ALBERTON WIND FARM

EPBC ACT BILATERAL AGREEMENT ASSESSMENT DOCUMENTATION

Consultant Report prepared for Synergy Pty Ltd

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1. EXECUTIVE SUMMARY

Synergy Wind Pty Ltd propose to develop a 34-turbine wind farm on farmland near Alberton in South Gippsland, Victoria. The Commonwealth Minister for the Environment has decided that the project is a controlled action and requires assessment under the EPBC Act Bilateral Agreement of 2014 between the Commonwealth and Victorian governments. This report summarises the proposed project and its implications under the Agreement.

The controlling provisions under the EPBC Act were:

- Ramsar wetlands (Sections 16 and 17B);
- Listed threatened species (Sections 18 and 18A); and
- Listed migratory species (Sections 20 and 20A).

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 (*Litoria raniformis*); and
- The listed migratory White-throated Needletail (*Hirundapus caudacutus*) and Fork-tailed Swift (*Apus pacificus*).

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 constructed and operated in an environmentally sensitive manner, ensuring that there will be no unacceptable residual risks of a detrimental impact on the ecological characteristics of the Corner Inlet Ramsar site for the life of the project.

The **Orange-bellied Parrot** (*Neophema chrysogaster*) historically has occurred infrequently east of Port Phillip Bay (3% of records and 1% of individuals) and even less frequently in Corner Inlet. As the current population is much lower than the period during which such observations were made, the likelihood of the species occurring on the site is extremely low, particularly having regard to the lack of suitable habitat in the project footprint. For this reason, the risks from the proposed Alberton Wind Farm to the Orange-bellied Parrot and its recovery are considered acceptably low.

Information is presented in this report on the distribution, abundance and habitat preference of the **Swift Parrot** (*Lathamus discolour*). This indicates that the site and its surrounding forested areas lack the preferred mainland foraging tree species of this species. For this reason, it is only likely to fly through the area during migration. Based on published wind farm collision risk modelling results for the species, no unacceptable risks to the Swift Parrot population are expected from the advent of an additional wind farm at Alberton.

The impacts of the wind farm on birds will be subject to a comprehensive Bat and Avifauna Management Plan that will monitor the impacts of the project on birds for a minimum of two years. This will include reporting and investigation requirements in the event of a threatened species being found under a turbine and scope of implementing targeted mitigation measures in the event of an ongoing impact.

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, suggesting that the species may no longer be extant in the region. The aquatic habitats within and near the site lack appropriate fringing vegetation, are too shallow, or are too heavily shaded by Swamp Paperbark to provide suitable breeding environments or dispersal routes for the Growling Grass Frog. The species is therefore unlikely to occur in the aquatic habitats on the site and will not be adversely affected by the project.

White-throated Needletails often fly at rotor swept area (RSA) heights and occasionally collide in small numbers with turbines. The numbers of birds affected is small and would not significantly affect the wider population of this non-threatened, migratory species. Based on numbers recorded at wind farms in north western Tasmania, the number likely to be affected is less than an ecologically significant proportion of the population, defined as 0.1% of 10,000 birds, or 10 birds annually by the Department of Environment and Energy (DoEE). 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). This makes it very unlikely that the proposed project will lead to an unacceptable risk to the Needletail's population at a scale of concern based on Commonwealth definitions of important populations and significance.

Based on an estimated population of 100,000 **Fork-tailed Swifts** (DoE 2015), an ecologically significant proportion of the population (i.e. 0.1% or 100 birds per year) would have to be affected for there to be impacts of concern. The species occurs in the region much less frequently than the Needletail. Given this and the larger population, 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 on foot and by boat (i.e. the nearest marine habitats for this group to the proposed wind farm). The findings of this research indicate that the larger roosts and foraging grounds of migratory shorebirds lie well away from the coast near the proposed Alberton Wind Farm, with most being at least three kilometres from any proposed turbines. Shorebirds in Corner Inlet confine their routine activities to low level movements, generally over water and mudflats. During migration shorebirds depart by climbing quite steeply into the air away from their habitats. Given the inlet's geography, and the distance of their favoured haunts from the wind farm, risks to listed migratory shorebirds from the construction and operation of the proposed wind farm will therefore be negligible.

In conclusion, the Alberton Wind Farm is not considered to have any unacceptable impacts or risks on any matter of national environmental significance.

2. INTRODUCTION

Synergy Wind Pty Ltd proposes 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 on the 29th March 2017 that the project is a controlled action and requires assessment and approval under the EPBC Act. This assessment is to be undertaken under the EPBC Act bilateral assessment agreement between the Commonwealth and Victorian governments.

The controlling provisions for the EPBC Act decision were:

- Ramsar wetlands (Sections 16 and 17B);
- Listed threatened species (Sections 18 and 18A); and
- Listed migratory species (Sections 20 and 20A).

