 15 m diameter concrete pad), all infrastructure will be of permeable materials and designed not to significantly alter surface water flows. ▪ Appropriate pipes will be placed under access tracks where they cross low points where surface runoff could pass during higher rainfall events.	The scale and layout of the project together with the adoption of the measures described will ensure no substantial change to the volume, timing, duration and frequency of ground and surface water flows. The risk of serious impacts on water flows is acceptable.
The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected	▪ Aquatic fauna will not be affected as no part of the project is in the wetland. ▪ Adoption of the mitigation measures to protect wetland hydrology and water quality described elsewhere in this table will ensure no changes to flows and water quality of consequence for aquatic biota in the wetland. ▪ Waterbirds move about the wind farm site but bird utilisation surveys show they represent a very small proportion of bird activity there and numbers likely affected by turbine collision will be very small. ▪ Turbines are sufficiently distant from the main habitat areas used by migratory birds that migrating birds will be well above turbine height by the time they	Serious effects on wetland dependent biota from the construction and operation of the proposed wind farm are highly unlikely, with residual risks considered acceptable.

Potential impact	Mitigation measure	Residual risks
	pass across the wind farm on north western or north-eastern migration paths (see Section 9 of this report).	
A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health	▪ The distance between the proposed works in the eastern part of the project and the Albert River, which flows into the Ramsar site, is at least 250 metres of grassed or cropped land, which is sufficient to remove any sediment mobilised from the works area during a rainfall event. ▪ Construction environmental management measures will be implemented, consistent with the Victorian EPA's *Environmental Guidelines for Major Construction Sites* (EPA Publication 480, 1996) to protect water quality.	The location of works well away from waterways and the adoption of construction environmental management measures will ensure that there will be no substantial and measurable change in water quality in the Albert River or the Ramsar site. The residual risk of water quality impacts of concern is considered negligible and acceptable.
An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.	▪ Victorian Wind Farm projects are undertaken consistent with a set of planning permit conditions that require a pest plant and animal management plan for the project. This will require the careful monitoring and management of pest plants and animals during and after construction and the proposed wind farm. ▪ The implementation of best practice methods for weed and pest animal control, documented in a pest plant and animal management plan for the project will ensure that no invasive species will affect the Ramsar site.	The risk that an invasive species harmful to the ecological character of the wetland will be established in the Ramsar site as a consequence of the project is very low and considered acceptable.

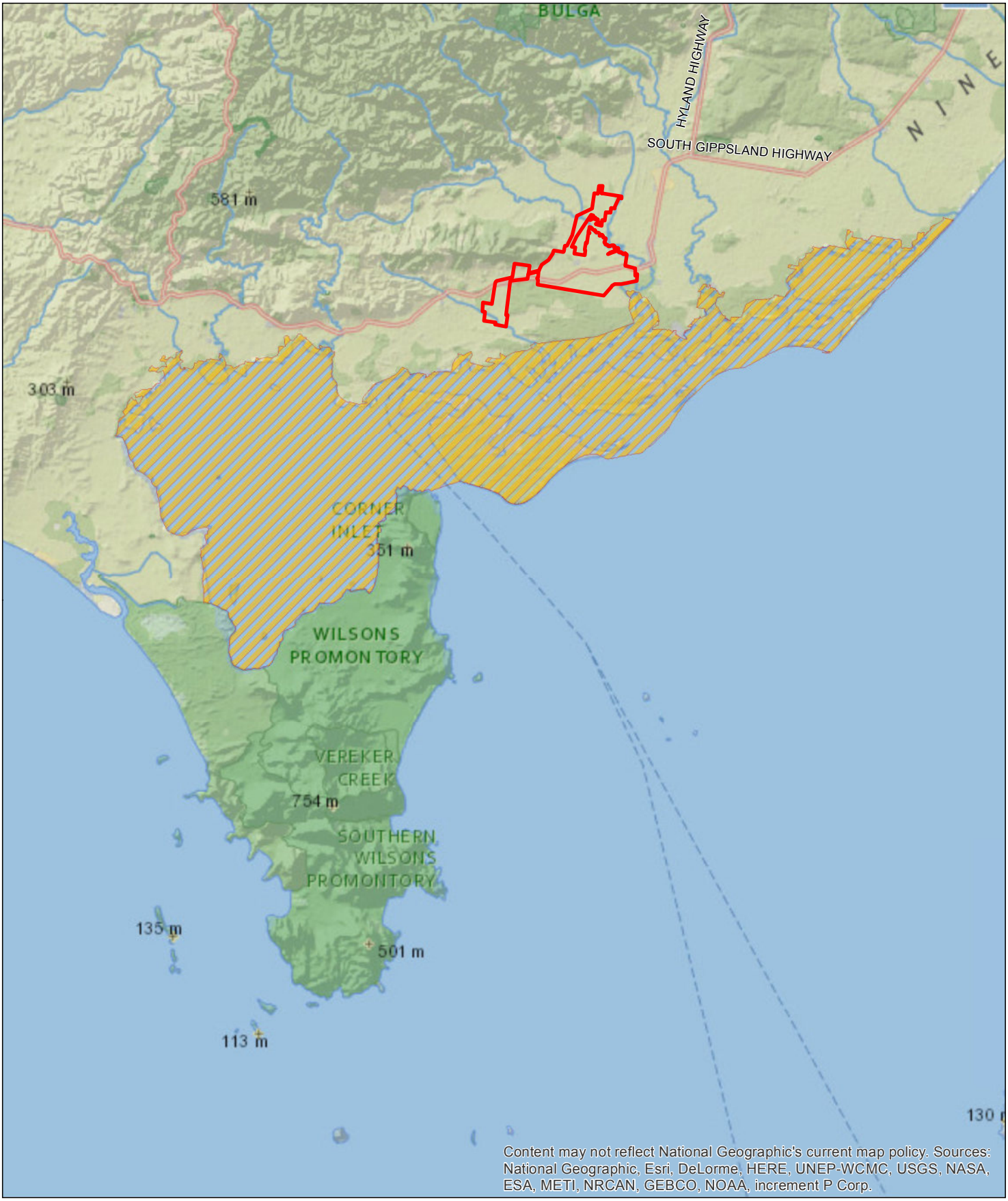

Figure 1: The Corner Inlet Ramsar site and the proposed Alberton Wind

Project: Alberton Wind Farm **Client**: Synergy Wind Pty Ltd **Date**: 29/06/2017

Study area

Ramsar Wetlands

N

Metres

0 6,000 12,000

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14107 - Created by: nmay / blane - E:\GIS\2014 Jobs\14107\14107 Corner Inlet Ramsar Site Boundary 170629.mxd

4. ORANGE-BELLIED PARROT

4.1. Biology

The Orange-bellied Parrot (*Neophema chrysogaster*) or OBP is a small to medium sized parrot (20 cm in length) predominantly green above, yellow underneath with blue markings on the leading edge of the wing and the tail. The species may be distinguished from its close relatives such as the Blue-winged Parrot (*Neophema chrysostoma*) by its brighter, grass-green colouration, a different extent and hue of blue on the wings and forehead, and its distinctive, metallic, buzzing contact and alarm calls. Adults have an orange lower belly patch but this may occasionally be observed in males of related species (Higgins 1999).

The OBP is migratory and breeds in south-west Tasmania, spending the winter mainly in the coastal saltmarshes of central and western Victoria and south-eastern South Australia. The northward migration of Orange-bellied Parrot is protracted (March – May), with birds stopping in King Island before continuing to the mainland. The southward migration in September – October is rapid (Higgins 1999). During northward migration, occasional birds can be found as far east as Jack Smith's Lake on the Victorian coast but birds spend most of the wintering period on the saltmarshes and coastal dune habitats in and west of Port Philip Bay.

Threats to the species on the mainland arise from loss of habitat due to coastal development, coastal wetland drainage and agriculture; introduced carnivores such as foxes and cats; increased competition from introduced and native seedeaters; and altered hydrological regimes and consequent loss of habitat and degradation of habitat quality. On the breeding grounds, competition for nest sites from introduced species of bird and the European Honeybee *Apis mellifera*, and inappropriate fire regimes in foraging habitats (Garnett *et al*. 2011; DELWP 2016).

4.2. Legislative protection

The Orange-bellied Parrot is protected by State and Commonwealth legislation throughout its range. It is listed as critically endangered under the federal EPBC Act 1999. Listed as threatened under the Victorian *FFG Act 1988*, as Critically Endangered in Vcitoria on the DSE *Threatened Species Advisory List* (DSE 2013), as Endangered on the *Threatened Species Protection Act 1995* in Tasmania, as Endangered on the *National Parks and Wildlife Act 1972* in South Australia, and as Endangered on the *Threatened Species Conservation Act 1995* in NSW.

The OBP is also listed as Critically Endangered under the International Union for conservation of Nature and Natural Resources (ICUN Red List), and is considered Critically Endangered in the Action Plan for Australian Birds 2010 (Garnett *et al* 2011).

4.3. Habitat

The parrot inhabits eucalyptus forest (in the breeding range), and saltmarshes, coastal dunes, pastures, and shrublands (in the non-breeding range), usually within one kilometre of the coast.

Breeding habitat for Orange-bellied Parrots is restricted to south-western Tasmania and includes eucalypt forest, rainforest and extensive moorland plains within the Tasmanian Wilderness World Heritage Area. The species uses hollows in live Smithton Peppermint *Eucalyptus nitida* throughout coastal southwest Tasmania, mainly within 20 km of Melaleuca and 5 km of Birchs Inlet.

On migration, the parrot inhabits dunes, heathland, coastal grasslands, saltmarshes and pasture.

In the mainland, they mainly inhabit saltmarshes dominated by Beaded Glasswort, Southern Seaheath, Shrubby Glasswort and associated grassy or weedy pastures (Higgins 1999; National Recovery Team 2016). The 16 VBA records of the Orange-bellied Parrot from Corner Inlet show that they have been found exclusively in saltmarsh habitats in the intertidal zone or very close to the high tide level on islands. None have been observed away from the intertidal zone or high tide mark.

4.4. Distribution

Orange-bellied Parrot is endemic to south-eastern Australia and Tasmania. Formerly the species range on the mainland extended from Adelaide, east through south-western coastal Victoria to near Sydney. In Tasmania, the species extended along the west and south coasts.

Historically, the parrot was rarely recorded west of the Murray River, South Australia or east of Port Phillip Bay. Westernmost records were the Dry Creek Saltfield north of Adelaide and Jack Smith's Lake in South Gippsland, Victoria.

Formerly, the species' breeding range was a narrow coastal strip of south-west Tasmania between Birch's Inlet, in Macquarie Harbour, and Louisa Bay on the southern coast. Currently breeding activity occurs only within 20 km of Melaleuca, in what is considered one breeding population (Higgins 1999; Garnett *et al*. 2011; National Recovery Team 2016).

An analysis of counts of over 13,000 individuals of the species in the Victorian Biodiversity Atlas and from the Birdlife Australia data base showed that from 1978 onwards, the proportion of the counted individuals east of 145°30' longitude (i.e. Port Philip Bay) was one percent of the total (i.e. about 130 individuals over 40 years). The OBP's preference for coastal areas was confirmed in the analysis of the records, which showed that only 2% of individuals in Victoria were recorded greater than two kilometres from the coast and most less than one kilometre from it (see Figure 2).

4.5. Population

In the nineteenth and early twentieth century, anecdotal observations described the species as 'abundant', e.g. around Adelaide and it was regularly observed around Sydney until 1907 (Higgins 1999). Its range and abundance have contracted since then in both breeding and non-breeding areas. On the mainland, the species is now rarely recorded beyond the coastal strip between the Coorong (South Australia) and Jack Smith Lake in South Gippsland, Victoria (Higgins 1999; BirdLife Australia 2012; Victorian Biodiversity Atlas 2016; Orange-bellied Parrot Recovery Team 2012a).

Population estimates based on marked individuals at Melaleuca for the period 1994–2004 showed an average minimum population of 71–116 birds. Between 2000 and 2008, the population decreased markedly, estimated to be at approximately 12% per annum (Holdsworth *et al*. 2011).

In 2011 and 2012, the minimum number of wild birds (including immature) leaving the breeding grounds in autumn was 27 and 36 respectively (Orange-bellied Parrot Recovery Team 2012b). One bird banded at Melaleuca and now ten years of age, has been observed on the mainland wintering ground in recent years, but is not spending summer around Melaleuca. Therefore, the post-breeding population must be slightly higher than 36. The

2016 national recovery plan (DELWP 2016) has estimated the population at about 50 individuals in the wild, with over 300 in captivity.

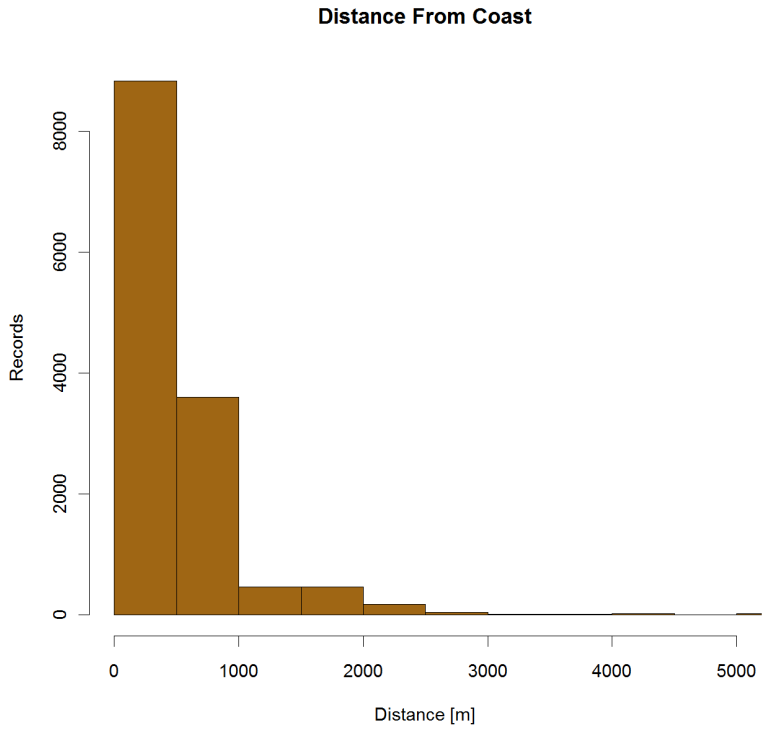

Figure 2: Total number of individual OBP counted versus distance from coast

The rate of decline was considered likely to culminate in extinction by 2015 (Garnett *et al*. 2011). However, latest data from the Orange-bellied Parrot Recovery Team (2016) suggest that in the three years since then numbers were stable (importantly, the female breeding participation was stable). Winter survival in 2011 was 94%, much greater than the 65% mean of the preceding ten years (M. Holdsworth, Orange-bellied Parrot Recovery Team, pers. comm. 6/8/2012).

A small number of birds remains in the wild, supplemented in the last three years by released captive-bred birds. The population size has varied annually over the last five years, but remains very small. No consistent trend in population size has emerged in recent years. Most years around 50-60% of the birds that migrate north for winter, will return to breed the following summer (DELWP 2016). It is likely that without the captive release program the species would currently be very close to extinction in the wild.

Recent winter surveys have failed to find any OPB's in Gippsland. The surveys have covered the east and west sides of Western Port, Phillip Island, Bass Coast, Inverloch and Venus Bay (Pritchard and Birdlife Australia, 2016).

4.6. Records of OBP in Corner Inlet

In Corner Inlet, 17 records of the parrot were found, mostly between 1980 and 1991, with one record (10 kilometres south of the wind farm site) in 2004. These records are shown in Figure 3 and listed in Table 2. Most involved one or two birds, with one record of three and one of five. There have been no records in the last 13 years in Corner Inlet.

Table 2: Victorian Biodiversity Atlas and Birdlife Australia records of the OBP in Corner Inlet.

Locality	Latitude	Longitude	Date	Count
Shallow Inlet, western side	-38.8306	146.1558	24/01/2007	1
Mangrove Island c. 2 km E of Big Hummock	-38.8581	146.2917	11/06/1987	1
Mangrove Island, Corner Inlet, Big Hummock	-38.8567	146.2928	23/07/1986	3
Mangrove Island, Corner Inlet, c. 6 km NW of Middle	-38.7667	146.3167	7/06/1987	1
Corner Inlet, E of Pt. Franklin	-38.6884	146.3326	6/02/2004	1
Corner Inlet, Barry Island	-38.8645	146.3547	28/06/1987	1
Corner Inlet, Barry Island	-38.8643	146.3549	23/05/1986	1
Corner Inlet, Barry Island	-38.8642	146.3549	11/06/1987	1
Corner Inlet, Barry Island	-38.8642	146.3549	29/06/1988	1
Corner Inlet, Chinaman's Creek	-38.8608	146.3603	23/07/1983	1
Small Island, E side of Corner Inlet	-38.8599	146.3606	20/07/1983	?
Corner Inlet, Port Albert	-38.6710	146.6727	1/07/1988	5
Mangrove Root Island	-38.6667	146.7167	unknown	?
Corner Inlet, N of Clonmel Island	-38.6841	146.7310	1/03/2004	2
Manns Beach Channel	-38.6131	146.7882	28/07/1991	2
McLoughlins Channel	-38.6078	146.8852	20/02/1980	?
McLoughlins Channel	-38.6078	146.8852	1/06/1980	?

The OBP was considered unlikely to occur or pass through the wind farm site during its migration (BL&A 2016). No record of the parrot has been obtained from the wind farm site and only one record (south of Port Albert) was recorded within the 10-km radius around the wind farm site (in 2004). There have been no records of the species in South Gippsland for over a decade.

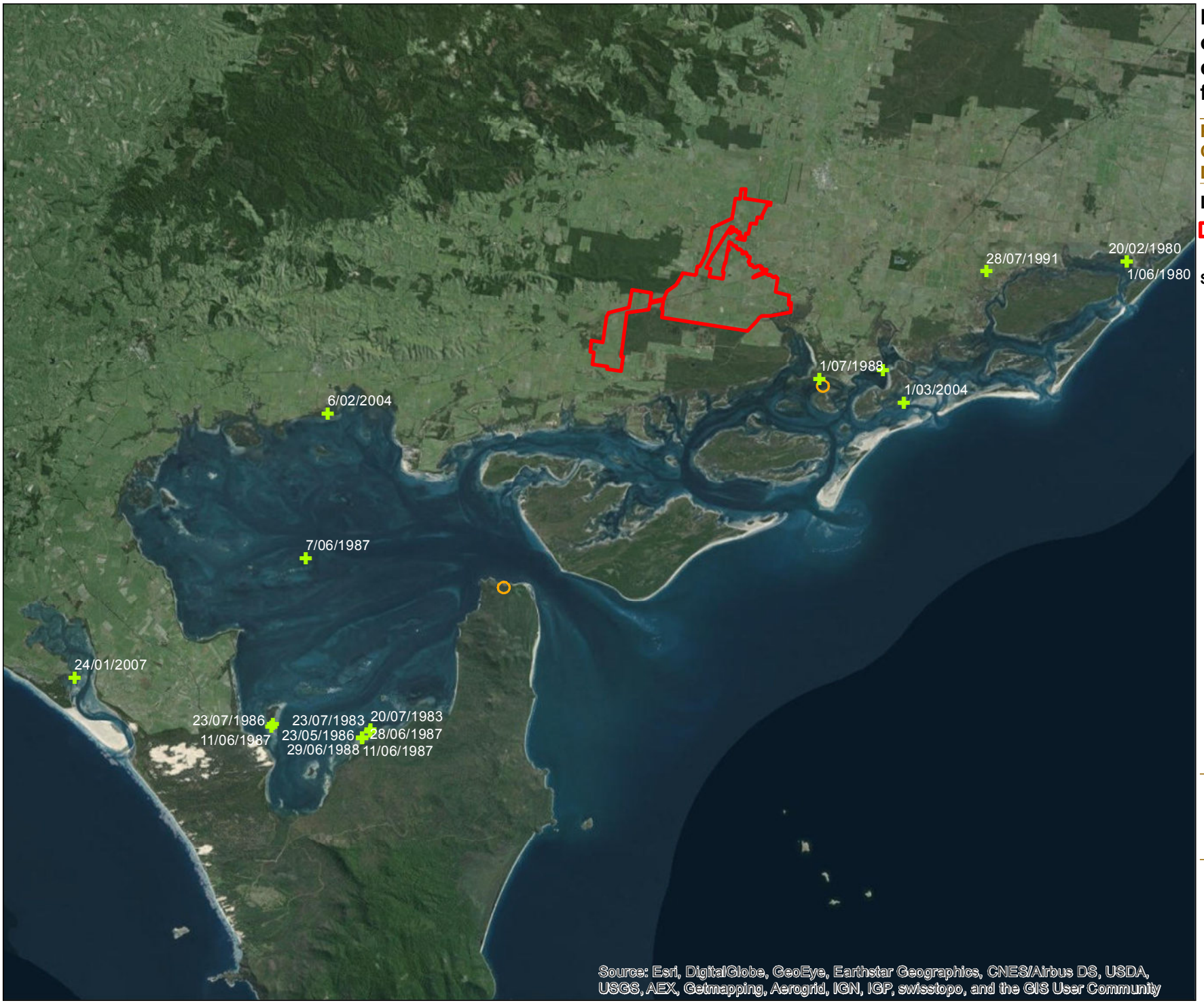

Figure 3: Total number of individual OBP counted versus distance from coast.