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 (*Litoria raniformis*); and
- The listed migratory White-throated Needletail (*Hirundapus caudacutus*) and Fork-tailed Swift (*Apus pacificus*).

The Referral of the project under the EPBC Act 1999 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, mitigation measures 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. It supplements and summarises relevant information from the more detailed flora and fauna assessment report prepared by Brett Lane & Associates (BL&A) in 2016 and submitted with the Victorian planning permit application (BL&A 2016). It has been prepared at the request of the planning arm of the Victorian Department of Environment Land Water and Planning (DELWP) on behalf of the Commonwealth Department of Environment and Energy (DoEE) to enable a stand-alone EPBC Act assessment to be undertaken in parallel with the planning permit application. This is the agreed approach between the DoEE and DELWP under the EPBC Act Assessment Bilateral Agreement.

The proposal does not relate to any other actions. The closest wind farms to the proposed Alberton wind farm are Bald Hills Wind Farm (52 turbines, 50 km to the west) and Toora Wind Farm (12 turbines, 16 km to the west).

This report is divided into the sections described below:

Section 3 describes the plans, policies, guidelines and instruments of relevance to the assessment of impacts on MNES through this process;

Section 4 provides a description of the project;

Section 5 summarises all ecological surveys and results;

Section 6 provides a description of impacts on MNES;

Section 7 describes additional avoidance and mitigation measures;

Section 8 identifies social and economic impacts, as provided by the proponent;

Section 9 details the environmental record of person(s) proposing to take the project; and

Section 10 details of information sources provided in the assessment documentation.

This report was prepared by a team comprising Khalid Al-Dabbagh (Zoologist), Jackson Clerke (Zoologist), Christopher Dunk (Senior Ecologist), Inga Kulik (Senior Ecologist and Project Manager) and Brett Lane (Principal Consultant). Input on construction environmental management measures was provided by Bernard Stewart of Beveridge Williams Pty Ltd.

Renewable Energy

The proponent has provided the following information in relation to the project.

"Both State and Federal Governments have policy and legislation in place to increase the level of renewable energy in Victoria and Australia.

The Victorian Government has committed to increase Victorian renewable energy generation targets by 25% by 2020 and by 40% by 2025. To demonstrate the State governments commitment to renewables, the Renewable Energy (Jobs and Investment) Act 2017 (Vic) has been introduced which legislates the Victorian Renewable Energy Targets. Information can be found at https://www.energy.vic.gov.au/renewable-energy/victorias-renewable-energy-targets.

The Government has a number of schemes and strategies in place to ensure these targets can be achieved which are outlined in the Renewable Energy Action Plan (https://www.energy.vic.gov.au/renewable-energy/victorias-renewable-energy-action-plan).

The Renewable Energy Action Plan sets out how Victoria will ensure a renewable, affordable and reliable energy supply, which uses large-scale renewable energy technology and ensures grid stability. The Alberton Wind Farm project would help in delivering this State Government Action Plan.

The Victorian Climate Change Act 2017 establishes a legislative framework to drive action to achieve a net zero emissions, climate-resilient Victorian community and economy by 2050.

This Act requires the Victorian Government to set five yearly interim greenhouse gas emissions reduction targets, starting in 2021, to set the State on a pathway to net zero greenhouse gas emissions by 2050.

Australia's Renewable Energy Target (RET) is a Federal Government policy designed to ensure that at least 33,000 Gigawatt-hour (GWh) of Australia's electricity comes from renewable sources by 2020, (https://www.cleanenergycouncil.org.au/policyadvocacy/renewable-energy-target.html).

This application also highlights the alternative paths of renewable versus non-renewable energy. The proposed site is subject to the planning State Resource Overlay – Schedule 1 (Gippsland Brown Coalfields) (SRO1) – See Figure 14. The overlay highlights a significant brown coal reserve.

The proposed windfarm represents an opportunity for this area to have a renewable energy future. The proposal will contribute to strengthening and diversifying a new sustainable economic base for the Shire of Wellington and contribute to the new green energy industry and image being sought for the wider Latrobe area. In addition, the proposal does not hinder potential future exploitation of the recognised brown coal resources recognised in the Wellington Scheme Overlay, should extract become viable in the future, within Australian commitments to reduce production of carbon emissions and greenhouse gases."

3. PLANS, POLICIES, GUIDELINES AND INSTRUMENTS OF RELEVANCE

The following plans, policies, guidelines and instruments were of particular relevance to the assessment of impacts on MNES through this process:

- DEWHA 2009. Significant Impact Guidelines for the Vulnerable Growling Grass Frog. Department of Environment, Water, Heritage and the Arts, now Department of the Environment, Canberra.
- 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
- Garnett, ST, Szabo, JK and Dutson, G 2011, *The Action Plan for Australian Birds 2010*. Birds Australia and CSIRO Publishing, Collingwood.
- Saunders, D.L. and Tzaros, C.L. 2011. *National Recovery Plan for the Swift Parrot Lathamus discolor*, Birds Australia, Melbourne.
- Department of Sustainability, Environment, Water Population and Communities (DSEWPaC) 2011, Corner Inlet Ramsar Site – Ecological Character Description, Canberra.

4. DESCRIPTION OF THE PROJECT

4.1. Site description

Synergy Wind Pty Ltd proposes to develop a 34-turbine wind farm on farmland near Alberton in South Gippsland, Victoria (Figure 1). The proposed development footprint covers 59.39 ha within the broader site that totals 3,200 ha of private land and public infrastructure reserves in South Gippsland near the townships of Alberton, Alberton West, Devon North, Gelliondale, Hedley and Yarram.

The wind farm site comprises four distinct landscapes, described below.

The northern part of the site comprised lower slopes of the foothills of the Strzelecki Ranges. Much of this land had been cleared of native vegetation, sown to pasture and was used for stock grazing. This part of the site abutted the extensive forests of the Strzelecki Ranges.

The southern part of the site 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 sown to pasture and was used for stock grazing. Adjacent state forests (to the south) supported extensive areas of Heathy Woodland, Swamp Scrub, Sedge Swamp and Damp Heathland.

Land between the coastal dune complex and higher, hilly country to the north 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 woody vegetation in this area comprised planted shelterbelts of non-indigenous trees.

The Albert River was the largest watercourse crossing the site. 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 several hundred metres to the south east of the eastern part of the site were wider and were lined with a narrow fringe of Mangrove Shrubland, with Saltmarsh and brackish wetland vegetation further from the river.

The Jack River was another significant, meandering permanent waterway that crossed the north-eastern part of the site. This river ran almost parallel to and within a kilometre or so of the Albert River 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 site.

In addition to the aforementioned waterways, the site had a number of farm dams, joined by numerous 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 rivers and creeks crossing the site, 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 site 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 site.

- 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 site 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 site.

- Corner Inlet and Nooramunga Marine and Coastal Parks (Ramsar Wetland)

  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. The Albert River comes to within 200 metres of the nearest proposed wind turbine and associated works. The Ramsar Wetland encompasses both the reserves and the nearby reaches of the Albert River to within 7300 metres of the nearest turbines and related infrastructure (see Figure 1B). Most of the Ramsar Wetland and the Reserve, and in particular the key waterbird habitats (see Section 5.4) lie south of the site about three kilometres from the nearest wind turbines and related infrastructure.

- Wilsons Promontory National Park

  This area extended southwards 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 management region.

The site 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 were 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 outlying pockets of saltmarsh and mangroves occurred about 300 to 600 metres south-east of two turbines at the south eastern end of the site 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.

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 potential 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 along the Albert River. These marshes were dominated by reeds, rushes and sedges, providing good intact and connected vegetation cover, providing dispersal and foraging opportunities for fauna.

4.2. Structures to be built

The proposed action includes the construction of:

- Access tracks with a maximum width of 6m (23 km of new access tracks).
- Underground cabling and associated trenching - 3m wide. (generally adjacent to proposed access tracks)
- 34 wind turbines, with bases of a 15m radius and one hardstand area next to each turbine 25x35m; turbines will have an overall tip height of 200m and a minimum ground to blade tip clearance of 40m.
- Anemometer masts (if required).
- 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 concept electrical connection plan has been submitted with the planning application and was used to assess impacts of the project. The plan illustrates the existing 66kv line that crosses the project site and how it would be utilised for connection, requiring minimal additional overhead lines or external lines to be constructed.

At the conclusion of project operations (25-30 years), decommissioning activities will include the removal of turbines and above ground infrastructure.

4.3. Proposed operations

The proposed action is anticipated to have a construction period of between 18 to 24 months and construction 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 in a manner consistent with the final permit conditions for the project (usually micro-siting is approved up to 100 metres from the proposed location).