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 29/06/2017

Legend

- Study area
- OBP_records

Swift parrot records

- 1980 - onwards
- Pre 1980

N

Metres

0 3,500 7,000

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4.7. Impacts on the Orange-bellied Parrot

Field assessments showed that there was no suitable habitat for the Orange-bellied Parrot on the wind farm site. Very few food plants were recorded on site during the flora and fauna assessment (BL&A 2016a). A more detailed examination of potential habitat on the site on 23rd June 2017 indicated that where tidal influence occurs along the Albert River at the eastern end of the site, the river is steeply incised into the surrounding land, with a narrow fringe of mangroves but no saltmarsh.

The maximum population of the parrot for the life of the project is not expected to exceed 200 individuals (i.e. four times current levels), and then possibly only towards the end of the project's life, assuming continued captive release and greater efforts to protect the wild population. Using the above proportion of 1% and assuming a maximum population of 200 individuals, the number of individual OBP's expected to migrate through the eastern part of its range per year has been calculated to be up to two individuals (1% of 200).

The nearest turbines to the coastal habitats most likely to be used by the species are in the eastern part of the project. Seven turbines are within two kilometres of the coast, three of those within one kilometre (see Figure 4). All other turbines are at least 2 kilometres from the coast. In view of their preference for the coast and having regard to the location of turbines mostly two kilometres or more from the coast, only a small proportion of the migratory flights that these two birds make each year would pass across the wind farm site. This conservatively assumes that all birds reached the coast near the proposed wind farm, which is unlikely given the availability of habitat elsewhere in Corner Inlet previously used by the species (see Figure 2). A simple calculation indicates that for most turbines, one flight would pass across the site every 25 years (i.e. 1% of 200 by 2% of 2 = 0.04, or one every 25 years). This ignores the fact that there is no habitat on the wind farm site to attract them and that the population is far from being 200 individuals.

Assuming an active avoidance rate of 90%, and (conservatively) that all flights more than two kilometres from the coast were directed within the air space around the turbines *and* resulted in a collision (highly unlikely), one parrot could hit the turbines more than 2 kilometres from the coast once every 250 years. The likelihood of a collision occurring at this rate is considered very low given the comparatively small proportion of the airspace around a turbine that is occupied by it at any time. The seven turbines less than two kilometres would experience slightly higher rates of collision, being closer to the coast, but as fewer turbines are involved, the rate of impact is considered very low.

This frequency of mortality, which, as indicated, is a very conservative over-estimate, would be of little consequence for the species. The project would not contribute significantly to the decline of the species given that current mortality levels from other sources are in the order of 35% of the population *each year* (1990 – 2006; DELWP 2016), and that no birds are expected in the area given current population levels. The risk to the species from the project is therefore considered negligible. It is also clear that should recovery efforts succeed in reducing the current annual mortality rate, the project will not compromise the recovery of the species.

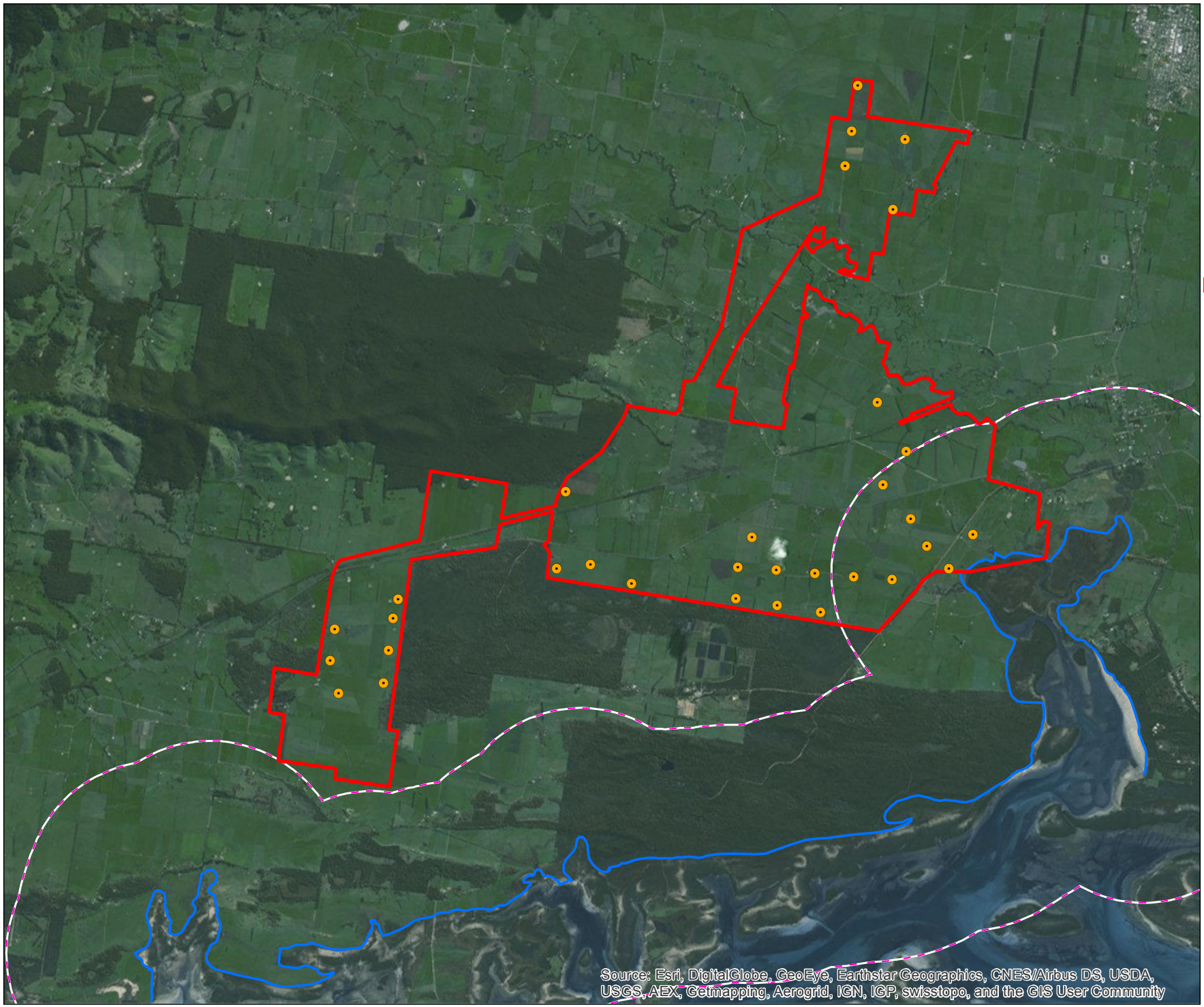

Figure 4: Distribution of coastal saltmarsh habitat near the Alberton Wind Farm in relation to the proposed wind farm.

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 25/07/2017

Legend

- Study area
- Coast
- Buffer zone (2km)
- Turbines

N

Metres
0 750 1,500

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5. SWIFT PARROT

5.1. Biology

The Swift Parrot (*Lathamus discolor*) is endemic to south-eastern Australia. It is a migratory, nectarivorous parrot about 25 centimetres in length with a wingspan of 32 – 36 cm. It is mostly green in colour with a long, dull red tail tapering to a pointed tip. The crown and ear coverts are dark blue and the face is red with yellow margins. The shoulder and underwing coverts are red, the rings around its eyes are yellow and its bill is a grey/brown colour (Higgins 1999).

The Swift Parrot breeds only in Tasmania during spring and summer, and migrates to spend autumn and winter in mainland south-eastern Australia (from western Victoria to south-eastern Queensland). It breeds mainly in areas of dry, grassy, Blue Gum forest in south-eastern Tasmania, with a smaller population breeding in shrubby, stringybark forest in coastal northern Tasmania (Swift Parrot Recovery Team 2011).

Typical Swift Parrot habitat on mainland Australian wintering grounds is dry open eucalyptus forests and woodlands, usually box-ironbark communities, especially those with Red Ironbark, Mugga Ironbark, Grey Box, White Box and Yellow Gum (Higgins 1999; Saunders and Tzaros 2011). A wide variety of other eucalypt species are also known to be used less often (Higgins 1999). In coastal New South Wales it prefers Swamp Mahogany and Spotted Gum (Garnett *et al*. 2011).

The Swift Parrot normally spends autumn and winter on the inland slopes of the Great Divide in Victoria and New South Wales; although in years when the box-ironbark forests of the inland slope flower poorly, they tend to prefer sites along the East Gippsland coast and foothills north to the central coast of New South Wales and sometimes as far as south-east Queensland (Emison et al. 1987; Barrett et al. 2003; Higgins 1999; Kennedy and Tzaros 2005).

Swift Parrots occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bug infestations) or pollen from Golden Wattle. They prefer to forage in large trees, defined as those greater than 60 centimetres diameter at breast height (Kennedy and Tzaros 2005).

Once on the mainland, this species undertakes semi-nomadic movements to take advantage of the richest areas of eucalypt nectar production and lerp infestation (Higgins 1999). The higher rainfall forests on the coastal plains of New South Wales are also important foraging areas in drier years (Saunders 2008; Saunders and Tzaros 2011).

The range of the Swift Parrot has contracted and population numbers have declined mainly as result of loss of habitat through clearing for agriculture, urban and industrial development and frequent fire events; loss of breeding habitat because of inappropriate forestry practices; and collisions with wire netting fences, windows and cars, during the breeding season and on migration (Garnett *et al*. 2011).

5.2. Population numbers

Population numbers of Swift Parrot have been estimated historically at 1,320 breeding pairs in 1987-88 and 940 breeding pairs in 1995-96. In the non-breeding range of mainland Australia, the most recent count available is of 2,158 birds in 2010 including immature birds (Saunders and Tzaros 2011; Garnett *et al*. 2011), however allowing that some birds were probably missed during that count, 2,500 is the maximum current population estimate (Garnett *et al*. 2011).

5.3. Records of the Swift Parrot.

The Swift Parrot was considered unlikely to occur or pass through the wind farm site regularly during its migration (BL&A 2016). Within the Corner Inlet region, the species has been recorded twice in the VBA notwithstanding the presence of many bird watchers in the region and in particular regular birdwatching at Wilson's Promontory. It is notable that there are few records from Wilson's Promontory during either the northward and southward migration seasons (the VBA has records at four locations on the promontory).

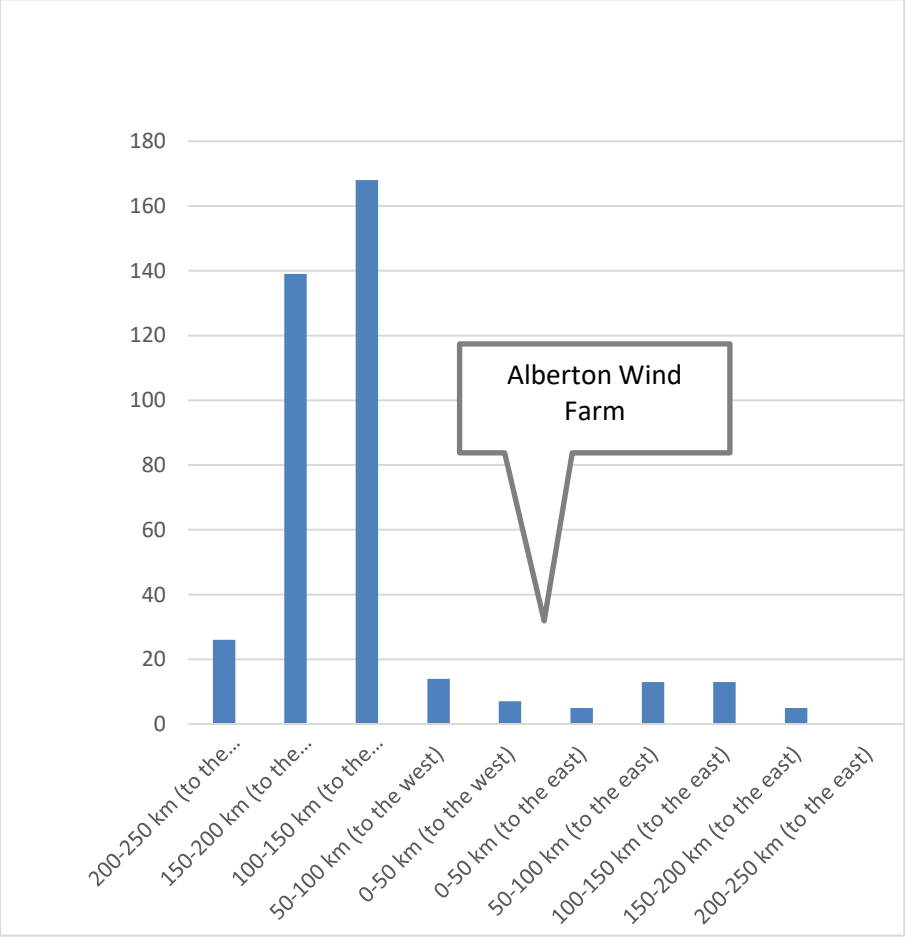
One record from the VBA is from south of Port Albert, approximately 7 km south of the wind farm site in April 1991. The nearest other record is from the northern tip of Wilson's Promontory in April 1992. The two records of the Swift Parrot in the region are listed in Table 3 and shown in Figure 2. Victorian records of the species are shown in Figure 6.

Table 3: Victorian Biodiversity Atlas; records of the Swift Parrot within 40 km of Alberton Wind Farm

Total Count	Survey Start Date	Site Location Description	Latitude	Longitude
20	2/04/1992	Mount Singapore, Wilson's Promontory	-38.7815	146.455
3	11/04/1991	2km W of Port Albert	-38.6735	146.6763

The number of Swift parrot records from the VBA within 60 km of the coast from Western Port eastwards in Victoria in 50 kilometre east-west intervals is shown in Figure 5.

Figure 5: Number of Victorian Swift parrot records within 60 kilometres of the coast from the VBA in 50 kilometre intervals east from Western Port, either side of the Alberton Wind Farm.



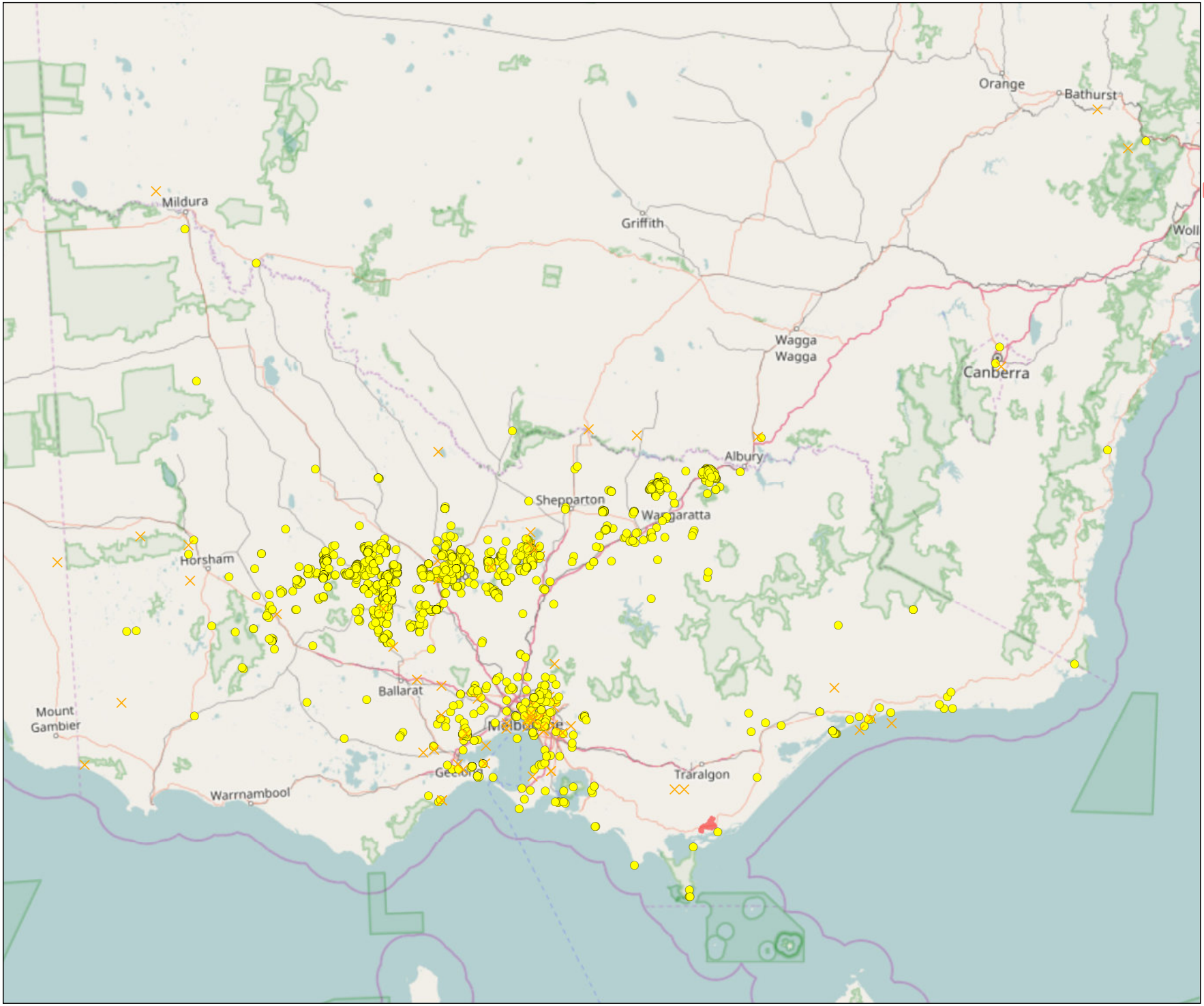


Figure 6: Records of the Swift Parrot in Victoria (source: VBA)

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 29/06/2017

Legend

Wind Farm site

Swift parrot records

- 1980 - onwards
- Pre 1980

N

Kilometers

0 120

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There are more records of the Swift Parrot to the west and east of the Alberton region in Victoria. It is likely that the dryer country up the Tambo Valley east of Bairnsdale provides better habitat (i.e. eucalypts that are favoured by the species) and this area lies on a roughly north-south line to more prospective habitat in that valley and over the Great Dividing Range to the Chiltern region of north-eastern Victoria.

The evidence that Wilsons Promontory is a favoured migration stopover is limited. The Eucalypt species of the dominant EVC's on the promontory are not favourable and there are few recent records of the species there. There are some historical records referred to by Higgins (1999) but no consistent evidence of regular use of the area by the species in recent decades when bird watching effort in the area has been significant (see Birdlife Australia's Birddata records).

It is also notable that many records occur during the northward migration in the Melbourne region, where there are more bird watchers. However, there are also more planted and indigenous eucalypts that flower at that time of year, such as the Sugar Gum and Grey Box. The suitability of the tree species in the vicinity of the wind farm to support the Swift Parrot is considered in the following sub-section.

The foregoing data on the distribution, seasonal timing and frequency of occurrence of the Swift Parrot indicates that the Corner Inlet region is not a significant area for this species. There are few recent records, even fewer than for the Orange-bellied Parrot.

5.4. Swift Parrot habitat at the Alberton Wind Farm.

On 23rd June 2017, a detailed assessment was made of the eucalypt species around the Alberton Wind Farm site. Figure 7 maps the areas of eucalypt woodland and forest and the Ecological Vegetation Class (EVC) to which they belong.

The following eucalypt species have been recorded in the forest and woodlands adjacent to the Alberton Wind farm:

- Messmate Stringybark *Eucalyptus obliqua*;
- Coast Manna Gum *E. viminalis* ssp. *pryoriana*;
- Swamp Gum *E. ovata*; and
- Yellow Stringybark *E. muelleriana*.

These trees occurred in the following EVC's:

- Plains Grassy Forest;
- Floodplain Riparian Woodland; and
- Heathy Woodland.

The occurrence by EVC and flowering times of the eucalypts in the vicinity of the Alberton Wind Farm are shown in Table 4. Figure 7 shows the location and extent of these EVC's around the Alberton Wind Farm. None of the eucalypt species is considered a preferred food source for the Swift Parrot in Victoria. It has been observed feeding on the nectar of the Swamp Gum and Manna Gum in Tasmania (Higgins 1999). In Victoria, it prefers drier forest types than those in the coastal parts of South Gippsland, that support abundant Yellow Gum *E. leucoxylon*, Red Ironbark *E.tricarpa*, Mugga *E. sideroxylon*, Grey Box, *E. macrocarpa* and Yellow Box *E. Melliorora*, all of which flower consistently during the autumn and winter months when the parrot is on the mainland. This is likely to account for the lack of regular records in South Gippsland of the Swift Parrot (see Figure 5).