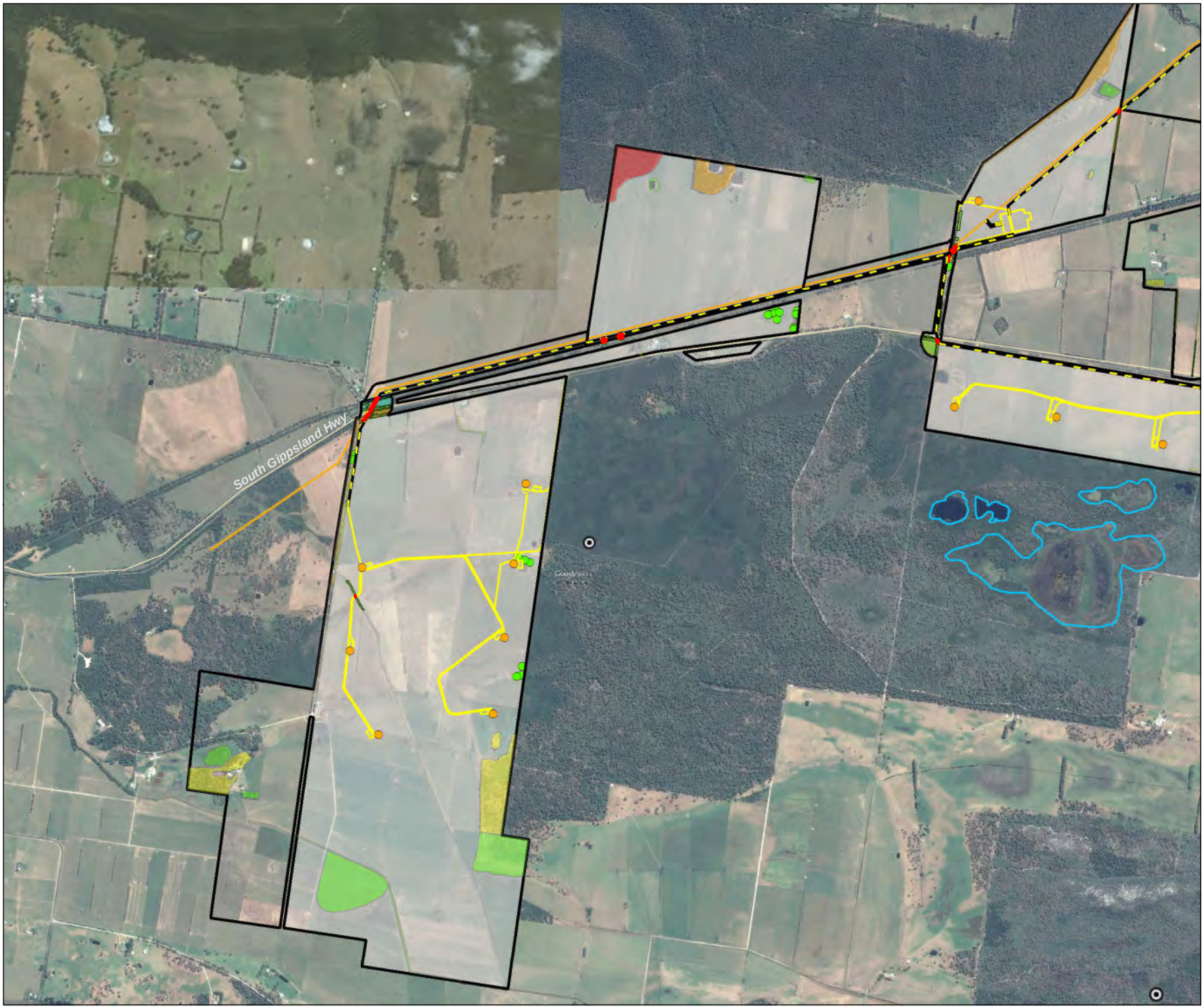

Figure 1A: Overview map

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Native vegetation to be removed

Detailed native vegetation survey

- South Gippsland Plains Grassland (EVC 132_62)
- Plains Grassy Forest (EVC 151)
- Damp Sands Herb-rich Woodland (EVC 3)
- Heathy Woodland (EVC 48)
- Swamp Scrub (EVC 53)
- Aquatic Herbland (EVC 653)
- Wet Heathland (EVC 8)
- Tall Marsh (EVC 821)
- Floodplain Reedbed (EVC 863)

Native Vegetation quality - Overview Assessment

- High
- Moderate
- Low
- Very low
- DELWP wetlands
- Scattered trees
- Ramsar site
- Freehold land
- Upgrade & augment existing powerline
- Development footprint
- Existing powerline
- Turbines