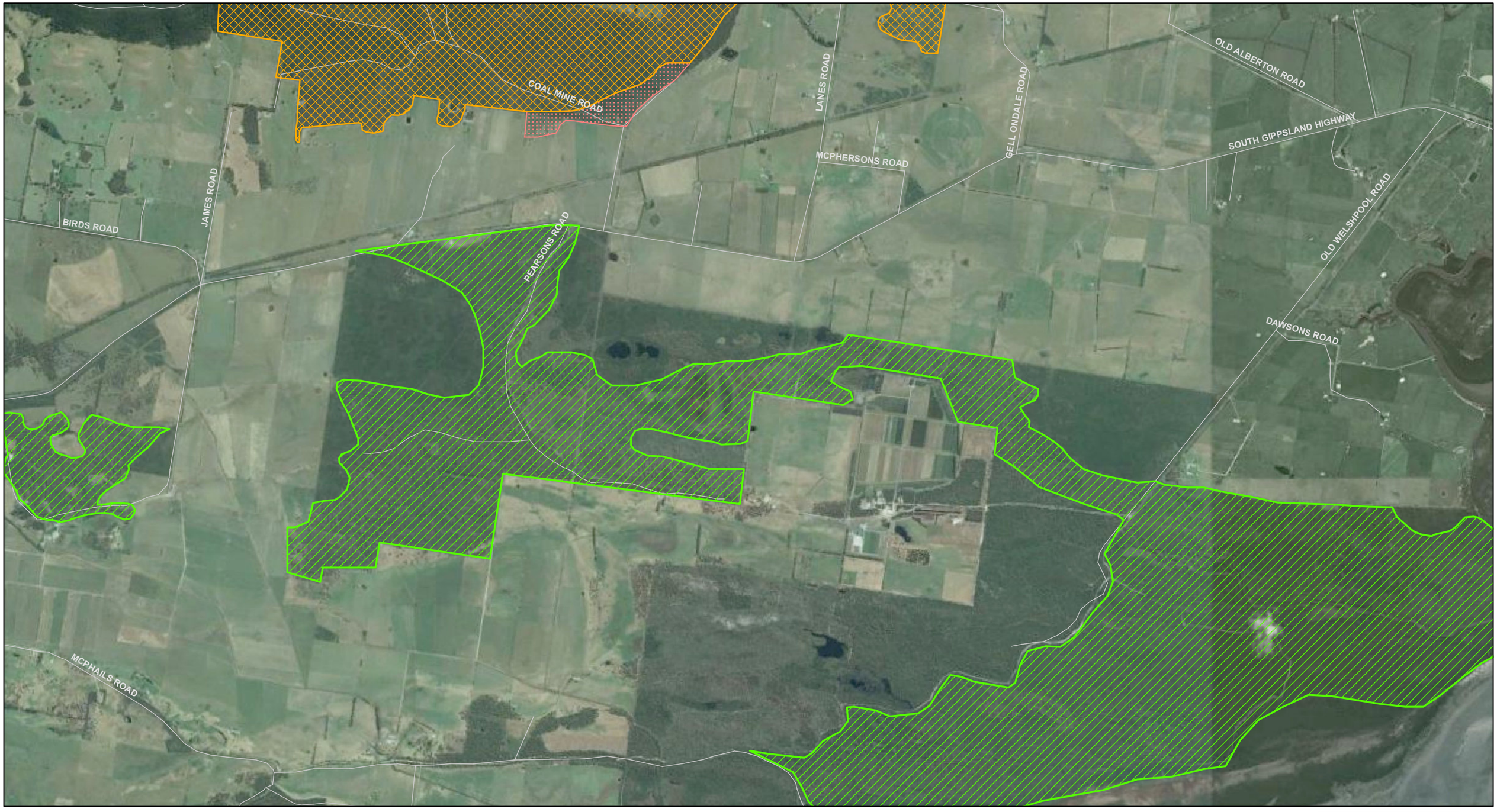
Table 4: Occurrence by EVC and flowering times of eucalypts at the Alberton Wind Farm.

Eucalypt Species	**Swift Parrot food source?**				**Flowering Period**											
		PGF	FRW	HW	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Yellow Stringybark, *Eucalyptus muelleriana*	Not recorded															
Messmate Stringybark, *E. obliqua*	Occasional															
Rough-barked Manna Gum, *E. viminalis* ssp. *pryoriana*	Tasmania															
Swamp Gum, *E. ovata*	Tasmania															
Swift Parrot Migration (Gippsland)																

PGF = Plains Grassy Forest

FRW = Floodplain Riparian Woodland

HW = Heathy Woodland



Legend

Ecological Vegetation Classes

- Floodplain Riparian Woodland (EVC56)
- Heaty Woodland (EVC48)
- Plains Grassy Forest (EVC151)

Metres
0 290 580 1,160

Figure 7: Extent and location of treed vegetation around the proposed Alberton Wind Farm.

Project: Alberton Wind Farm

Client: Synergy Wind Pty Ltd

Project No.: 14107	Date: 29/06/2017	Created By: N. May / B.Lane

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N

In New South Wales, the Swift Parrot can appear in significant numbers in coastal lowland forests in the high rainfall parts of the state, where they feed on the nectar of flowering Swamp Mahogany (Saunders 2008). In South Gippsland, no extensive winter-flowering source of nectar exists in lowland coastal areas and no drought-related coastward movement has been observed in this part of the species' range.

Although Swamp Gum flowers in winter, the extent of its occurrence near the proposed wind farm is limited to the small remnant patch of Floodplain Riparian Woodland area north of the site (see Figure 7). The limited extent of the occurrence of this species in the area is unlikely to represent a regular food resource for the parrot. Therefore, the forests and woodlands near Alberton would not act as a drought refuge for the species.

5.5. Impacts on the Swift Parrot

The proposed Alberton Wind Farm lies in an area where there are few Swift Parrot records and where regular migration is not likely to occur given the lack of suitable habitat, in particular preferred eucalypt species.

Coastal parts of Victoria further east and west have more records of the species due to the availability of suitable habitat and their location relative to habitats immediately north of the Great Dividing Range.

Smales (2006) modelled the collision risk of 39 wind farm proposals in south eastern Australia to determine their cumulative impact on threatened birds listed on the EPBC Act. This analysis pre-dates the Alberton Wind Farm proposal but includes a significant number of projects that have not proceeded and are unlikely to. Based on scenario modelling and collision risk modelling for the number of wind turbines at each wind farm site, Smales predicted that in total, across all 39 projects, roughly one Swift Parrot every ten years would be killed through collision with a wind turbine. This indicated that the risk of wind farms to this species is low.

Based on the information presented herein about the distribution, abundance and habitat preference of the Swift Parrot, and taking into consideration the lack of preferred mainland foraging tree species on and around the project site, and the modelling results of Smales (2006), the risks to the Swift Parrot population from the proposed Alberton Wind Farm are considered negligible.

6. GROWLING GRASS FROG

This section addresses the likelihood that the project will have an unacceptable impact on the Growling Grass Frog.

6.1. Distribution in South Gippsland

A search of the Victorian Biodiversity Atlas (VBA) and the MNES search tool showed that there have been no records of the Growing Grass Frog within seven kilometres of the proposed wind farm site. The locations and years of these records are shown in Figure 8.

The nearest records are about 7.5 kilometres to the south-west of the proposed wind farm site, on Snake Island and/or adjacent parts of the mainland (the accuracy of the record does not enable the precise location of the record to be determined) but there are at least six such records between 7.5 and 15 kilometres from the site. Additional records occur between 7.5 and more than 20 kilometres north east of the site.

It is noteworthy that one record alone is from 1995 (on Snake Island). All other records are either very historic (nominally dated 1788 in the VBA) or from 1977. It is likely that the species is extinct in the region.

Given this, no targeted surveys for this species were deemed to be necessary and were not undertaken. The risk of the project to the species is considered negligible as the species is unlikely to occur in the study area.

6.2. Habitat on the wind farm site

The wind farm site lacks any remnant natural wetlands with sufficient vegetative cover to provide permanent ongoing breeding habitat to support a metapopulation of the Growling Grass Frog on the project site. Farm dams on the site have been heavily grazed and lack suitable dense vegetated shorelines.

The Department of Environment and Energy have expressed concern that individuals may move along and near waterways within the site. The waterways on the site were not considered to be suitable as they are heavily treed with Swamp Paperbark that shades them, making habitat unsuitable, or they lack any deep pools with dense fringing vegetation. Natural waterways support abundant tree cover, making them unsuitable for the species. Where unfenced, they are heavily grazed and lack suitable habitat. In many parts of the project area, waterways have been channelised and straightened to prevent flooding of low lying farmland. These remain grazed by stock and lack suitable habitat for the species.

6.3. Precautionary mitigation measures

To address concerns that the project may impact the species should it occur in the area, the following measures have been adopted by the proponent:

- Most infrastructure associated with the development is at least 200 metres from a natural waterway;
- A total of five of access track crossings of channelised farmland drains are required as part of the project, specifically from turbine 2 to 3, 12 to 15, 18 to the South Gippsland Highway, 18 to 22 and 24 to 25.

- Access tracks will be a maximum of 6 metres wide and crossings will involve a single drainage pipe under the track surface. This type of crossing of mostly ephemeral drains will not impede the movement of any frogs along these channels.
- A spring-summer survey of these five crossing locations will be undertaken before construction to ascertain if the Growling Grass Frog is present.
- If the species is present then a salvage and translocation protocol will be developed and implemented to avoid impacts on this species.

The foregoing measures will ensure that the project will have no unacceptable residual risk to the Growling Grass Frog.

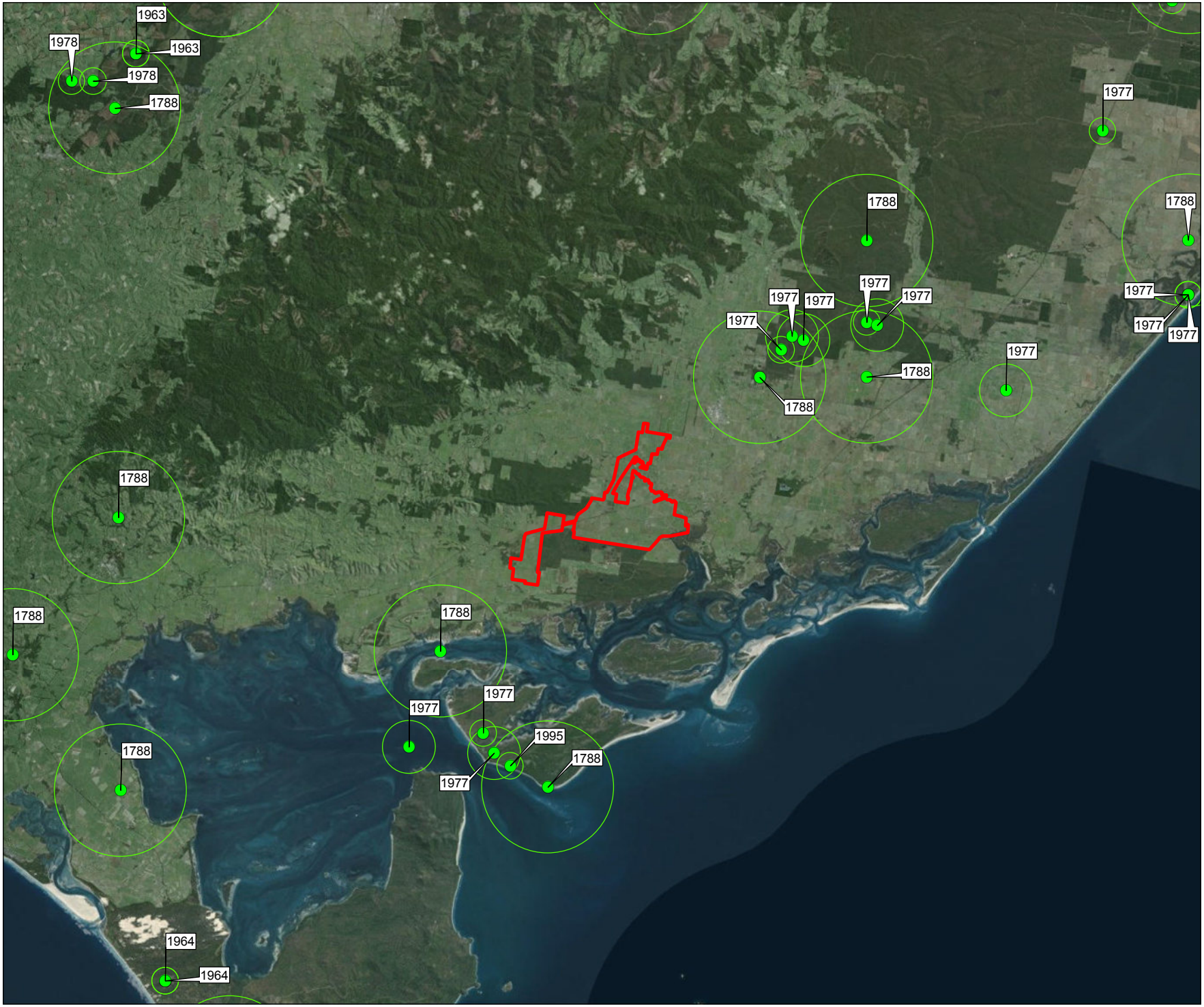

Figure 8: VBA GGF records

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 18/07/2017

Legend

- Study area
- GGF records, recorded date and estimated accuracy (circles)

N

Metres

0 4,000 8,000

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7. WHITE-THROATED NEEDLETAIL

7.1. Biology

The White-throated Needletail (*Hirundapus caudacutus*) is a large swift with brown and dark grey plumage with a distinctive white vent and throat, and a pale brown wash on the back. Its body is approximately 30 cm long and its wing span is about 60 cm. It weighs between 100 and 130 grams.

White-throated Needletail is a non-breeding migrant from breeding grounds in Siberia that visits eastern, south-eastern and northern Australia in the austral spring and summer. They arrive in October each year and have departed by early May

The species is a high-flying one that is able to fly at speeds of up to 130 km per hour and at heights of up to one kilometre above the ground. Small numbers have been recorded colliding with wind turbines at most wind farms investigated in south eastern Australia.

The White-throated Needletail spends the daylight hours on the wing in search of aerial insects. Radio-tracking has confirmed that at night it roosts in trees. It feeds on flying insects, such as termites, ants, beetles and flies. It catches them in flight in its wide beak. It usually feeds in rising thermals and updrafts and wind change zones associated with storm fronts and bushfires where insects concentrate.

The needletail has been recorded foraging over a range of habitats, from high alpine meadows and mountain passes to coastal plains, and over forested areas and land extensively cleared for agriculture.

7.2. Legislative protection

The White-throated Needletail is a listed migratory species under the *Environment Protection and Biodiversity Conservation Act 1999* as it is protected by international migratory bird conventions between Australia and Japan, China and the Republic of Korea.

White-throated Needletail has a conservation status of ***'least concern'*** or 'secure' throughout most of its range in Australia and internationally (BirdLife Australia 2013, BirdLife International 2013). In Australia, Victoria has recently up-listed the species to '***vulnerable***' status (DSE 2013).

7.3. Population

The population of the Needletail is said to have declined but evidence for this is scarce (Namba *et al*. 2010; Tarburton 2012).

Birdlife International (2013) states that the White-throated Needletail population trend is currently stable. Although there is no current accurate population estimate, the population is estimated at greater than 10,000 birds (BirdLife International 2013).

Despite the reports of a decline the overall population spending the warmer months in Australia is likely to number in the tens of thousands (Higgins 1999). The official estimate by the Commonwealth Department of the Environment and Energy for the purpose of defining a significant impact is "at least 10,000 individuals but probably fewer than 100,000" (DoEE 2015). The lower range of 10,000 is used for the purpose of defining an 'important population'. At a national level, an important population is 0.1% of the total population, or 100 birds in the case of the White-throated Needletail. A significant impact involves the loss of this many birds from the population in a year.

7.4. Records of the White-throated Needletail.

In Victorian, the White-throated Needletail occurs most frequently in Victoria south of the Great Dividing Range in eastern Victoria, including South Gippsland (Emison et al., 1987; Barrett et al., 2003).

The White-throated Needletail is likely to occur on the wind farm site during summer months while visiting south-eastern Australia (BL&A 2016). On one occasion during the summer 2015 Bird Utilization Survey; 10 birds were observed flying over the wind farm site at Rotor Swept area of the turbines (BL&A 2016).

The Victorian Biodiversity Atlas listed five records for the 10-kilometre radius area surrounding the wind farm site, including the BL&A record from within the wind farm site.

Table 5: Victorian Biodiversity Atlas; records of the White-throated Needletail within 10 km of Alberton Wind Farm (date report extracted June 2017)

Total Count	Survey Date	Site Location Description	Latitude GDA94	Longitude GDA94
–	5/04/1980	YARRAM AERODROME	-38.5818	146.7513
–	27/12/1980	ALBERT RIVER	-38.5818	146.5846
–	9/01/1981	YARRAM AERODROME	-38.5818	146.7513
70	29/02/2004	end of Old Port Road: Port Albert	-38.6669	146.6674
10	21/02/2015	South Boundary Track, Alberton Wind Farm	-38.6244	146.5536

7.5. Impacts on the White-throated Needletail

According to the Commonwealth significant impact guidelines (DoE 2013), an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The first two points are not relevant to the Alberton Wind Farm, as the project would not have these effects on the needletail. Regarding the third point, the loss of individuals from collision with turbines is likely to occur and is discussed below.

This species has been found under turbines in several operating wind farms in south-eastern Australia (BL&A, unpubl. data). The number of detected casualties at any wind farm varied from 1 to 3 birds annually. Correction factors are applied to carcass search results to allow for carcasses that are scavenged and those that are missed by searchers. For some wind farms, the number of needletail carcasses found in some years indicates that more than 10 individuals may be affected in a year. This is much less than an ecologically significant proportion of the population, defined as 0.1% of 10,000, or 100 birds (DoE 2015). With 33 turbines, the Alberton Wind Farm is smaller than many wind farms where estimates of impacts have been made (e.g. many are more than 50 turbines), making it less likely that a unacceptable impact will occur at the Alberton Wind Farm.

Mitigating impacts from wind turbines is unlikely to be possible given the aerial nature of the species and its intermittent and unpredictable presence at the site in response to varying weather conditions. Notwithstanding this, the scale of the impact on this species is not considered to represent an unacceptable risk to its population.

8. FORK-TAILED SWIFT

The Fork-tailed Swift is a medium to large swift with a slim body, long wings that taper to finely pointed tips and a long, deeply forked tail. It has a body length of 18–21 cm, a wingspan of 40–42 cm and weighs around 30–40 g. It is smaller and slimmer than the White-throated Needletail, with much narrower wings and a longer, deeply forked tail. The Fork-tailed Swift is mainly blackish with a white band across the rump. There is also a white patch on the chin and throat (Higgins 1999).

The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia and is sparsely scattered in all regions of Victoria (Higgins 1999). It usually arrives to Australia in October and records are more common in Victoria in December–April, after which they depart for their northern hemisphere breeding grounds.

This species is almost exclusively aerial, flying over a wide variety of habitats and can be seen in large flocks, sometimes of hundreds or thousands, and exceptionally, in tens of thousands. It often associates with the White-throated Needletail and its flocks often precede or accompany thunderstorms or weather fronts (Higgins 1999).

The global population is still not quantified. Populations are believed to be stable throughout most of its range. There are no measures of abundance in Australia. The largest flocks recorded in Australia were 90 000 near Mildura, Victoria, during 1961; 50 000 at Portland, south-west Victoria, during January 1960; and 50 000 at Ivanhoe, NSW (Higgins 1999).

There are no significant threats to the Fork-tailed Swift in Australia.

8.1. Legislative protection

The Fork-tailed Swift is a listed migratory species under the *Environment Protection and Biodiversity Conservation Act 1999* as it is protected by international migratory bird conventions between Australia and Japan, China and the Republic of Korea.

Fork-Tailed Swift has a conservation status of 'least concern' or 'secure' throughout most of its range in Australia and internationally (BirdLife International 2013).

8.2. Records of the Fork-tailed Swift.

The Fork-tailed Swift is considered likely to occur or pass through the wind farm site during the summer months while visiting south-eastern Australia (BL&A 2016). On one occasion during the summer 2015 Bird Utilization Survey, one bird was observed flying over the wind farm site at Rotor Swept Area height (BL&A 2016).

The Victorian Biodiversity Atlas listed the above same record from the wind farm site and no other record has appeared in the area since 1970. This single record from the wind farm and its surroundings suggests that the presence of the swift in the area is rather rare.

8.3. Impacts on the Fork-tailed Swift

There has been at least one recorded instance of a Fork-tailed Swift colliding with a wind turbine (BL&A, unpubl. data). This is a much lower rate of recorded fatalities than for the previous swift species, probably reflecting the numerical dominance of that species over the Fork-tailed Swift in eastern Australia.

The infrequency with which it occurs in the region suggests that it would interact with the proposed Alberton Wind Farm only occasionally, when passing through the area. Based

on experience at other wind farms in south eastern Australia, impacts on this species from the Alberton Wind Farm are likely to be much less than for the White-throated Needletail.

Based on an estimated population of 100,000 individuals (DoE 2015), impacts on an ecologically significant proportion of the population (i.e. 0.1%), would have to affect 1,000 birds per year, which will almost certainly not happen given the species' status in the region.

Based on the foregoing information it is considered that the Alberton Wind Farm will not have an unacceptable impact of conservation concern on the Fork-tailed Swift.