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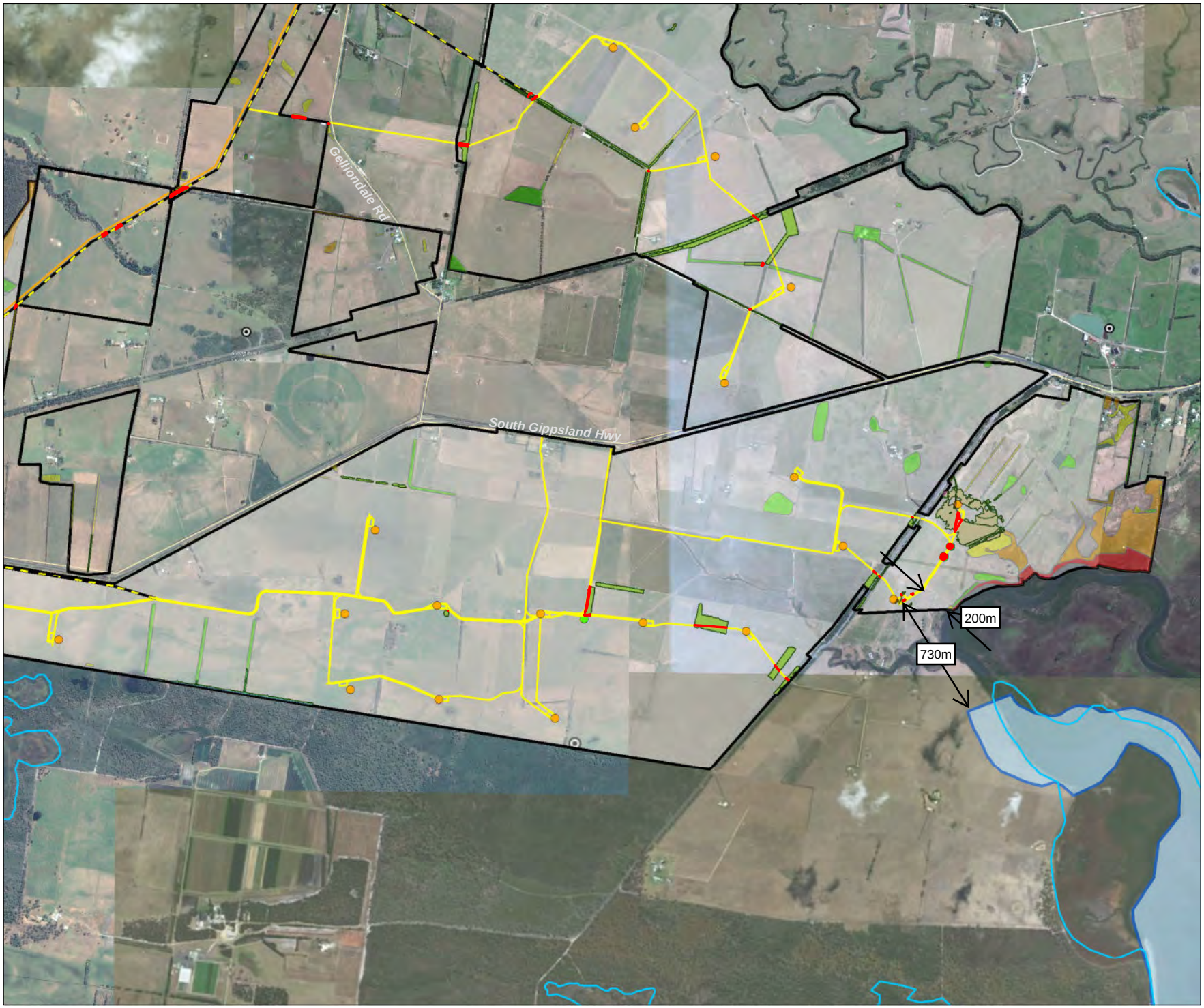

Figure 1B: Overview map

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Native vegetation to be removed

Detailed native vegetation survey

- South Gippsland Plains Grassland (EVC 132_62)
- Plains Grassy Forest (EVC 151)
- Damp Sands Herb-rich Woodland (EVC 3)
- Heathy Woodland (EVC 48)
- Swamp Scrub (EVC 53)
- Aquatic Herbland (EVC 653)
- Wet Heathland (EVC 8)
- Tall Marsh (EVC 821)
- Floodplain Reedbed (EVC 863)