9. LISTED MIGRATORY SHOREBIRDS

This section of the report addresses the potential impacts and risks of the project for the important populations of listed migratory shorebirds that occur in the Corner Inlet and Nooramunga areas. The sources of information are considered first, followed by the results of the work and conclusions in relation to the acceptability of the risks from the project for this group of birds.

Based on screening of the potential for significant impacts under the EPBC Act for the project Referral, and having consideration to draft significant impact guidelines (DEWHA 2009), the Commonwealth did not consider that the listed migratory shorebirds would be significantly affected by the project (see Appendix 1). Notwithstanding this, impact on this important group of birds are of concern at a state level and the results of this assessment are included here for completeness in relation to the EPBC Act.

9.1. Sources of Information

This assessment is based on two sources of information;

- A field investigation undertaken in 2012 to ascertain how shorebirds use those parts of eastern Corner Inlet within three to five kilometres of the proposed wind farm; and
- Shorebird count data collected by birders for Birdlife Australia since 1980.

The purpose of the analysis was to identify if any important populations of migratory shorebirds occur close enough to the proposed wind farm to be at risk of an unacceptable impact. The field investigation methods are described first, followed by the existing information used.

9.1.1. Field investigation

The migratory bird surveys were conducted between 25th and 27th February, 2015 at low tide to identify areas where shorebirds might be foraging on intertidal sand- and mudflats. On the first day, surveys were undertaken by car and foot along the coastline from the land side, while on the second and third day, surveys were undertaken by boat along the edge of the coastline from the water.

9.1.2. Existing data

Existing information was obtained for the eastern part of Corner Inlet from the Birdlife Australia Shorebird 2020 count database (provided in November 2016). These data have been generated over the last 35 years (1980 to 2015) from bird counts within the Corner Inlet Ramsar wetland. The most relevant data are those from the eastern part of the area including data from 15 survey sites.

Data for the following EPBC Act listed 31 migratory shorebird species were analysed.

- Asian Dowitcher
- Bar-tailed Godwit
- Black-tailed Godwit
- Broad-billed Sandpiper
- Common Greenshank
- Common Redshank
- Common Sandpiper
- Curlew Sandpiper
- Double-banded Plover
- Eastern Curlew
- Great Knot
- Greater Sand Plover
- Grey Plover
- Grey-tailed Tattler
- Latham's Snipe
- Lesser Sand Plover

- Little Curlew
- Long-toed Stint
- Marsh Sandpiper
- Oriental Plover
- Pacific Golden Plover
- Pectoral Sandpiper
- Red Knot
- Red-necked Stint
- Ruddy Turnstone
- Ruff
- Sanderling
- Sharp-tailed Sandpiper
- Terek Sandpiper
- unidentified medium wader
- unidentified small wader
- Whimbrel
- Wood Sandpiper

The 15 sites surveyed by Birdlife Australia in eastern Corner Inlet and included in this analysis are listed below and shown in Figure 9.

- Box Bank Island - F
- Clonmel Island - D
- Dog Island south - M
- Dream Island - H
- Dream south (shallow inlet) - G
- East Sunday Island / Drum Island - A
- Kate Kearney entrance - E
- McGloughlans entrance - J
- North of St Margaret Island - L
- One Tree Island - G2 - now S
- Port Albert entrance - C
- Port Welshpool foreshore
- Robertsons Beach - K
- Snake Island (east side) - G3 - now B
- Sunday Island west end.

Most of the sites were located close to the southern, coastal edge of the Ramsar Wetland such as Dream south (shallow inlet), Kate Kearney entrance and Snake Island (east side).

The closest regular shorebird monitoring sites to the Alberton Wind Farm are One Tree Island, Robertson's Beach and Port Welshpool foreshore, which are approximately seven to eight kilometres from the nearest wind turbine at the proposed Alberton wind farm.

9.2. Data analysis

9.2.1. Species abundance trends between 1980 and 2015

Shorebirds 2020 data from Birdlife Australia were used to analyse population trends for EPBC Act listed migratory shorebird species within Corner Inlet east (see above). Average summer and average winter counts for each of these species were calculated separately for each survey decade. The decade averages for each species were then added together to produce a total migratory shorebird average count for 1980-89, 1990-99, 2000-09 and 2010-16 and corresponding maps.

9.2.2. Counts of the most abundant migratory shorebirds from 2010 to 2015

Focusing on the more recent data, the seven most abundant species during the summer counts between 2010 and 2015 were mapped for all survey sites. During this period, these species represented 98 percent of the total of site average shorebird counts in Corner Inlet east. These species were:

- Bar-tailed Godwit
- Black-tailed Godwit
- Curlew Sandpiper
- Eastern Curlew
- Grey Plover
- Red Knot
- Red-necked Stint

The averages for all species recorded in this period by survey site were also tabulated (see Appendix 3).

9.2.3. Limitations

Some of the 15 survey sites were not surveyed during each decade, leaving some gaps in the database. Given that only three sites where not surveyed during summer in the 1980s and one site (Sunday Island west end) was not surveyed from 1990 onwards the data has been considered sufficient for this analysis.

9.3. Results

9.3.1. Field results from 2015

The species, time when observed and conservation status of migratory birds recorded during February survey are listed in Table 6.

Table 6: Shorebird species recorded during 25th to 27th February 2015 survey at the coastal area south of Alberton Wind Farm.

Species	Number birds seen in February			Conservation status*
	25th	26th	27th	
Pied Oystercatcher		250	300	secure
Sooty Oystercatcher		46	58	NT (DEPI),
Eastern Curlew	11	22	12	VU (DEPI), EPBC (m)
Whimbrel		30	28	VU (DEPI), EPBC (m)
Bar-tailed Godwit		135	1124	EPBC (m)
Common Greenshank		11	12	EPBC (m)
Red Knot		0	18	EN (DEPI); EPBC (m)
Great Knot		0	2	EN (DEPI); EPBC (m)
Red-necked Stint		4	320	EPBC (m)
Other waterbirds				
Royal Spoonbill	100			NT (DEPI)
Black-faced Cormorant		30		NT (DEPI)
Little Egret			3	EN (DEPI)
White bellied Sea-eagle		1	1	VU (DEPI);
Gull-billed Tern		2	9	EN (DEPI); EPBC (m)
White-throated Needletail		3		VU (DEPI), EPBC (m)

EPBC (m) protected under the Environmental Protection and Biodiversity Conservation Act 1999 as a migratory species.

DEPI protected under Department of Environment and Primary Industries Advisory List of Threatened Vertebrate fauna in Victoria (2013), EN – endangered, VU – vulnerable, NT - near threatened

A summary of field observations in February 2015 for each of the above birds is discussed below:

***Pied and Sooty Oystercatchers* (non-migratory):** The most common species at the shores of the study area. When feeding or roosting they spread throughout the whole area.

***Eastern Curlew*:** Similar to the oystercatcher, common and feed and roost throughout the whole of the study area.

***Whimbrel*:** This species was found to feed as a flock, primarily at Lipscore Point on Sunday Island.

***Bar-tailed Godwit*:** The species ecology is similar to the Whimbrel where they feed in flocks, primarily at Lipscore Point on Sunday Island.

***Common Greenshank*:** Found to feed in flocks, mainly close to the jetty on Sunday Island.

Red Knot and Great Knot: Both found to feed within Bar-tailed Godwit flocks.

***Red-necked Stint*:** Common shorebirds found feeding in the mudflats throughout the study area.

In addition, other waterbirds were also recorded within the study area. These included:

***Royal Spoonbill* (non-migratory):** A large flock of 100 birds was found at a high-tide roost at McMillons Beach at Port Albert.

***Black-faced Cormorant* (non-migratory):** almost strictly marine species, common on the shores of the study area.

***Little Egret* (non-migratory):** Rather common, usually found in association with wetlands, creeks and rivers and might occasionally feed in farm dams.

***Gull-billed Tern*:** An uncommon tern along the shores of Port Albert and Port Welshpool. The birds observed were in full breeding plumage indicating that these birds may breed in the area.

***White-bellied Sea-Eagle*:** An uncommon eagle, usually found along the shores of southern Victoria. They are mainly restricted to the coastal habitats but might occasionally travel inland along large rivers.

9.3.2. Average Counts of all migratory birds from 1980 to 2015

Summer Counts

The average counts of all migratory shorebirds in Corner Inlet east in the summers between 1980 and 2015 are shown in Table 7, sorted by distance of the survey site to the wind farm site and grouped by decade.

Table 7: Sum of average counts for all migratory shorebird species over Summer 1980 – 2015.

Survey Site	1980-89	1990-99	2000-09	2010-15	Distance from wind farm site
One Tree Island - G2 - now S	4266	3585	3442	2161	7 km
Port Welshpool foreshore	Ns	60	15	40	7.5 km
Robertsons Beach – K	Ns	0	0	500	7.5 km
Sunday Island west end	377	ns	ns	ns	7.5 km
Clonmel Island – D	2413	2276	2329	2063	9 km
Dog Island south – M	ns	1268	70	18	9 km
East Sunday Island / Drum Island - A	101	145	18	7	9 km
Port Albert entrance – C	946	621	1049	2676	11 km
Box Bank Island – F	8662	4426	3110	2877	12 km
Kate Kearney entrance – E	2081	1477	12920	9909	12 km
Snake Island (east side) - G3 - now B	2523	3780	3191	0	12.5 km

Survey Site	1980-89	1990-99	2000-09	2010-15	Distance from wind farm site
Dream south (shallow inlet) - G	3086	9173	515	2598	16 km
Dream Island – H	5095	428	99	343	18 km
McGloughlans entrance – J	921	1195	1104	1061	19 km
North of St Margaret Island - L	1951	21	25	129	20 km
Average	2702	2033	1992	1742	

Notes: ns – Not surveyed. Counts greater than 3,000 are highlighted in grey

Average counts of shorebirds by site and decade for Corner Inlet are tabulated in Appendix 2.

In the 1980s (Figure 10) the two sites where most migratory shorebirds were recorded over summer were the Box Bank Island site and the Dream Island site, which are located on the eastern side of Corner Inlet east, approximately 12 and 18 kilometres respectively from the proposed wind farm site. In the 1990s (Figure 11), even though the count for Box Bank Island had decreased by almost 50%, it was still supported large number of shorebirds. The site where the most birds were recorded in the 1990s was Dream South (shallow inlet), located close to Box Bank Island. At Dream Island, high numbers were recorded in the 1980s but numbers had decreased markedly in the 1990s. All sites with an average count of more than 3000 migratory shorebirds over the count period (shaded in Table 1) are 12 or more kilometres from proposed turbines, except One Tree Island, which is located seven kilometres from the closest turbine.

The 2000-09 period (Figure 12) saw a big change, with Kate Kearney entrance being the site where the most shore birds were counted. This was again the case between 2010 and 2015 (Figure 13). This site is located nearby Box Bank Island, approximately 12 kilometres from the closest proposed wind turbine.

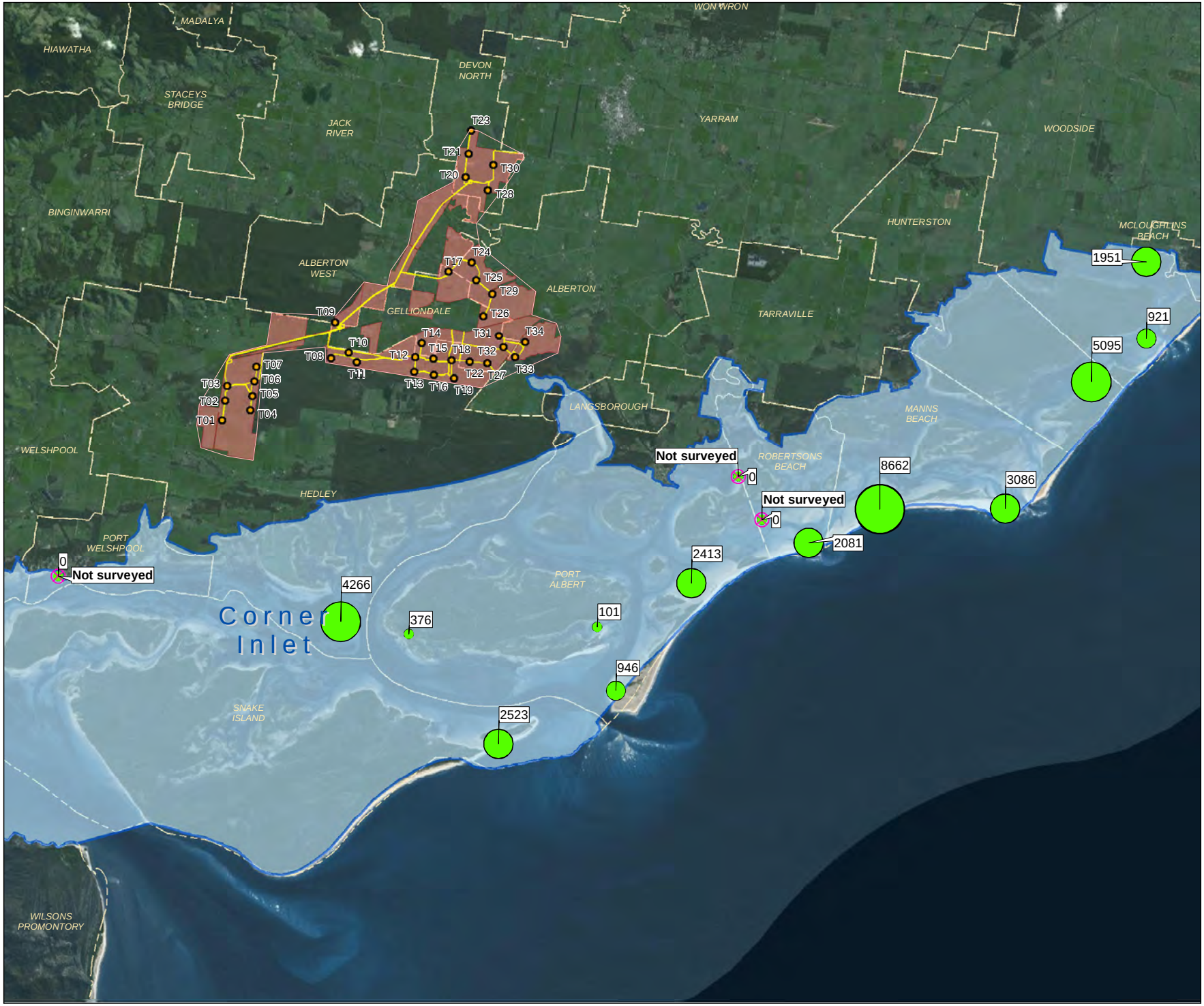
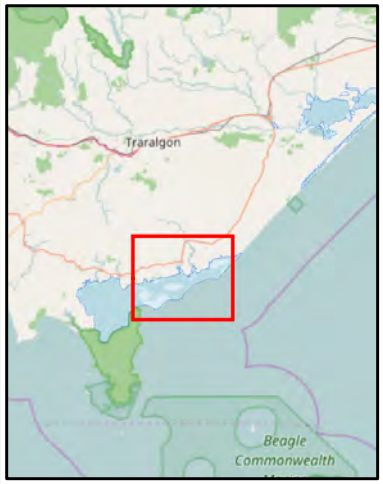


Figure 9: 1980-1989 sum of average migratory shorebird counts

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site



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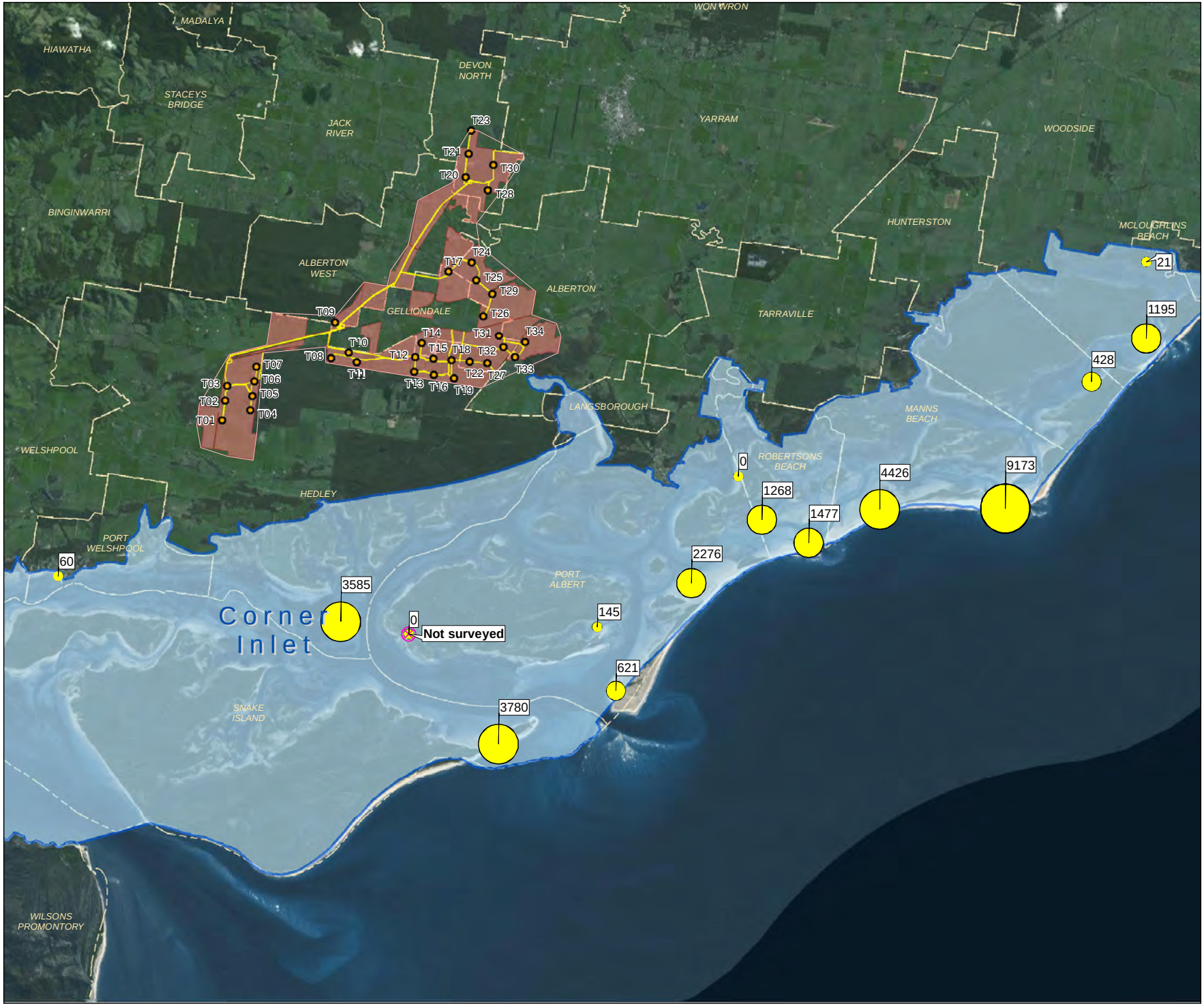
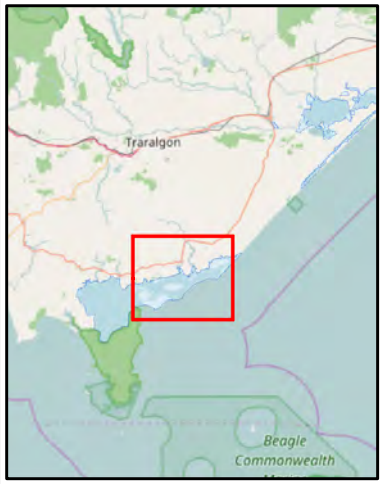


Figure 10: 1990-1999 sum of average migratory shorebird counts

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site



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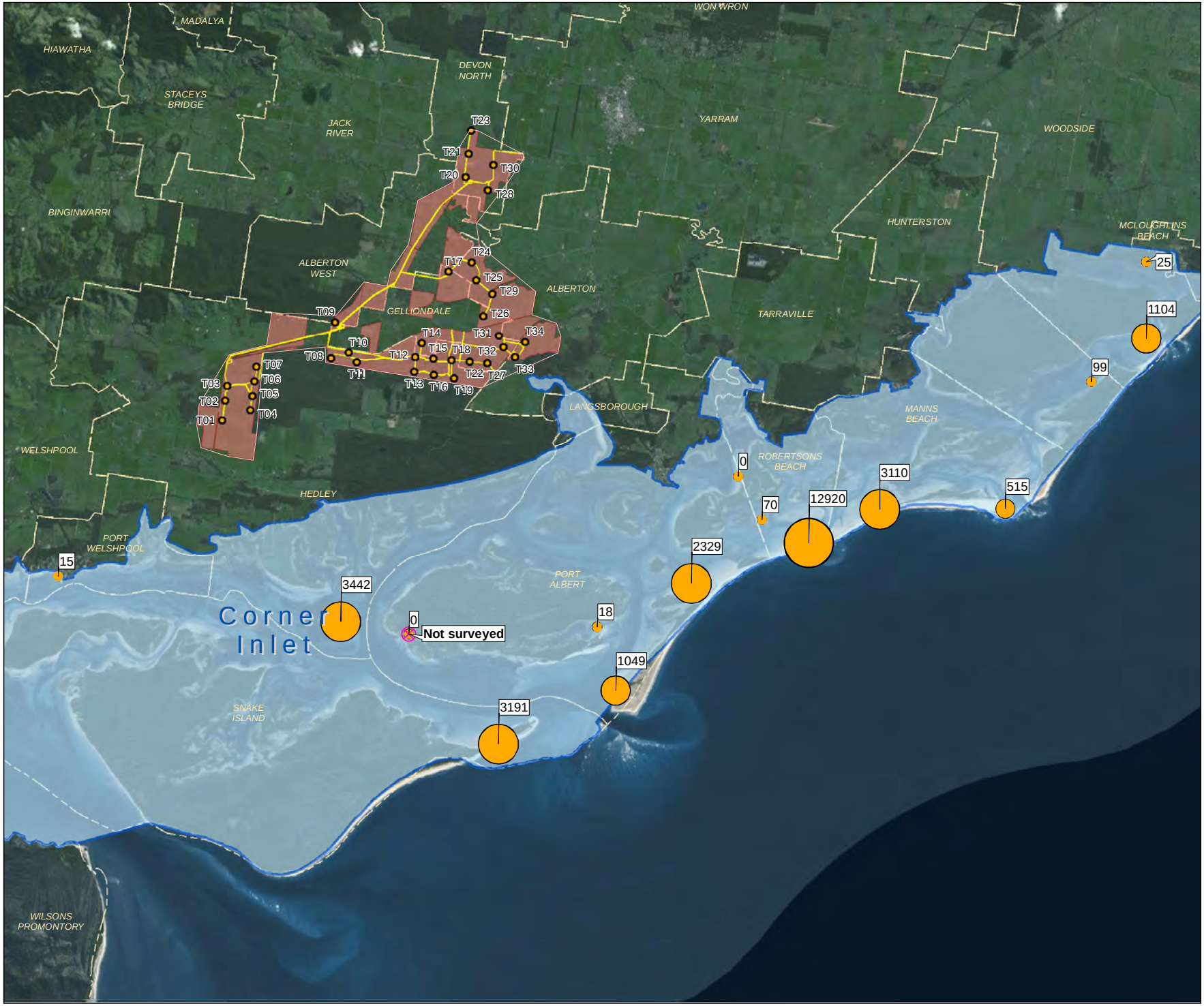
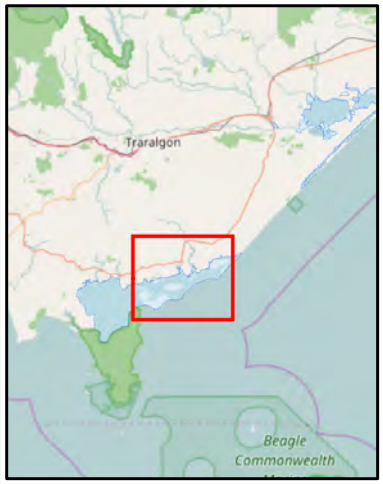


Figure 11: 2000-2009 sum of average migratory shorebird counts

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site



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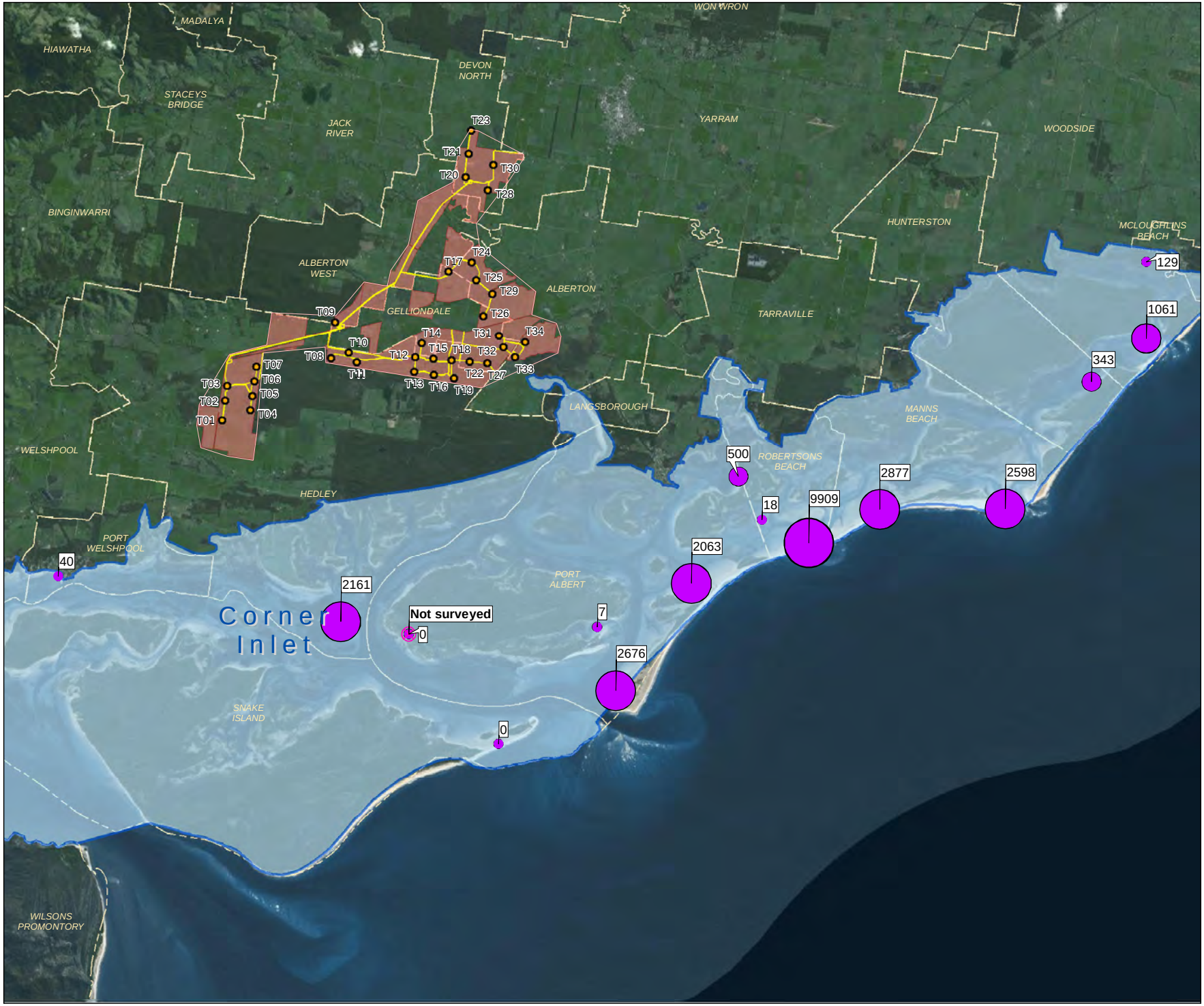
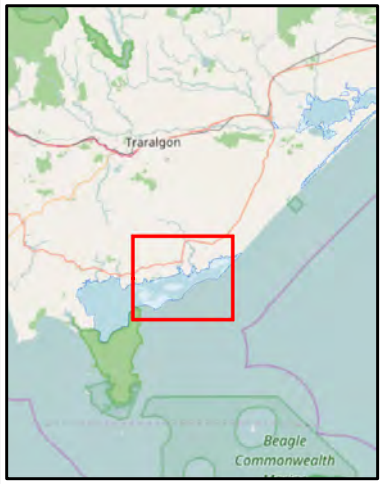


Figure 12: 2010-2016 sum of average migratory shorebird counts

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site



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Trends in summer shorebird abundance from 1980 to 2015

Trends of the shorebird summer observations between 1980 and 2015 are shown in Figure 13. There were sites such as Box Bank Island and One Tree Island that saw a noticeable decrease in yearly average migratory shorebird counts over the decades (see also Table 7). Others, like Kate Kearney entrance showed a significant increase in numbers. Some sites, such as McLoughlans entrance and Clonmel Island showed remarkably consistent numbers over the recording period.

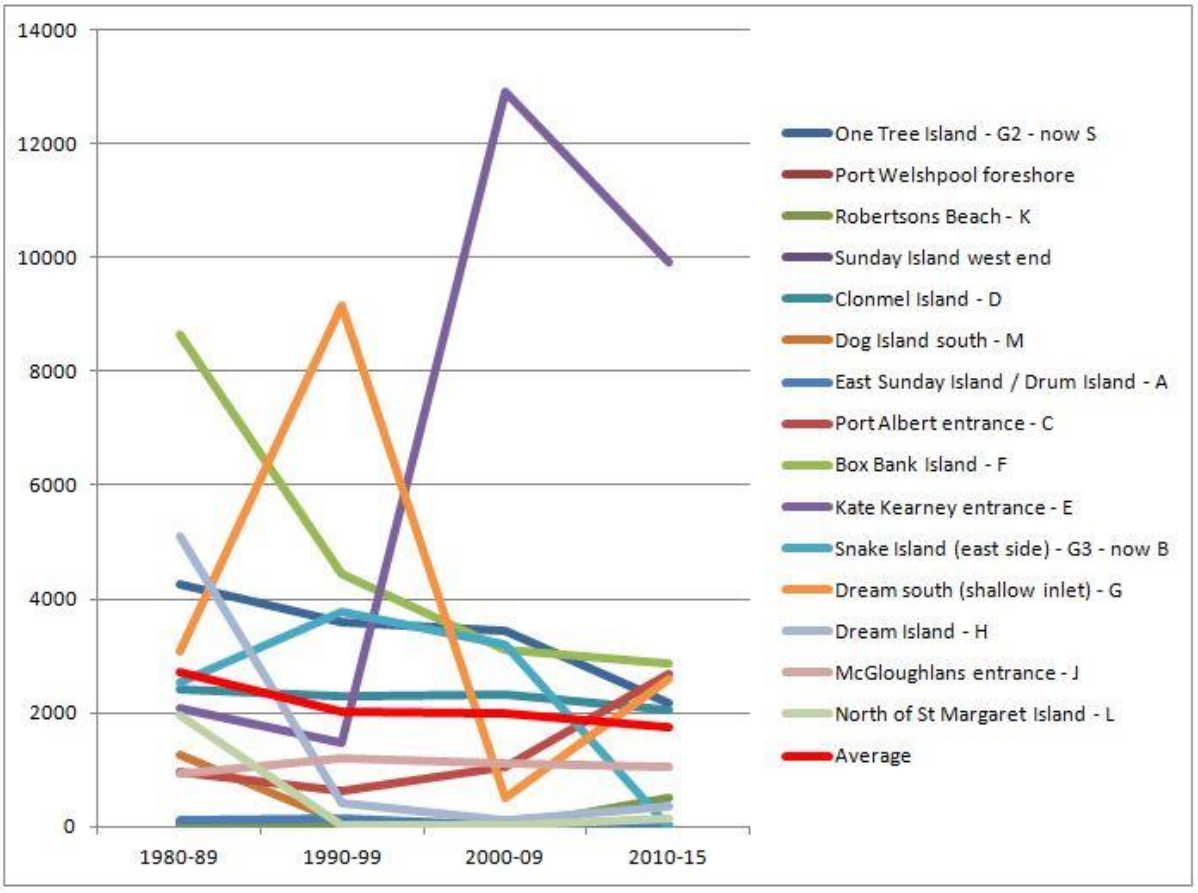

Figure 13: Changes between decades in the total of the average summer counts for all migratory shorebird species at each site between 1980 and 2016

Figure 13 shows a decline in the average number of migratory shorebirds counted per site (red line in Figure 13 and Table 2), with 2,702 being the average counts per site average for the 1980s, which decreased to 2,033 for the 1990s, then only a slight decrease to 1,992 for the 2000-09 period, and finally down to 1,741 for the latest period (2010-16). These figures suggest a gradual decrease over the last 35 years of migratory shorebird numbers over the summer survey period at Corner Inlet east. This is consistent with declining numbers of migratory shorebirds throughout Australia in recent decades.

Winter Counts

By comparison, the winter count averages (Table 8 and Figure 14) were more consistent, with no significant change in average counts per site over the decades.

Table 8: Sum of average counts for all migratory shorebird species over Winter 1980-2015.

Survey Site	1980-89	1990-99	2000-09	2010-15	Distance from wind farm site
One Tree Island - G2 - now S	1	51	1	ns	7 km
Port Welshpool foreshore	166	316	87	365	7.5 km
Robertsons Beach - K	0	9	0	ns	7.5 km
Sunday Island west end	2	269	165	5	7.5 km
Clonmel Island - D	1177	790	458	302	9 km
Dog Island south - M	ns	315	32	2	9 km
East Sunday Island / Drum Island - A	320	111	13	410	9 km
Port Albert entrance - C	1037	458	375	138	11 km
Box Bank Island - F	886	355	891	33	12 km
Kate Kearney entrance - E	179	85	1924	1874	12 km
Snake Island (east side) - G3 - now B	ns	0	0	ns	12.5 km
Dream south (shallow inlet) - G	187	295	62	284	16 km
Dream Island - H	44	6	10	ns	18 km
McGloughlans entrance - J	532	117	120	262	19 km
North of St Margaret Island - L	ns	ns	3112	ns	20 km
Average	378	227	483	368	

Notes: ns – not surveyed, counts bigger than 1000 are highlighted in grey

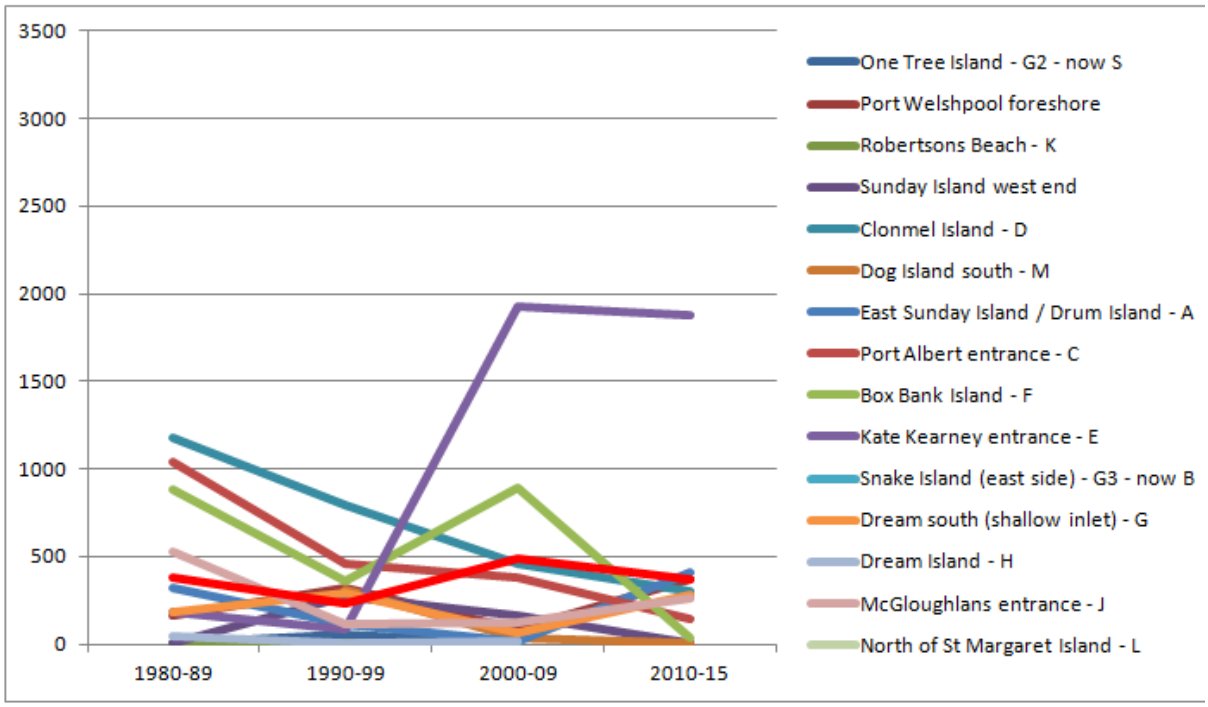

Figure 14: Trends of winter shorebird observations between 1980 and 2015

There were however trends at individual sites with decreases in average counts found at sites such as Clonmel Island and Port Albert entrance in the 1990s and an increase recorded at Kate Kearney entrance from 2000 to 2015. North of Margaret Island was only surveyed in the 1990s, where it experienced a high average species count of over 3000 birds. This site is located approximately 20 kilometres from the proposed wind farm site.

Increased average counts were reported from Kate Kearney entrance and Box Bank Island from 2000 to 2009. At the former site, this persisted until the present.

9.3.3. Summer counts of abundant migratory bird species from 2010 to 2015

Table 9 shows the average of the summer counts since 2010 for the seven most abundant species within Corner Inlet east (see also Figures 15 to 21). This is based on data tabulated in Appendix 3. Bar-tailed Godwit and Red-necked Stint were the two most numerous species. More than 4,000 of both species were recorded at Kate Kearney Entrance, approximately 12 kilometres from the nearest proposed turbine. The Red-necked Stint was also recorded in good numbers at Port Albert Entrance and Box Bank Island (11 and 12 km from the wind farm site) and Dream south (shallow inlet, 16 km). and with over 1,000 birds from One Tree Island, approximately 7 kilometres from the closest proposed turbine.

Table 9: Average counts (summer) for target species per site from 2010 to 2015.

Survey Sites	Bar-tailed Godwit	Black-tailed Godwit	Curlew Sandpiper	Eastern Curlew	Grey Plover	Red Knot	Red-necked Stint	Distance from wind farm site
One Tree Island - G2 - now S	807	0	0	44	0	90	1180	7 km
Port Welshpool foreshore	0	0	0	0	0	0	40	7.5 km
Robertsons Beach - K	0	500	0	0	0	0	0	7.5 km
Clonmel Island - D	941	<1	50	168	50	59	776	9 km
Dog Island south - M	10	0	<1	<1	0	0	0	9 km
East Sunday Island / Drum Island - A	0	0	0	5	0	0	0	9 km
Port Albert entrance - C	568	0	47	45	<1	18	1955	11 km
Box Bank Island - F	1099	0	2	42	91	77	1551	12 km
Kate Kearney entrance - E	4313	0	58	67	141	182	4936	12 km
Snake Island (east side) - G3 - now B	0	0	0	0	0	0	0	12.5 km
Dream south (shallow inlet) - G	1260	0	34	21	5	105	1136	16 km
Dream Island - H	300	0	0	0	0	<1	0	18 km
McGloughlans entrance - J	132	0	13	73	0	0	842	19 km
North of St Margaret Island - L	0	0	0	128	0	0	1	20 km
Total	**9429**	**500**	**204**	**591**	**287**	**531**	**12416**	

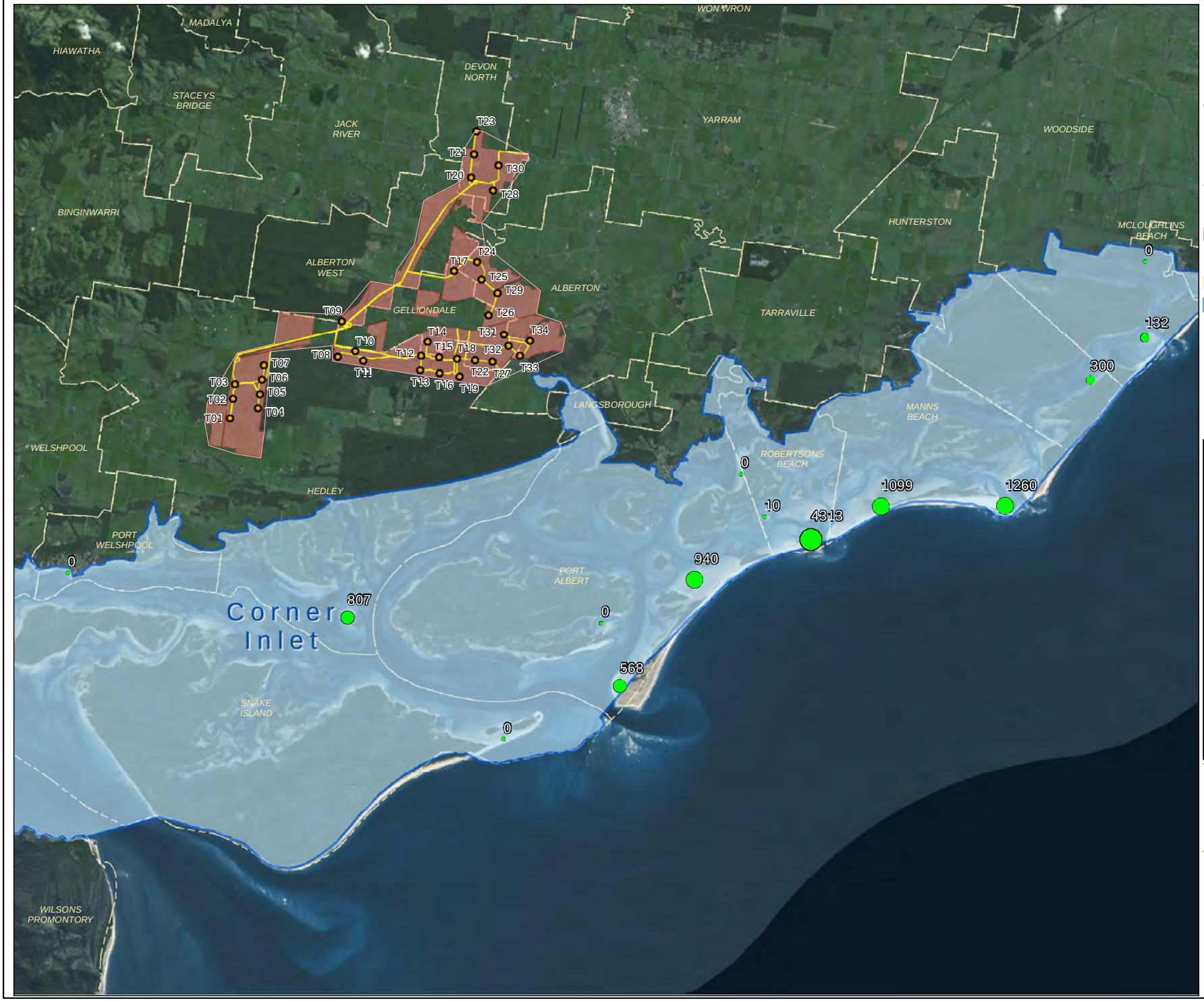

Figure 15: Average counts (per year) for target species per site in the 2010-2016 period - Bar-tailed Godwit