Native Vegetation quality - Overview Assessment

- High
- Moderate
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- DELWP wetlands
- Scattered trees
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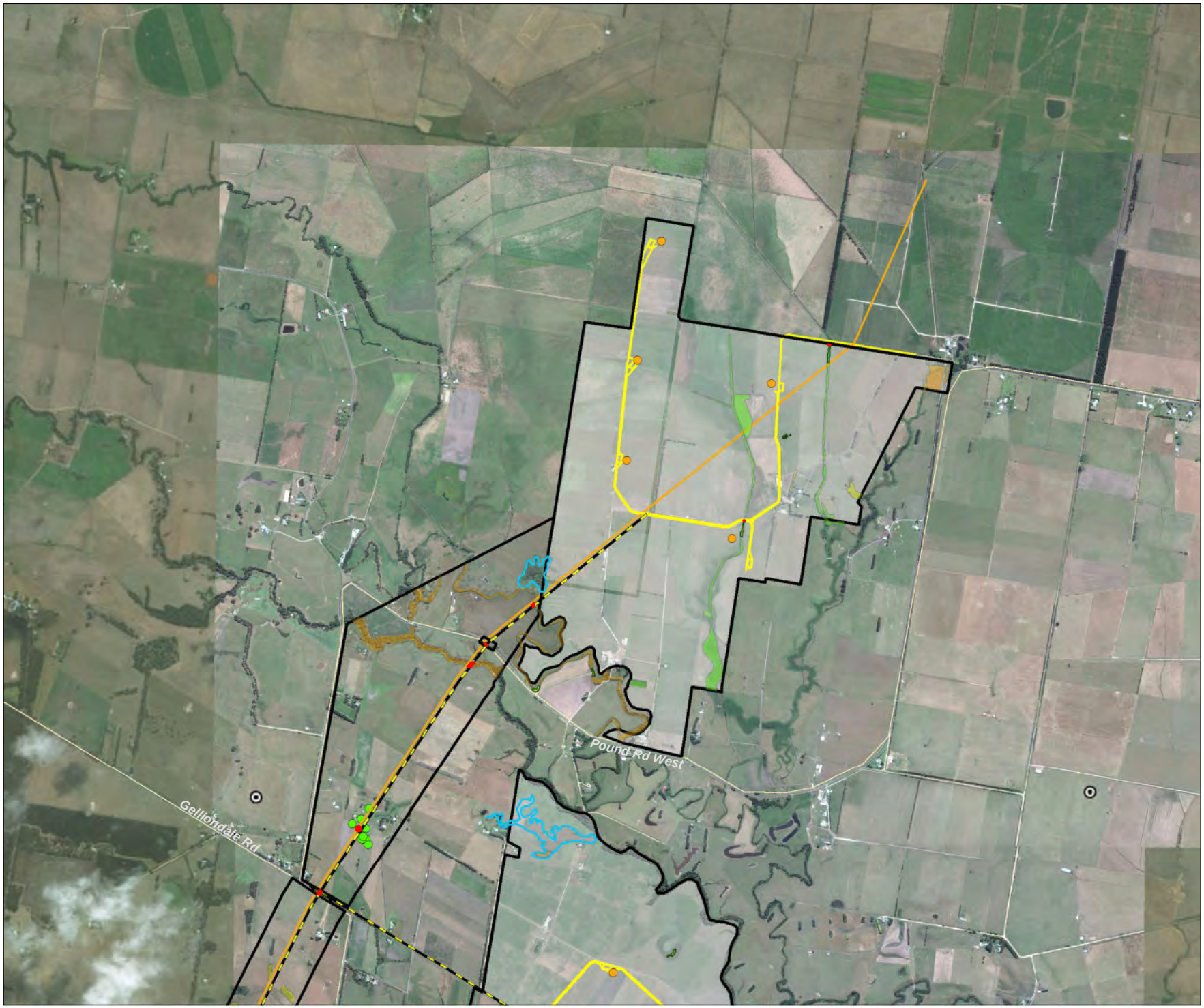

Figure 1C: Overview map

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Native vegetation to be removed

Detailed native vegetation survey

- South Gippsland Plains Grassland (EVC 132_62)
- Plains Grassy Forest (EVC 151)
- Damp Sands Herb-rich Woodland (EVC 3)
- Heathy Woodland (EVC 48)
- Swamp Scrub (EVC 53)
- Aquatic Herbland (EVC 653)
- Wet Heathland (EVC 8)
- Tall Marsh (EVC 821)
- Floodplain Reedbed (EVC 863)

Native Vegetation quality - Overview Assessment

- High
- Moderate
- Low
- Very low
- DELWP wetlands
- Scattered trees
- Ramsar site
- Freehold land
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5. ECOLOGICAL ASSESSMENTS AND RESULTS

The following section summarises flora and fauna surveys undertaken to date at the Alberton Wind Farm, including survey methods, results, the potential occurrence of EPBC Act-listed species, and conclusions about project impacts. For those species for which the action was made a controlled action, separate detailed accounts and impact assessments are provided in later sections of this report.

The following surveys have been undertaken for this project:

- Overview vegetation mapping - March 2015 and June 2016
- Detailed vegetation mapping and habitat hectare assessment - September 2016
- Targeted threatened flora and listed community investigations - November 2016
- General fauna assessment to characterise habitats and assess likelihood of occurrence of threatened species – March 2015
- Bird Utilisation Studies in February 2015
- Bat Utilisation Studies between 26th February and 11th of March 2015, totalling 65 recorder-nights;
- Migratory and resident shorebird surveys of the intertidal and shallow marine habitats in the nearby parts of the Nooramunga Marine and Coastal Parks – March 2015
- Review of Birdlife Australia Shorebirds 2020 database for all listed migratory shorebird records

Detailed methods for these surveys can be found in the submitted Flora and Fauna Assessment report (BL&A 2016).