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site

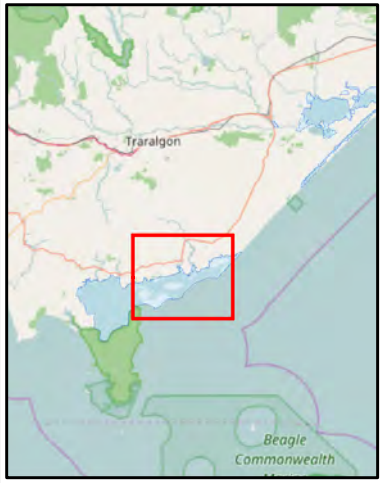

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Figure 16: Average counts (per year) for target species per site in the 2010-2016 period - Black-tailed Godwit

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site

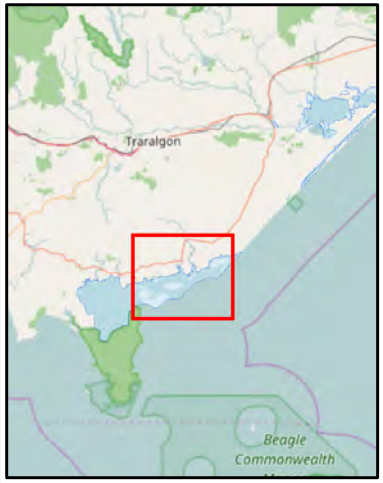

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Figure 17:Average counts (per year) for target species per site in the 2010-2016 period - Curlew Sandpiper

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site

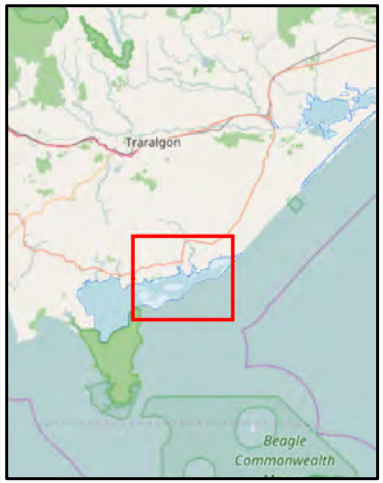

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Figure 18: Average counts (per year) for target species per site in the 2010-2016 period - Eastern Curlew

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site

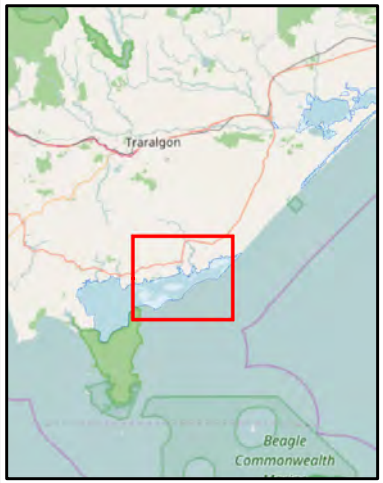

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Figure 19: Average counts (per year) for target species per site in the 2010-2016 period - Grey Plover

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 8/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site

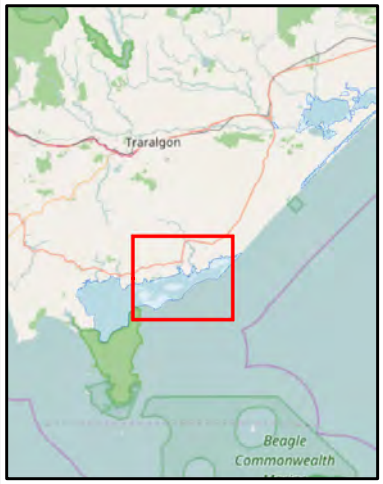

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Figure 20: Average counts (per year) for target species per site in the 2010-2016 period - Red Knot

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Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site

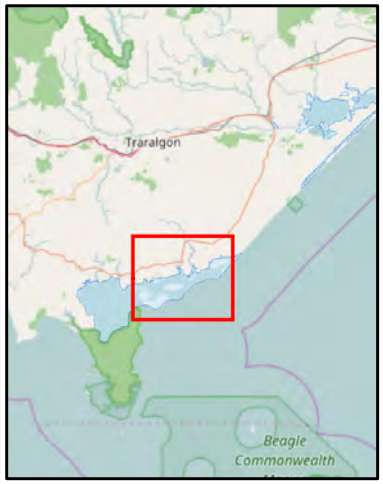

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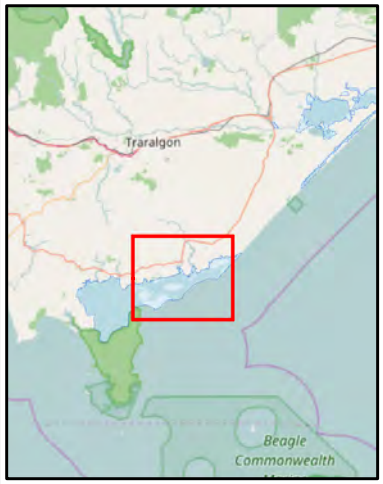
Figure 21: Average counts (per year) for target species per site in the 2010-2016 period - Red-necked Stint

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/12/2016

Legend

- Wind Farm site
- Turbines
- Development footprint
- Ramsar site



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9.4. Impact assessment and conclusions

Table 10 summarises the impact assessment as detailed within the Significant Impact Guidelines for Migratory Shorebird Species (DEWHA 2009).

Table 10: Significant Impact Assessment guide for migratory shorebirds (DEWHA 2009).

Ecological element affected	Significant impact assessment	Comment
Important Habitat	**Loss** of important habitat	The loss (for example, clearing, infilling or draining) of important habitat areas is likely to have a significant impact on migratory shorebirds when it results in a reduction in the capacity of the habitat to support migratory shorebirds. The magnitude of the impact may increase with the number of shorebirds using the area, the regional significance of the site and/or the extent to which the loss reduces carrying capacity.
	Degradation of important habitat leading to a substantial reduction in migratory shorebirds using the site	Defining substantial reduction will need to be made on a case-by-case basis. Factors to consider will include: ▪ the number of migratory shorebirds historically using a site (based on surveys and historical data) ▪ likely resultant changes in bird numbers and species diversity ▪ alterations to the value, quality, geographic extent of the site (for example, will the site still be classed as important habitat) ▪ the function and role of the site (roosting, foraging) and likely changes in ecology and hydrology ▪ the regional and local context of the site, and ▪ the nature, extent, duration of impacts, their likelihood and consequence.
	Increased **disturbance** leading to a substantial reduction in migratory shorebirds using important habitat Important habitat	
	Direct mortality of birds leading to a substantial reduction in migratory shorebirds using important habitat	

The bird species studied in this analysis were strictly intertidal shore or marine birds that do not fly inland to utilise dams or other wetlands, such as those within the proposed wind farm site. Consequently, none of the populations of listed migratory shorebirds will be impacted by the construction and operation of the proposed wind farm while roosting or feeding in Corner Inlet. No important habitat will be **lost, degraded or disturbed** by the proposed wind farm.

Observations at a wind farm in South Australia (BL&A, unpublished data) two years before and two years after wind farm construction indicated that operating wind turbines sited within 300 metres of coastal shorebird habitats did not alter the distribution and abundance of shorebirds compared with their distribution and abundance before wind farm construction commenced. Therefore, indirect impacts from the proposed Alberton Wind Farm, at a minimum distance of about three kilometres from intertidal habitats are considered unlikely. Increased **disturbance** that excludes shorebirds from habitats at Corner Inlet is considered a very remote possibility.

The possibility that, when migrating to and from Corner Inlet east, shorebirds may fly across the proposed Alberton Wind Farm site was explored. Shorebird migration has been described by a number of authors (Lane & Jessop 1985; Piersma *et al.* 1990; Swennen 1992; Tulp *et al.* 1994). These studies show that wherever it has been studied shorebird migratory departure has remarkably consistent characteristics, described below.

- Shorebirds depart in flocks of between 5 and 250 birds, with occasional observations of larger flocks (averages: 52, Lane & Jessop 1985; 10 – 151, depending on species, Piersma *et al.* 1990;127, Swennen 1992; 13 – 94, depending on species, Tulp *et al.* 1994)
- They fly in an elongated, shallow "V" formation, termed an "echelon" (see Piersma *et al.* 1990)
- Shorebirds are very vocal when they depart, calling unceasingly to one another rather loudly compared with their normal calling during flight
- They ascend rapidly and steeply, and are usually still ascending when lost from sight by the observer. Estimates of climb rate vary, with larger, heavier species of shorebirds climbing at slower rates (Piersma *et al.* 1990, 1997). Rates of ascent for smaller shorebirds in West Africa were between 0.7 and 0.92 metres per second. Optimal climb rates of approximately twice this have been predicted for shorebirds by Hedenstrom and Alerstam (1994)
- Observations of flight altitude using weather radar show that during migration, shorebirds fly at between 0.5 and 6 kilometres (Williams *et al.* 1981; Piersma *et al.* 1990; Tulp *et al.* 1994). Altitudes of migration given in the last two studies are of birds still ascending when they disappeared from sight, often at altitudes of greater than one kilometre, and are therefore likely to be at the lower range of altitude estimates for level migratory flight. The first two studies used radar on oceanic islands to study shorebirds on long-distance, level, migratory flights. Altitudes in these circumstances ranged from 2.5 to 6 kilometres
- Ground speeds for migrating shorebirds range between 20 km/h and 91 km/h (Lane & Jessop 1985; Tulp *et al.* 1994), although both studies were of birds climbing with varying strength winds affecting them.

Given the consistent behaviour of migratory shorebirds and their high rate of climb on departure, it is highly unlikely that shorebirds migrating northwards from the nearby intertidal habitats would be low enough by the time the crossed the proposed wind farm site to interact with operating wind turbines. Therefore, **direct mortality** is considered highly unlikely.

Based on the findings from this analysis of historical migratory shorebird count data and observations from site-based investigations in 2012, the risk to important populations of

migratory shorebirds in Corner Inlet from the proposed wind farm is considered very low. The reasons are set out below.

- No major wetland capable of supporting an important population of migratory shorebirds is located on the wind farm site and its immediate surrounds.
- The nearest potential habitat lies three kilometres to the south of the nearest proposed wind turbine and was found during the 2015 survey to support only low numbers of shorebirds foraging at low tide.
- Most roosting shorebirds in the eastern part of Corner Inlet use the sandy beaches and spits of the outer barrier islands, located 12 kilometres or more from the closest proposed turbine.
- The routine tidal movements of birds using these roosts would be to adjacent areas of intertidal sand- and mudflat more than five kilometres from the nearest proposed wind turbine.
- An evaluation of the risk of shorebirds from eastern Corner Inlet colliding with wind turbines on the proposed project site found that by the time they would be over the site, they would be well above the turbines, given the usual steep rate of climb of migrating shorebirds.

10. REFERENCES

Barrett, G, Silcocks, A, Barry, S, Cunningham, R and Poulter, R 2003. *The New Atlas of Australian Birds*. Birds Australia, Melbourne.

Birdlife Australia 2016. Shorebirds 2020 Program, Melbourne, Victoria.

Birdlife International 2013, 'Datazone - Species: White-throated Needletail *Hirundapus caudacutus'* www.birdlife.org/datazone.

Brett Lane & Associates, 2016a, Alberton Wind Farm, Bird and Bat Surveys, Report No. 14107 (1.3), August 2016.

Brett Lane & Associates 2012, Bald Hills Wind Farm, collision risk assessment for Orange-bellied Parrot, Swift Parrot and White-bellied Sea-eagle, Report No. 8127 (6.0), August 2012.

Department of the Environment (DoE) 2013. *Matters of National Environmental Significance - Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999.* Department of the Environment, Canberra.

Department of the Environment (DoE) 2015. *Referral guideline for 14 birds listed as migratory species under the EPBC Act.* Department of the Environment, Canberra.

Department of Environment Land Water and Planning (DELWP) 2016. *National Recovery Plan for the Orange-bellied Parrot* Neophema chrysogaster. Australian Government, Canberra.

Department of Environment, Water, Heritage and the Arts (DEWHA) 2009. Significant impact guidelines for 36 migratory species, EPBC policy statement 3.21, Commonwealth of Australia

Department of Sustainability and Environment 2013, *Advisory List of Threatened Vertebrate Fauna in Victoria*. Department of Sustainability and Environment, East Melbourne, Victoria.

Department of Sustainability and Environment 2013. *The Orange-bellied Parrot Recovery Team 2011 National Recovery Plan for the Orange-bellied Parrot* Neophema chrysogaster*,* Birds Australia website, viewed April 2012.

Emison, WB, Beardsell, CM, Norman, FI, Loyn, RH 1987. *Atlas of Victorian Birds.* Department of Conservation Forests and Lands, Royal Australasian Ornithologists' Union, Melbourne.

Garnett, ST, Szabo, JK and Dutson, G 2011, *The Action Plan for Australian Birds 2010*. Birds Australia and CSIRO Publishing, Collingwood.

Hederstron, A and Alerstam, T (1994) Optimal climbing flight in migrating birds: predictions and observations of knot and turnstone. *Anim. Behav.* 48: 47-54.

Higgins, PJ (ed) 1999, *Handbook of Australian, New Zealand and Antarctic Birds*, Volume 4: Parrots to Dollarbird, Oxford University Press, Melbourne.

Holdsworth, M, Dettmann B & Baker GB 2011, Survival in the Orange-bellied Parrot (*Neophema chrysogaster*), *Emu* 111 (3): 222-228.

Kennedy, SJ & Tzaros, CL 2005, 'Foraging ecology of the Swift Parrot *Lathamus discolor* in the Box-ironbark forests and woodlands of Victoria', *Pacific Conservation Biology* 11, 158 – 173.

Lane, B A and Jessop, A (1985) Tracking of migrating waders using in north-western Australia using meteorological radar. *Stilt* 6: 17-29.

Namba *et al*. 2010, 'Changes in the Avifauna of the Hokkaido University Campus, Sapporo, detected by long-term census', *Ornithological Science* 9(1): 37- 48.

Orange-bellied Parrot Recovery Team 2011, National Recovery Plan for the Orange-bellied Parrot *Neophema chrysogaster*, Bird Australia website, viewed April 2012.

Orange-bellied Parrot Recovery Team 2012, *Update on the Orange-bellied Parrot Recovery Program*, www.birdlife.org.au.

Piersma, T; Zwarts, L and Bruggemann, J H (1990) Behavioural aspects of the departure of waders before long distance flights: flocking, vocalisations, flight paths and diurnal timing. *Ardea* 78: 157-184.

Piersma, T; Hedenstrom, A and Bruggemann, J H (1997) Climb and flight speeds of shorebirds embarking on an intercontinental flight; do they achieve the predicted optimal behaviour? *Ibis* 139: 299-304.

Pritchard, R and Birdlife Australia 2016, *Orange-bellied Parrot National Recovery Team, Winter Monitoring Program 2016*. Department of Environment, Land, Water and Planning and Birdlife Australia.

Saunders, D.L. 2008. *Ecology and Conservation of the Swift Parrot – an endangered austral migrant,* PhD thesis, Australian National University, Canberra.

Saunders, D.L. and Tzaros, C.L. 2011. *National Recovery Plan for the Swift Parrot Lathamus discolor*, Birds Australia, Melbourne.

Swennen, C (1992) Observations on the departure of Knots from the Dutch Wadden Sea in spring. *Wader Study Group Bull.* 64, Suppl.: 87-90.

Tarburton, M.K. 2012, *2011-12 season report for White-throated Needletail* birding-aus archives, www.bioacoustics.cse.nsw.edu.au/birding-aus, 22 May 2012, viewed 30 April 2013).

Tulp, I; McChesney, S and De Goeij, P (1994) Migratory departures of waders from north-western Australia: behaviour, timing and possible migration routes. *Ardea* 82: 201-221.

Appendix 1: Commonwealth government 'Reasons for Decision' in relation to the controlled action decision for the Alberton Wind Farm under the EPBC Act.

Statement of Reasons for a Decision on Controlled Action under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999*

I, James Barker, Assistant Secretary of the Assessments and Governance Branch, Department of the Environment and Energy (**Department**), provide the following statement of reasons for my decision of 29 March 2017, under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**), that the proposed action by Synergy Wind Pty Ltd (**proponent**) to construct a wind farm east of the township of Alberton West in South Gippsland, Victoria, including 34 wind turbines and associated infrastructure (EPBC 2017/7854) is a controlled action.

Legislation

1. Relevant provisions of the EPBC Act are extracted at Attachment A.[1]

Background

2. On 23 December 2016 the proposed action was referred under section 68 of the EPBC Act by Brett Lane and Associates Pty Ltd (**BLA**) on behalf of the proponent. The proponent stated its belief that the proposed action is not a controlled action for the purposes of the EPBC Act.

3. The proposed development covers approximately 59.39 ha within the broader study area of 2900 ha. The proposed action includes the construction of:

   - Access tracks – 6 m wide.
   - Underground cabling and associated trenching – 3 m wide.
   - Overhead transmission lines – 16 m wide.
   - 34 wind turbines with a 15 m radii, an overall tip height of 200 m and a minimum ground to blade tip clearance of 40 m.
   - Anemometer masts, and one hardstand area next to each turbine 25x35 m.
   - Electrical substations – one large and two small, contained within the impact area.
   - Four works compounds – approximately 0.58 to 2.77 ha (not all of these compounds will be used but impacts for all have been assumed).
   - A 66 kilovolt line runs across the project at three points. The project will connect to the main power grid at one of these locations and therefore no external powerline is required.
   - Decommissioning activities, including the removal of turbines and above ground infrastructure.

4. The proposed action is anticipated to have a construction period of between 18 to 24 months and is expected to commence 8 to 12 months after development approval. The operational lifespan of the proposed action is 20 to 25 years. The referral states that further micro-siting of infrastructure will occur during the construction stage.

[1] These extracts are provided for background and context and do not form part of the statement of reasons.

Public Submissions

5. On 3 January 2017 in accordance with section 74(3) of the EPBC Act, the public was invited to provide comments on the referral within ten (10) business days (on or before 17 January 2017). The Department received no public submissions.

6. On 4 January 2017, in accordance with section 74(1) of the EPBC Act, Senator the Hon Nigel Scullion, Minister for Indigenous Affairs, was invited to provide comments on the referral within ten (10) business days (on or before 17 January 2017).

7. On 18 January 2017, a representative of the Minister for Indigenous Affairs responded providing comment that there are no Indigenous ranger or Indigenous Protected Area projects in the area of the proposed action.

8. On 4 January 2017, in accordance with section 74(2) of the EPBC Act, Ms Jane Homewood of the Department of Environment, Land, Water and Planning (**DELWP**) and delegated contact for the Victorian Minister for Planning, the Hon Richard Wynne MP, was invited to provide comments on the referral within ten (10) business days (on or before 17 January 2017).

9. On 17 January 2017, a representative of the DELWP collated comments from state agencies, noting, among other things, the following:

   - DELWP support the conclusions in the referral in regard to impacts to listed birds, mammals and fish, flora and ecological communities. Siting of turbines is supported as appropriate avoidance and mitigation. DELWP noted that a management plan to manage impacts to birds and bats has not yet been developed but would be endorsed by DELWP if submitted.

   - Aboriginal Victoria provided comments that it is not aware of any Aboriginal cultural heritage of national significance within the proposed action area; however, intact Aboriginal heritage cannot be excluded based on the information provided. There is a substantial risk that the project may disturb or identify Aboriginal Cultural Heritage and there is no mechanism in place (such as an approved cultural heritage management plan) to allow the works to proceed.

Evidence or other material on which my findings were based

10. On 29 March 2017, under section 75(1) of the EPBC Act, I determined that the proposed action is a controlled action, due to likely significant impacts on listed threatened species and communities (ss. 18 and 18A), listed migratory species (ss. 20 and 20A) and Ramsar wetlands (ss. 16 and 17B).

11. My decision under section 75 was informed by a Referral Decision Brief (**Brief**) prepared by officers of the Department of the Environment and Energy (the **Department**), dated 24 March 2017, including information contained in the following attachments to the Brief:

    i. a copy of the referral and associated appendices received by the Department on 23 December 2016

    ii. two emails providing further information to support the referral provided by BLA on 19 January 2017

iii. the Department's Environmental Reporting Tool (**ERT**) report on Matters of National Environmental Significance that may be affected by the proposed action

iv. advice provided by the Department's Migratory Species Section

v. advice provided by the Department's Wetlands Section

vi. comments from delegates of the State Minister and the Commonwealth Minister for Indigenous Affairs

12. The Brief was prepared taking into account relevant policy documents including the:

a. EPBC Act *Policy Statement 1.1 Significant impact Guidelines – Matters of National Environmental Significance (*2013*)*

b. EPBC Act *Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (2015)

c. *Draft Referral guidelines for 14 birds listed as migratory species under the EPBC Act (*2015)

d. *EPBC Act Policy Statement 3.14: Significant impact guidelines for the vulnerable growling grass frog (Litoria raniformis) (2010)*

e. Approved Departmental conservation advices and recovery plans

f. Corner Inlet Ramsar site Ecological Character Description (2011)

Findings on material questions of fact

13. I considered that the quality and quantity of information before me were adequate for me to make a decision under section 75 of the EPBC Act.

14. In deciding whether the proposed action is a controlled action, and which provisions of Part 3 of the EPBC Act are controlling provisions for the action (if any), I considered all adverse impacts the action has or will have, or is likely to have on each matter protected by a provision of Part 3 of the EPBC Act. I did not consider any beneficial impacts that the action has or will have, or is likely to have on matters protected by Part 3 of the EPBC Act.

15. My findings are set out below in relation to the relevant controlling provisions for the proposed action and other matters that I was required to take into account in making my decision. In summary, I determined that the proposed action is likely to have a significant impact on matters protected by a provision of Part 3 of the EPBC Act.

Listed threatened species and ecological communities

16. The Department's Environment Reporting Tool (**ERT**) indicated that a total of 57 listed threatened species and two listed ecological communities are likely to, may or are known to occur within two kilometres of the proposed action. Based on the location of the action and the likely habitat present in the area of the proposed action, I considered that the species discussed in paragraphs 17–60 below were the most likely to be impacted by the proposed action.

Swift parrot (*Lathamus discolor*) – critically endangered

17. The referral states that the proposed project area contains indigenous and planted eucalypts including *E. obliqua*, *E. viminalis* and *E. ovata* which are known to be foraging and roosting habitat for swift parrots. I was advised by the Department that large forested areas like the Alberton State Forest adjoining the proposed action area to the north and the un-named State forest abutting the south are likely to contain suitable habitat.

18. I was also advised by the Department that Wilsons Promontory Marine National Park to the south-west of the proposed action area is known as a first stopping point for swift parrots on their winter migration. There is potential for this species to pass through the proposed action area when dispersing between large forested areas and during north-ward and south-ward migrations.

19. The referral states that the population of swift parrots using the area is likely to be small relative to that using the larger forested blocks further north and therefore this species is likely to experience minimal impact from the proposed windfarm. The Department disagreed with this assumption, stating that this species' site use is dependent on the availability of foraging resources, and coastal areas such as the proposed action area are likely to serve as refuges during inland drought periods.

20. The referral included details of a bird utilisation survey that was undertaken in the proposed action area; however, the timing of the surveys was outside of the appropriate season to identify swift parrots.

21. I was advised by the Department that threats to the species include clearing of foraging and winter habitats; competition from other species; death from collision; psittacine beak and feather disease; illegal wildlife capture and predation by sugar gliders.

22. The *National Recovery Plan for the Swift Parrot (*Lathamus discolor*)* (2011) states that the construction of wind energy turbines in south-eastern Australia may have implications for the conservation of the parrot when poorly sited. Monitoring the impact of collisions is a key recovery action.

23. The referral states that measures to avoid and mitigate impacts on avian fauna were considered by the proponent during the design phase of the project and that further micro-siting of turbines may occur during construction. The referral further states that an avifauna management plan has not been prepared yet, however one is likely to be required by a State planning permit.

24. The Department considered that the proposed action has the potential to impact swift parrots through individuals or flocks colliding with wind turbines resulting in mortality.

25. Swift parrots aggregate in small parties of up to 30 birds, or occasionally in larger flocks (several hundred birds) around sources of abundant flowering eucalypts. The life-span of the proposed action is expected to be 20-25 years. The Department advised that regular swift parrot mortalities over the 20 to 25 year life of the proposed action could lead to a long term decrease in the overall population. I accepted this advice.

26. The Department further advised that while the likelihood of collisions is not well understood, the small size of the remaining swift parrot population (estimated at 2000 individuals in 2011) means the risk of the proposed action leading to a long-term decrease in the overall population is high. I accepted this advice.

27. Therefore, based on the information discussed in paragraphs 17-26 I determined that there is a real chance or possibility that the proposed action could lead to a long-term decrease in the swift parrot population. As a result, I was satisfied that the proposed action, as described in the referral documentation, is likely to have a significant impact on the swift parrot.

Orange-bellied parrot (*Neophema chrysogaster*) – critically endangered

28. I was advised by the Department that, when on the mainland, orange-bellied parrots are usually found within coastal saltmarshes and adjacent pastures, which are similar to the proposed action area. The referral states that suitable saltmarsh habitat exists in the south-east of the study area along the Albert River. These areas are predominately made up of beaded glasswort (*Sarcocornia quinqueflora*), which are a preferred saltmarsh forage for orange-bellied parrots. The Department noted that orange-bellied parrots have not been recorded in the area recently, but the small remaining population size of the species (estimated at roughly 50 individuals) makes detection difficult.

29. I considered that the species are highly mobile through their non-breeding range and are known to change locations to favour new food resources. The proposed action area is between sites where orange-bellied parrots are known to occur at Jack Smith Lake Wildlife Reserve approximately 35 km to the north-east and Wilson's promontory approximately 22 km to the south-west suggesting the area may become occupied over the life of the proposed action.

30. The *National Recovery Plan for the Orange-bellied Parrot (*Neophema chrysogaster*)* (2016), states that while evidence of the impact of barriers is scarce, individuals may be killed by flying into energy turbines, powerlines and associated infrastructure.

31. A high priority action outlined in the recovery plan is to manage direct threats to birds in the wild, specifically by assessing and managing the risks from development proposals that may represent a barrier to migration or movement. No specific mitigation measures for avian species during the construction and operation phases of the project have been prepared by the proponent

32. I was advised by the Department that although the likelihood of collisions is not well understood, the small size of the remaining orange-bellied parrot population means the risk of the proposed action leading to a long-term decrease in the overall population is high. I accepted this advice.

33. Based on the information discussed in paragraphs 28-32 and applying the precautionary principle, there is a real chance or possibility that the proposed action could lead to a long-term decrease in the orange-bellied parrot population. Therefore, I determined that the proposed action is likely to have a significant impact on the orange-bellied parrot.

Growling grass frog (*Litoria raniformis*) – vulnerable

34. The referral states that suitable habitat exists for the species within the broader proposed action area in the form of farm dams, drainage lines and ephemeral wetlands and that no listed frog species have the potential to occur in the proposed action area. The Department disagreed, noting that while larger areas of permanent water in the broader area are suitable for breeding, the proposed action area is also likely to provide habitat important for dispersal, foraging and shelter.

35. I considered that growling grass frogs were not observed during general fauna surveys in the proposed action area undertaken by BLA. I was advised by the Department that although the surveys were conducted within the period recommended by the *EPBC Act Policy Statement 3.14: Significant impact guidelines for the vulnerable growling grass frog (*Litoria raniformis*)* (2010), it was not indicated if the survey conditions were suitable for growling grass frogs.

36. I was advised by the Department that key threats to the species include: habitat loss, fragmentation and degradation; disease caused by chytrid fungus; predation by introduced fish; chemical pollution; salinisation of water bodies; and biocides.

37. I considered that potential impacts to growling grass frogs from the proposed action include the permanent removal or degradation of terrestrial habitat (for example between dams, drainage lines or other temporary/permanent habitat) within 200 metres of a water body or the removal, alteration of terrestrial or aquatic habitat corridors (including alteration of connectivity during flood events) and degradation of aquatic habitats.

38. The referral states that a buffer of at least 50 m from waterways and wetland habitats will prevent impacts on frog habitat; however, the proponent did not commit to this action in the referral.

39. The Brief noted that the referral lacks sufficient information regarding the areas immediately surrounding the proposed action area to conclude whether or not an important population of growling grass frogs exists within the region and if so, how this population may use the proposed action area for dispersal.

40. As such I could not be certain that the proposed action would have a significant impact on the growling grass frog; but nor could I rule it out. Having regard to the information discussed in paragraphs 34-39, and applying the precautionary principle, I was satisfied that the proposed action was likely to have a significant impact on the growling grass frog.

Red knot (*Calidris canutus*) – endangered, migratory; curlew sandpiper (*Calidris ferruginea*) – critically endangered, migratory; eastern curlew (*Numenius madagascariensis*) – critically endangered, migratory

41. I received advice from the Department's Migratory Species area stating that the distance of the proposed turbines from important shorebird habitat indicates it is unlikely that shorebirds would be at risk from turbine strike. The proposed action area is inland from shore and potential impacts on shorebird habitat are considered unlikely. There is no suitable habitat to the north of the turbines and therefore no short flights are likely to occur. If undertaking longer flights birds are likely to be at heights well above the turbines.

42. I considered the proposed action is not likely to lead to a long-term decrease in the size of an important population, reduce the area of occupancy of an important population, fragment or disrupt the breeding cycle of an important population, adversely affect habitat critical to the species, decrease the availability or quality of habitat, result in invasive species or disease, or interfere with the recovery of the species. Therefore, based on the information discussed in paragraph 41, I concluded that a significant impact on threatened shorebirds is not expected or considered likely.

Dwarf galaxias (*Galaxiella pusilla*) – vulnerable and Australian grayling (*Prototroctes maraena*) – vulnerable

43. I was advised by the Department that suitable habitat exists within the proposed action area for both the Australian grayling, in Albert River, and the dwarf galaxias, within tributaries associated with the Albert and Jack Rivers, both situated in the north-east of the site.

44. I considered that four records of the grayling exist nearby with the most recent from 1982. No records exist of the galaxias and no targeted surveys were undertaken for either of these fish species.

45. The Brief stated that impacts on fish from the proposed construction works may include depleted water quality in waterways through accidental spills of contaminants, erosion, runoff and sedimentation. The referral states that provided there is no impact on flows or water quality in the Albert River from construction and operation of the proposed wind farm then impacts on fish species are not likely to occur.

46. I considered that given the scale, intensity, nature and duration of the proposed action (i.e. works not being undertaken within the waterway), the risk of a significant impact posed by the proposed action to an important population of these species is low. I considered that the proposed action is not likely to lead to a long-term decrease in the size of an important population, reduce the area of occupancy of an important population, fragment or disrupt the breeding cycle of an important population, adversely affect habitat critical to the species, decrease the availability or quality of habitat, result in invasive species or disease, or interfere with the recovery of the species.

47. Therefore, based on the information discussed in paragraphs 43-46, I concluded that the proposed action as described in the referral documentation is unlikely to result in a significant impact on the dwarf galaxias and Australian grayling.

Mammals – long-nosed potoroo (*Potorous tridactylus*) – vulnerable, southern brown bandicoot (*Isoodon obesulus obesulus*) – endangered, grey-headed flying-fox (*Pteropus poliocephalus*) – vulnerable

48. The referral states that potential habitat exists for the vulnerable long-nosed potoroo and endangered southern brown bandicoot near the proposed action area in the form of dense heathy vegetation and woodland.

49. The Department noted that whilst no records exist for these species within the proposed action area, they are likely to move through the proposed action area and landscape within any dense vegetation cover in the open or patchy habitat for dispersal and foraging purposes.

50. The referral states that vegetation in such areas should be avoided; however, no commitment by the proponent to retain these areas is stated in the referral.

51. I considered that given the large area of the windfarm and the alternative habitat available within the landscape for dispersal, a significant impact on the long-nosed potoroo and southern brown bandicoot species is unlikely.

52. The Department noted that a permanent camp of vulnerable grey-headed flying-fox (*Pteropus poliocephalus*) exists in Bairnsdale, approximately 125 km from the proposed action. The species is capable of nightly flights of up to 50 km from their roost to

different feeding areas as food resources change; however, foraging areas are usually within 15 km of the day roost site.

53. I considered that while it is possible that the species forages occasionally in the flowering eucalypts and fruit trees in the region a significant impact on an important population of the grey-headed flying-fox from the proposed action is unlikely.

Flora: river swamp wallaby-grass (*Amphibromus fluitans*) – vulnerable, thick-lipped spider-orchid (*Caladenia tessellate*) – vulnerable, clover glycine (*Glycine latrobeana*) – vulnerable, Strzelecki gum (*Eucalyptus strezeleckii*) – vulnerable, eastern spider orchid (*Caladenia orientalis*) – endangered, maroon leek-orchid (*Prasophyllum frenchii*) – endangered, metallic sun-orchid (*Thelymitra epipactoides*) – endangered

54. I considered that seven listed flora species were identified in the referral as potentially occurring within the proposed action area.

55. A targeted flora survey for these species was undertaken by BLA in November 2016. The Department considered this survey appropriate for identification of these species. None of these flora species were identified during targeted surveys of the proposed action area.

56. Therefore, I decided that the proposed action is unlikely to significantly impact listed flora species.

Natural damp grassland of the Victorian coastal plains ecological community – critically endangered

57. The referral states that areas suitable for natural damp grassland of the Victorian coastal plains ecological community occur within the proposed development area and in damp areas in the south-eastern corner of the broader study area.

58. The Department noted that targeted surveys undertaken in November 2016 confirmed that natural damp grassland of the Victorian coastal plains ecological community does not occur within the proposed development footprint. The referral notes that this assessment considered the Department's identification criteria and condition thresholds from the listing advice for this ecological community.

59. Owing to the ecological community not being present within the proposed action area I decided that a potential significant impact on natural damp grassland of the Victorian coastal plains ecological community from the proposed action is not expected or considered likely.

Other listed species and ecological communities

60. The Department noted that other species and ecological communities identified in the ERT report were not recorded during the flora and fauna assessment undertaken throughout the proposed action area. Accordingly, I decided that a significant impact on these species and communities are not expected or considered likely.

Listed migratory species

61. The Department noted that of the 62 migratory species listed in the ERT that are known to, likely to, or may occur within two km of the proposed action area:

    - 11 are marine species that inhabit ocean environments and will not be adversely impacted as the proposed project area is inland.

- 18 are marine birds, of which only the fork-tailed swift (*Apus pacificus*) (discussed in paragraphs 61-72) is considered likely to occur within the proposed action area.

- 28 are migratory wetland birds, of which six are listed threatened shorebirds that have been recorded or are considered likely to occur within the broader project area. These are: the red knot (*Calidris canutus*); curlew sandpiper (*Calidris ferruginea*); great knot (*Calidris tenuirostris*); greater sand plover (*Charadrius leschenaultii*); lesser sand plover (*Charadrius mongolus*); and eastern curlew (*Numenius madagascariensis*) and are discussed above under listed threatened species.

- 5 are terrestrial migratory birds, of which four are known or likely to occur within the proposed action including: three flycatchers – the black-faced monarch (*Monarcha melanopsis*), satin flycatcher (*Myiagra cyanoleuca*), and rufous fantail (*Rhipidura rufifrons*); and a swift – the white-throated needletail (*Hirundapus caudacutus*).

62. The Department noted that the main threat to migratory birds from the proposed action is collision with turbines. For the reasons listed below, I considered that a significant impact on listed migratory species is likely.

Aerial foraging migratory birds (Swifts)

63. The Department noted that the fork-tailed swift and white-throated needletail were recorded in the proposed action area during bird utilisation surveys conducted by BLA. These two species are aerial foragers spending most of their time flying in search of aerial insect prey.

64. The Department noted that both of these species are susceptible to collisions with turbines and other structures as they fly mostly at or above the rotor sweep area.

65. The Department noted that whilst there are no standard survey techniques for swifts, they often travel ahead of storm fronts meaning weather conditions can greatly affect the likelihood of these birds being present.

66. I considered that the Department's draft *Referral guidelines for 14 birds listed as migratory species under the EPBC Act* (**referral guidelines**), states that an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. The referral guidelines define ecologically significant proportions for fork-tailed swift as being 100 individuals, and 10 individuals for the white-throated needletail.

67. The fork-tailed swift is a non-breeding visitor to all Australian states and territories. In Victoria it is widespread but sparsely scattered in all regions. Feeding flights are characterised by circular patterns throughout areas of high prey concentration in flocks ranging from 10 to 1000 birds.

68. I was advised by the Department that fork-tailed swift were recorded in the proposed action area at heights within the rotor sweep area during surveying.

69. I was further advised by the Department that during events of high prey concentration the number of individuals susceptible to turbine collision within the proposed action area could exceed an ecologically significant proportion of fork-tailed swift.

70. The Brief noted that there is a risk that over the course of a non-breeding season, numerous flocks colliding with turbines could result in mortalities to an ecologically significant proportion of the population.

71. The white-throated needletail is widespread in eastern and south-eastern Australia. The referral stated that the loss of an occasional white-throated needletail individual will occur; however, argues that due to the large population size of this species (estimated at 10,000 in 1999) this is expected to have negligible consequences for the species' population.

72. I concluded that because 10 individuals constitutes an ecologically significant proportion of white-throated needletail (as mentioned above), a single flock, or numerous instances of individuals colliding with the turbines within one non-breeding season would constitute a significant impact.

73. I considered that the risk of collision for white-throated needletail is high on the following bases. First, a flock containing an ecologically significant proportion of white-throated needletail was identified within the proposed action area and within the rotor sweep area during bird utilisation surveys. Second, white-throated needletails have been known to collide with wind turbines at a number of south-eastern Australian wind farms in recent years and these incidences are likely to be under reported.

74. Based on the information discussed in paragraphs 63-73, I concluded that there is a real chance or possibility that collisions with turbines could seriously disrupt the lifecycle for an ecologically significant proportion of fork-tailed swift and white-throated needletail. As a result, I was satisfied that the proposed action was likely to have a significant impact on the fork-tailed swift and white-throated needletail.

Migratory shorebirds

75. The Department noted that the migratory wetland birds considered likely to occur within the proposed action area are the shorebirds: bar-tailed godwit (*Limosa limosa*); glossy Ibis (*Plegadis falcinellus*); Latham's snipe (*Gallinago hardwickii*); and red-necked stint (*Calidris ruficollis*).

76. I received advice from the Department's Migratory Species Section on 19 January 2017 that the distance of the proposed turbines from important shorebird habitat means it is unlikely that birds would be at risk from turbine strike. The advice also said there is no suitable habitat to the north of the turbines and therefore no short flights are likely to occur. The advice further noted that if undertaking longer flights, birds are likely to be at heights well above the turbines. I accepted this advice.

77. Therefore, for reasons discussed in paragraphs 75-76, I concluded that a significant impact on migratory shorebirds is not expected or considered likely.

Terrestrial migratory birds (flycatchers)

78. The rufous fantail and satin flycatcher have been recorded in areas of native vegetation in the areas surrounding the proposed action area according to BLA's records. The black-faced monarch has the potential to occur, but has not been previously recorded.

79. The Department noted that, based on their foraging behaviour, these three species are expected to fly below the rotor sweep area and generally confine their activities to wooded areas. The Department considered it unlikely that mortalities due to turbine collisions will occur.

80. I considered that the relatively wide distributions of these species suggests that a disruption to the life cycle to an ecologically significant proportion of these species is unlikely.

81. Therefore, for reasons discussed in paragraphs 76-78, I have decided that a significant impact on flycatchers is not expected or considered likely.

Ramsar wetlands

82. The Department noted that the Corner Inlet Ramsar site is approximately one kilometre from the southern boundary of the proposed action, at its closest point.

83. Based on the Corner Inlet Ramsar site Ecological Character Description (2011), the Department advised me that the orange-bellied parrot and growling grass frog are a part of the ecological character of the Ramsar site. The potential impacts to these species from the proposed action are discussed in paragraphs 28-32 and 34-39 respectively.

84. I received advice from the Department's Wetlands Section, which concluded that adverse impacts to native species dependent on the Corner Inlet Ramsar site could occur as a result of the proposed action if appropriate mitigation and management measures are not implemented.

85. The Department further advised me that likely impacts to the Ramsar site include: sediments and contaminants entering the site via Albert and Jacks River during the construction phase, potentially including acid sulfate soils; bird strike from collision with turbines during the operation phase; and, the spread of weeds from the proposed action site to the Ramsar site during the construction phase.

86. I considered that detailed mitigation measures have not been included as part of the referral; however, BLA stated in the referral that Environmental Management Plans and Construction Management Plans are standard conditions on Victorian planning permits.

87. Advice from the Department's Wetlands Section stated that impacts from sediments and contaminants entering the Corner Inlet Ramsar site could be managed through appropriate mitigation measures. However, further information is required from the proponent to provide me with confidence that appropriate mitigation measures will be undertaken.