5.1. Native vegetation assessment and targeted flora surveys

5.1.1. Methodology and timing

Botanical assessments involved the activities described below.

- Overview assessment and initial vegetation mapping - March 2015 and June 2016
- Detailed mapping and habitat hectare assessment - September 2016
- Targeted threatened flora and listed community investigations - November 2016 targeting:
    - Natural Damp Grassland of the Victorian Coastal Plains (EPBC Act threatened community)
    - Clover Glycine
    - Eastern Spider-orchid
    - Maroon Leek-orchid
    - Metallic Sun-orchid
    - River Swamp Wallaby-grass
    - Strzelecki Gum and
    - Thick-lip Spider-orchid

5.1.2. Results

The site comprises 2,900 hectares of agricultural land used for stock grazing, mostly dairy and beef cattle, or cropping. Patches of the following EVCs were found to occupy the site:

- 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)

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.

The total area occupied by native vegetation in 116 habitat zones was 23.062 hectares, representing 0.72% of the 3,200 hectare site. Of this, **1.195 hectares** (c. 5.2% of vegetation remaining in the site) will be affected by the proposed development, together with 16 scattered trees. A range of design changes have been made to minimise impacts on native vegetation, as required under Cl.12.01 and 52.17 of the Planning Scheme.

The assessment of the permit application for native vegetation removal will be in the **high**-risk assessment pathway due to the presence on a small part of the area of removal mapped as Location Risk C. 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 generates an offset target of **0.386 general biodiversity equivalence units.** Offset must have a minimum strategic biodiversity score of 0.286.

Potential occurrence of listed flora species

The review of existing information indicated that nine flora species listed under the Commonwealth EPBC Act and/or the state FFG Act either have been recorded within the search region in the last 30 years, or for which the EPBC Act Protected Matters Search Tool indicated the presence of potential habitat (Table 1).

Seven of these had the potential to occur at the wind farm site, but were not recorded during seasonally appropriately timed targeted, transect-based surveys.

Table 1: EPBC Act listed flora species and likelihood of occurrence

Common Name	Scientific name	EPBC	Habitat	No. of records	Date of last record	Likelihood of occurrence
Clover Glycine	*Glycine latrobeana*	VU	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 *Rytidosperma* 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 remnant native plains grassland and woodland vegetation on drier fertile ground – **Potential to occur in EVCs 3, 48, 132_62 and 151, but not recorded during targeted surveys.**
Eastern Spider-orchid	*Caladenia orientalis*	EN	Heathland and Heathy Woodland in coastal areas between the Mornington Peninsula and Wilsons Promontory (Jeanes & Backhouse 2006).	None	N/A	Habitat present within Heathland and heathy woodland patches with an intact ground layer - **Potential to occur in EVCs 8 and 48, but not recorded during targeted surveys.**

Common Name	Scientific name	EPBC	Habitat	No. of records	Date of last record	Likelihood of occurrence
Maroon Leek-orchid	*Prasophyllum frenchii*	EN	Favouring heathland and Grassland on black clays (Bates 1994).	2	1/09/2003	Habitat present within roadsides supporting a fertile, damp grassy and herbaceous ground layer in plains country – **Potential to occur in EVCs 8, 48 and 132_62, but not recorded during targeted surveys.**
Matted Flax-lily	*Dianella amoena*	EN	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 present - **Unlikely to occur**
Metallic Sun-orchid	*Thelymitra epipactoides*	EN	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 areas with a relatively intact and diverse grassy or heathy understory - **Potential to occur in EVCs 3, 8, 48, 132_62 and 151, but not recorded during 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 drainage channels, vegetated dams and waterways – **Potential to occur in EVCs 653 and 863, but not recorded during targeted surveys.**

Common Name	Scientific name	EPBC	Habitat	No. of records	Date of last record	Likelihood of occurrence
Strzelecki Gum	*Eucalyptus strzeleckii*	VU	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 Plains Grassy Forest – **Potential to occur in EVC 151, but not recorded during targeted surveys.**
Swamp Everlasting	*Xerochrysum palustre*	VU	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**
Thick-lip Spider-orchid	*Caladenia tessellata*	VU	Coastal open woodlands, Lowland forest, heathy woodland (Entwisle 1994).	2	15/04/1992	Habitat present within forest and heathy woodland with intact ground layer – **Potential to occur in EVCs 3, 48 and 151, but not recorded during targeted surveys.**

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

5.1.3. Listed species and communities

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 potentially suitable habitat for nine threatened species and one threatened community listed under the Commonwealth EPBC Act. None of these were recorded during the field survey.