88. Owing to uncertainty surrounding the potential impacts to the orange-bellied parrot and growling grass frog, I was advised by the Department that there is a real chance or possibility of the habitat or lifecycle of native species dependent on the Corner Inlet Ramsar site being seriously affected. I agreed with this advice.

89. Based on the information in paragraphs 82-88, and applying the precautionary principle, I concluded that it is likely that the proposed action will have a significant impact on the ecological character of a Ramsar wetland.

World Heritage properties

90. The ERT did not identify any world heritage properties located within or adjacent to the proposed action area. Therefore, I decided that the proposed action was unlikely to have a significant impact on the world heritage values of any world heritage property.

National Heritage places

91. The ERT did not identify any National Heritage places located within or adjacent to the proposed action area. Therefore, I decided that the proposed action is unlikely to have a significant impact on the National Heritage values of any National Heritage place.

Commonwealth marine environment

92. The proposed action is not within or near a Commonwealth marine area. Therefore, I decided that the proposed action is unlikely to have a significant impact on the Commonwealth marine environment.

Commonwealth action

93. The referring party is not a Commonwealth agency. Therefore, I decided this controlling provision does not apply.

Commonwealth land

94. The proposed action is not being undertaken on Commonwealth land. Therefore, I decided that the proposed action is unlikely to have a significant impact on Commonwealth land.

Nuclear action

95. The proposed action does not meet the definition of a nuclear action as defined in the EPBC Act. Therefore, I decided this controlling provision does not apply.

Great Barrier Reef Marine Park

96. The action will not take place on or near the GBRMP. Therefore, I decided that the proposed action is unlikely to have a significant impact on the GBRMP.

Commonwealth Heritage places overseas

97. The proposed action is not located overseas. Therefore, I decided this controlling provision does not apply.

A water resource, in relation to coal seam gas development and large coal mining development

98. The proposed action is not a coal seam gas or a large coal mining development. Therefore, I decided this controlling provision does not apply.

Precautionary principle

99. In making my decision under section 75, I am required to take account of the precautionary principle (section 391). The precautionary principle is that a lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage. As discussed above, I took account of the precautionary principle in making my decision.

Reasons for decision

100. For the reasons set out in paragraphs 17-89, I was satisfied that the proposed action is likely to have a significant impact on matters protected by sections 16 and 17B (Ramsar wetlands), sections 18 and 18A (listed threatened species and communities) and sections 20 and 20A (listed migratory species).

101. I therefore decided, on 29 March 2017, that the proposed action is a controlled action for the purposes of the EPBC Act and that the controlling provisions for the action are sections 16 and 17B, sections 18 and 18A and sections 20 and 20A.

Signed

.....

JAMES BARKER

ASSISTANT SECRETARY

21/6 2017

Attachment A

Section 68 of the EPBC Act relevantly provides:

(1) A person proposing to take an action that the person thinks may be or is a controlled action must refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action.

(2) A person proposing to take an action that the person thinks is not a controlled action may refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action.

Section 74 of the EPBC Act relevantly provides:

Inviting other Commonwealth Ministers to provide information

(1) As soon as practicable after receiving a referral of a proposal to take an action, the Minister (the ***Environment Minister***) must:

(a) inform any other Minister whom the Environment Minister believes has administrative responsibilities relating to the proposal; and

(b) invite each other Minister informed to give the Environment Minister within 10 business days information that relates to the proposed action and is relevant to deciding whether or not the proposed action is a controlled action.

Inviting comments from appropriate State or Territory Minister

(2) As soon as practicable after receiving, from the person proposing to take an action or from a Commonwealth agency, a referral of a proposal to take an action in a State or self-governing Territory, the Environment Minister must, if he or she thinks the action may have an impact on a matter protected by a provision of Division 1 of Part 3 (about matters of national environmental significance):

(a) inform the appropriate Minister of the State or Territory; and

(b) invite that Minister to give the Environment Minister within 10 business days:

(i) comments on whether the proposed action is a controlled action; and

(ii) information relevant to deciding which approach would be appropriate to assess the relevant impacts of the action (including if the action could be assessed under a bilateral agreement).

Inviting public comment

(3) As soon as practicable after receiving a referral of a proposal to take an action, the Environment Minister must cause to be published on the internet:

(a) the referral; and

(b) an invitation for anyone to give the Minister comments within 10 business days (measured in Canberra) on whether the action is a controlled action.

Section 75 of the EPBC Act relevantly provides:

Is the action a controlled action?

(1) The Minister must decide:

(a) whether the action that is the subject of a proposal referred to the Minister is a controlled action; and

(b) which provisions of Part 3 (if any) are controlling provisions for the action.

(1AA) To avoid doubt, the Minister is not permitted to make a decision under subsection (1) in relation to an action that was the subject of a referral that was not accepted under subsection 74A(1).

Minister must consider public comment

(1A) In making a decision under subsection (1) about the action, the Minister must consider the comments (if any) received:

(a) in response to the invitation under subsection 74(3) for anyone to give the Minister comments on whether the action is a controlled action; and

(b) within the period specified in the invitation.

Considerations in decision

(2) If, when the Minister makes a decision under subsection (1), it is relevant for the Minister to consider the impacts of an action:

(a) the Minister must consider all adverse impacts (if any) the action:

(i) has or will have; or

(ii) is likely to have;

on the matter protected by each provision of Part 3; and

(b) must not consider any beneficial impacts the action:

(i) has or will have; or

(ii) is likely to have;

on the matter protected by each provision of Part 3.

Timing of decision and designation

(5) The Minister must make the decisions under subsection (1) and, if applicable, the designation under subsection (3), within 20 business days after the Minister receives the referral of the proposal to take the action.

Section 391 of the EPBC Act relevantly provides:

Taking account of precautionary principle

(1) The Minister must take account of the precautionary principle in making a decision listed in the table in subsection (3), to the extent that he or she can do so consistently with the other provisions of this Act.

Precautionary principle

(2) The ***precautionary principle*** is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.

Decisions in which precautionary principle must be considered

(3) The decisions are:

Decisions in which precautionary principle must be considered

Item	Section decision is made under	Nature of decision
1	75	whether an action is a controlled action
2	133	whether or not to approve the taking of an action
3	201	whether or not to grant a permit
4	216	whether or not to grant a permit
5	238	whether or not to grant a permit
6	258	whether or not to grant a permit
6A	269AA	whether or not to have a recovery plan for a listed threatened species or a listed threatened ecological community
7	269A	about making a recovery plan or adopting a plan as a recovery plan
7A	270A	whether or not to have a threat abatement plan for a key threatening process
7B	270B	about making a threat abatement plan or adopting a plan as a threat abatement plan
8	280	about approving a variation of a plan adopted as a recovery plan or threat abatement plan
9	285	about making a wildlife conservation plan or adopting a plan as a wildlife conservation plan
10	295	about approving a variation of a plan adopted as a wildlife conservation plan
10A	303CG	whether or not to grant a permit
10AA	303DC	whether or not to amend the list of exempt native specimens
10B	303DG	whether or not to grant a permit
10C	303EC	about including an item in the list referred to section 303EB
10D	303EN	whether or not to grant a permit
10E	303FN	about declaring an operation to be an approved wildlife trade operation
10F	303FO	about declaring a plan to be an approved wildlife trade management plan

10G	303FP	about declaring a plan to be an accredited wildlife trade management plan
10H	303GB	whether or not to grant an exceptional circumstances permit

Appendix 2: Migratory shorebird count averages by site and species per decade

Decade averages per species per site	Asian Dowitcher	Bar-tailed Godwit	Black-tailed Godwit	Broad-billed Sandpiper	Common Greenshank	Common Redshank	Common Sandpiper	Curlew Sandpiper	Double-banded Plover	Eastern Curlew	Great Knot	Greater Sand Plover	Grey Plover	Grey-tailed Tattler	Latham's Snipe	Lesser Sand Plover	Little Curlew	Long-toed Stint	Marsh Sandpiper	Oriental Plover	Pacific Golden Plover	Pectoral Sandpiper	Red Knot	Red-necked Stint	Ruddy Turnstone	Ruff	Sanderling	Sharp-tailed Sandpiper	Swinhoe's Snipe	Terek Sandpiper	unidentified medium wader	unidentified small wader	Wandering Tattler	Whimbrel	Wood Sandpiper
Box Bank Island - F																																			
1980-89	0	3433	<1	0	1	0	0	707	<1	241	217	3	207	0	0	25	0	0	0	0	<1	0	1628	2100	50	0	36	14	0	<1	0	0	0	0	0
1990-99	0	2267	0	0	9	0	0	87	1	156	80	2	159	1	0	6	0	0	0	0	0	0	978	636	22	0	22	<1	0	<1	0	0	0	0	0
2000-09	0	1290	0	0	3	0	0	7	0	95	7	0	24	4	0	0	0	0	0	0	0	0	29	1643	1	0	3	4	0	0	0	0	0	0	0
2010-15	0	1099	0	0	4	0	0	2	0	42	6	0	91	<1	0	0	0	0	0	0	0	0	77	1551	1	0	6	0	0	0	0	0	0	0	0
Clonmel Island - D																																			
1980-89	0	1033	0	0	17	0	0	106	<1	376	6	0	37	0	0	0	0	0	0	0	0	0	264	561	4	0	0	0	0	0	0	0	0	9	0
1990-99	0	955	0	0	1	0	0	275	1	389	0	0	18	0	0	0	0	0	0	0	0	0	210	415	<1	0	4	0	0	0	0	0	0	9	0
2000-09	0	1136	0	0	0	0	0	31	0	280	1	1	10	0	0	0	0	0	0	0	0	0	137	729	3	0	0	0	0	0	0	0	0	<1	0
2010-15	0	941	<1	0	0	0	0	50	0	168	1	<1	50	0	0	0	0	0	0	0	0	0	59	776	1	0	17	0	0	0	0	0	0	2	0
Dog Island south - M																																			
1980-89	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
1990-99	0	1080	0	0	7	0	0	8	<1	37	6	0	13	0	0	0	0	0	0	0	0	0	33	81	<1	0	0	3	0	0	0	0	0	0	0
2000-09	0	12	0	0	4	0	0	0	0	26	0	0	24	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	<1	0
2010-15	0	10	0	0	8	0	0	<1	0	<1	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dream Island - H																																			
1980-89	0	1442	0	0	49	0	0	383	0	100	70	<1	72	4	0	<1	0	0	0	0	<1	0	1252	1667	12	0	25	0	0	0	0	0	0	20	0
1990-99	0	239	0	0	133	0	0	8	0	3	0	0	0	0	0	0	0	0	1	0	3	0	13	14	0	0	0	0	0	0	0	0	0	16	0
2000-09	0	25	0	0	35	0	0	0	0	1	0	0	0	13	0	0	0	0	0	0	0	0	3	8	0	0	0	0	0	3	0	0	0	10	0
2010-15	0	300	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	15	0
Dream south (shallow inlet) - G																																			
1980-89	0	257	0	0	0	0	0	469	0	56	29	0	100	0	0	23	0	0	0	0	5	0	386	1731	13	0	4	14	0	0	0	0	0	0	0
1990-99	0	2929	<1	0	0	0	0	414	0	47	43	12	121	2	0	33	0	0	0	0	0	0	732	4714	21	0	76	23	0	<1	0	0	0	4	0
2000-09	0	198	0	0	0	0	0	0	0	56	10	0	37	<1	0	0	0	0	0	0	0	0	80	130	<1	0	4	0	0	0	0	0	0	0	0
2010-15	0	1260	0	0	0	0	0	34	0	21	1	<1	5	3	0	2	0	0	0	0	0	0	105	1136	17	0	15	0	0	0	0	0	0	0	0
East Sunday Island / Drum Island - A																																			
1980-89	0	2	0	0	1	0	0	1	0	4	0	0	<1	0	0	0	0	0	0	0	0	0	0	93	0	0	0	0	0	0	0	0	0	0	0
1990-99	0	130	0	0	7	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	2	0
2000-09	0	0	0	0	17	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010-15	0	0	0	0	2	0	0	0	0	5	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kate Kearney entrance - E																																			
1980-89	0	930	0	0	1	0	0	144	0	162	65	1	56	0	0	2	0	0	0	0	0	0	256	450	13	0	1	<1	0	0	0	0	0	0	0
1990-99	0	222	0	0	0	0	0	53	0	65	0	0	59	0	0	0	0	0	0	0	0	0	2	1074	1	0	1	0	0	0	0	0	0	0	0
2000-09	0	5343	0	0	0	0	0	268	1	18	54	1	161	0	0	4	0	0	0	0	0	0	473	6411	21	0	118	48	0	0	0	0	0	0	0
2010-15	0	4313	0	0	0	0	0	58	<1	67	40	9	141	3	0	1	0	0	0	0	0	0	182	4936	9	0	112	39	0	1	0	0	0	0	0
McGloughlans entrance - J																																			
1980-89	0	260	<1	0	22	0	0	117	0	67	2	0	0	0	0	0	0	0	0	0	1	0	17	437	0	0	0	0	0	0	0	0	0	0	0
1990-99	0	75	0	0	0	0	0	76	<1	119	1	0	<1	0	0	0	0	0	0	0	9	0	36	879	0	0	0	0	0	0	0	0	0	0	0
2000-09	0	233	0	0	0	0	0	0	2	76	0	0	0	0	0	0	0	0	0	0	0	0	11	781	<1	0	0	0	0	0	0	0	0	0	0
2010-15	0	132	0	0	0	0	0	13	0	73	0	0	0	0	0	0	0	0	0	0	0	0	0	842	1	0	1	0	0	0	0	0	0	0	0
Nooramunga Section																																			
1980-89	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
1990-99	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
2000-09	0	8354	0	0	51	0	0	427	13	693	162	<1	277	<1	0	<1	0	0	0	0	0	0	1744	14256	28	0	80	66	0	0	0	0	0	12	0
2010-15	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
North of St Margaret Island - L																																			
1980-89	0	90	0	0	27	0	0	267	0	63	0	0	0	0	0	0	0	0	0	0	0	0	367	1067	0	0	0	67	0	0	0	0	0	4	0
1990-99	0	0	0	0	15	0	0	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0
2010-15	0	0	0	0	0	0	0	0	0	128	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
One Tree Island - G2 - now S																																			
1980-89	0	650	0	0	2	0	0	416	0	7	102	4	71	0	0	10	0	0	0	0	0	0	671	2229	15	0	24	66	0	0	0	0	0	0	0
1990-99	0	767	<1	0	0	0	0	361	0	27	23	6	13	2	0	14	0	0	0	0	0	0	461	1811	32	0	30	34	0	<1	0	0	0	2	0
2000-09	0	723	0	0	0	0	0	75	1	28	5	0	29	<1	0	<1	0	0	0	0	0	0	72	2483	2	0	<1	18	0	0	0	0	0	7	0
2010-15	0	807	0	0	0	0	0	0	0	44	24	0	0	0	0	0	0	0	0	0	0	0	90	1180	0	0	7	0	0	0	0	0	0	9	0
Port Albert entrance - C																																			
1980-89	0	57	0	0	0	0	0	64	<1	4	0	0	3	0	0	0	0	0	0	0	0	0	20	796	1	0	0	<1	0	0	0	0	0	0	0
1990-99	0	211	0	0	0	0	0	0	0	<1	0	1	28	0	0	0	0	0	0	0	0	0	10	366	2	0	4	<1	0	0	0	0	0	0	0
2000-09	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	10	1034	2	0	<1	0	0	0	0	0	0	0	0
2010-15	0	568	0	0	0	12	0	47	2	45	1	1	<1	0	0	0	0	0	0	0	0	0	18	1955	3	0	25	<1	0	0	0	0	0	<1	0
Port Welshpool foreshore																																			
1980-89	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
1990-99	0	0	0	0	20	0	0	12	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0
2000-09	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0
Robertsons Beach - K																																			
1980-89	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
1990-99	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010-15	0	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Snake Island (east side) - G3 - now B																																			
1980-89	0	1390	0	0	5	0	0	31	0	203	2	0	114	8	0	0	0	0	0	0	0	0	63	697	4	0	7	0	0	0	0	0	0	0	0
1990-99	0	1535	0	0	13	0	0	87	<1	150	21	4	126	<1	0	18	0	0	0	0	0	0	380	1433	5	0	8	1	0	<1	0	0	0	0	0
2000-09	0	1007	0	0	0	0	0	67	5	37	50	2	93	0	0	<1	0	0	0	0	0	0	192	1717	5	0	17	0	0	0	0	0	0	0	0
2010-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sunday Island west end																																			
1980-89	0	0	0	0	26	0	0	14	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	336	0	0	0	0	0	0	0	0	0	0	0

Appendix 3: Average of 2010-2016 for each species at each site

Species	Box Bank Island - F	Clonmel Island - D	Dog Island south - M	Dream Island - H	Dream south (shallow inlet) - G	East Sunday Island / Drum Island - A	Kate Kearney entrance - E	McGloughlans entrance - J	Nooramunga Section	North of St Margaret Island - L	One Tree Island - G2 - now S	Port Albert entrance - C	Port Welshpool foreshore	Robertsons Beach - K	Snake Island (east side) - G3 - now B	Total	Percentage
Asian Dowitcher	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	**0**	**0.0**
Bar-tailed Godwit	1099	941	10	300	1260	0	4313	132	ns	0	807	568	0	0	0	**9429**	**38.7**
Black-tailed Godwit	0	<1	0	0	0	0	0	0	ns	0	0	0	0	500	0	**500**	**2.1**
Broad-billed Sandpiper	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	**0**	**0.0**
Common Greenshank	4	0	8	28	0	2	0	0	ns	0	0	0	0	0	0	**42**	**0.2**
Common Redshank	0	0	0	0	0	0	0	0	ns	0	0	12	0	0	0	**12**	**0.0**
Common Sandpiper	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	**0**	**0.0**
Curlew Sandpiper	2	50	<1	0	34	0	58	13	ns	0	0	47	0	0	0	**204**	**0.8**
Double-banded Plover	0	0	0	0	0	0	<1	0	ns	0	0	2	0	0	0	**2**	**0.0**
Eastern Curlew	42	168	<1	0	21	5	67	73	ns	128	44	45	0	0	0	**591**	**2.4**

Species	Box Bank Island - F	Clonmel Island - D	Dog Island south - M	Dream Island - H	Dream south (shallow inlet) - G	East Sunday Island / Drum Island - A	Kate Kearney entrance - E	McGloughlans entrance - J	Nooramunga Section	North of St Margaret Island - L	One Tree Island - G2 - now S	Port Albert entrance - C	Port Welshpool foreshore	Robertsons Beach - K	Snake Island (east side) - G3 - now B	Total	Percentage
Great Knot	6	1	0	0	1	0	40	0	ns	0	24	1	0	0	0	72	0.3
Greater Sand Plover	0	<1	0	0	<1	0	9	0	ns	0	0	1	0	0	0	9	0.0
Grey Plover	91	50	0	0	5	0	141	0	ns	0	0	<1	0	0	0	287	1.2
Grey-tailed Tattler	<1	0	0	0	3	<1	3	0	ns	0	0	0	0	0	0	6	0.0
Latham's Snipe	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	0	0.0
Lesser Sand Plover	0	0	0	0	2	0	1	0	ns	0	0	0	0	0	0	3	0.0
Little Curlew	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	0	0.0
Long-toed Stint	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	0	0.0
Marsh Sandpiper	0	0	<1	0	0	0	0	0	ns	0	0	0	0	0	0	0	0.0
Oriental Plover	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	0	0.0
Pacific Golden Plover	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	0	0.0
Pectoral Sandpiper	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	0	0.0

Species	Box Bank Island - F	Clonmel Island - D	Dog Island south - M	Dream Island - H	Dream south (shallow inlet) - G	East Sunday Island / Drum Island - A	Kate Kearney entrance - E	McGloughlans entrance - J	Nooramunga Section	North of St Margaret Island - L	One Tree Island - G2 - now S	Port Albert entrance - C	Port Welshpool foreshore	Robertsons Beach - K	Snake Island (east side) - G3 - now B	Total	Percentage
Red Knot	77	59	0	<1	105	0	182	0	ns	0	90	18	0	0	0	**531**	**2.2**
Red-necked Stint	1551	776	0	0	1136	0	4936	842	ns	1	1180	1955	40	0	0	**12416**	**50.9**
Ruddy Turnstone	1	1	0	0	17	0	9	1	ns	0	0	3	0	0	0	**31**	**0.1**
Ruff	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	**0**	**0.0**
Sanderling	6	17	0	0	15	0	112	1	ns	0	7	25	0	0	0	**183**	**0.7**
Sharp-tailed Sandpiper	0	0	0	0	0	0	39	0	ns	0	0	<1	0	0	0	**39**	**0.2**
Terek Sandpiper	0	0	0	0	0	0	1	0	ns	0	0	0	0	0	0	**1**	**0.0**
unidentified medium wader	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	**0**	**0.0**
unidentified small wader	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	**0**	**0.0**
Whimbrel	0	2	0	15	0	0	0	0	ns	0	9	<1	0	0	0	**25**	**0.1**
Wood Sandpiper	0	0	0	0	0	0	0	0	ns	0	0	0	0	0	0	**0**	**0.0**