The likelihood of occurrence in the study area of flora listed under the EPBC Act is addressed in Table 1. 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 likelihood of occurrence for each species was tested through targeted flora surveys undertaken between 2nd and 4th November 2016. The adequacy of the surveys is assessed against the Department of Environment and Energy's relevant scientific and policy guidance in Table 2.

Table 2: Details and adequacy of targeted surveys for EPBC Act listed flora

Species	Survey requirements	Survey details	Assessment of adequacy
Clover Glycine	October to December when the species is in flower or fruit (DoEE 2017).	5 m transects within all impact areas in November 2016.	Adequate survey timing and effort.
Eastern Spider-orchid	Systematic traverse of the survey site in parallel transects 5 - 10 m apart during optimal flowering time (DoE 2013b), September to November (Backhouse & Jeanes 1995).	5 m transects within all impact areas in November 2016.	Adequate survey timing and effort, although no reference site checked.
Maroon Leek-orchid	Systematic traverse of the survey site in parallel transects 5 - 10 m apart during optimal flowering time (DoE 2013b), November to early December (DoEE 2017).	5 m transects within all impact areas in November 2016.	Adequate survey timing and effort, although no reference site checked.
Metallic Sun-orchid	Systematic traverse of the survey site in parallel transects 5 - 10 m apart during optimal flowering time (DoE 2013b), September to November (Weber & Entwisle 1994).	5 m transects within all impact areas in November 2016.	Adequate survey timing and effort, although no reference site checked.
River Swamp Wallaby-grass	Flowering and fruiting occurs mainly between November and March, with mature flowers required for identification (DoEE 2017).	5 m transects within all impact areas in November 2016.	Adequate survey timing and effort.
Strzelecki Gum	Identifiable from the glaucous (waxy) new growth evident at the outside of crown. The species has small ovoid buds, and fruit that is broader than it is long. flowers in spring and ripe fruit has been collected in November (DoEE 2017).	5 m transects within all impact areas in November 2016.	Adequate survey timing and effort.

Species	Survey requirements	Survey details	Assessment of adequacy
Thick-lip Spider-orchid	Systematic traverse of the survey site in parallel transects 5 - 10 m apart during optimal flowering time (DoE 2013b), September to early November (DoEE 2017).	5 m transects within all impact areas in November 2016.	Adequate survey timing and effort, although no reference site checked.

None of the species outlined below were recorded in the impact area. They are therefore now considered unlikely to occur within the impact area.

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

The EPBC Act listed community *Natural Damp Grassland of the Victorian Coastal Plains* was identified as potentially occurring within areas of South Gippsland Plains Grassland (EVC 132_62). Surveys of the remnant native vegetation on the site indicated that the listed threatened community Natural Damp Grassland of the Victorian Coastal Plains did not occur.

5.2. General fauna assessment

5.2.1. Methodology and timing

An initial overview assessment was carried out in March 2015. 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).

5.2.2. Results

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).

See section 4.1 for detailed description.

During the field assessment 120 fauna species were recorded. This included 1021 bird (10 introduced), 10 mammal (5 introduced), six reptile, three frog, and an array of invertebrate species.

Potential occurrence of listed species

The review of existing information indicated that 49 fauna species listed under the Commonwealth EPBC 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. The likelihood of occurrence of these species in the study area was assessed and the results are presented in Table 3. Those considered as having the potential to occur are highlighted grey.

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.

Table 3: Listed fauna species from the search region and their 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				
Birds							
Australasian Bittern	*Botaurus poiciloptilus*	EN		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)	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, As 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.**
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)	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.**
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 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.**

Common Name	Scientific name	Conservation Status		Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M				
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.**
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		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))	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.**
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 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))	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.**

Common Name	Scientific name	Conservation Status		Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M				
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
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 Tern	*Sternula albifrons sinensis*		M (JAMBA, CAMBA, ROKAMBA, Bonn (A2S))	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)	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		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				
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)	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**
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		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))	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.**

Common Name	Scientific name	Conservation Status		Habitat	Number of records	Date of last record	Likelihood of occurrence
		EPBC - T	EPBC - M				
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-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**
Grey-headed Flying-fox	*Pteropus poliocephalus*	VU		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**
Long-nosed Potoroo	*Potorous tridactylus*	VU		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		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		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**
Growling Grass Frog	*Litoria raniformis*	VU		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.**
Australian Grayling	*Prototroctes maraena*	VU		Large and small coastal streams and rivers with cool, clear waters with a gravel substrate and altering pools and riffles (Cadwallader and Backhouse 1983).	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		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,

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

One bird species listed under the EPBC Act (Swift Parrot) was considered to have the potential to occur in the study area. The Swift Parrot could occur occasionally during migration, particularly when in transit between Tasmania and the woodlands north of the Great Dividing Range. This species has not been recorded in the area and the paucity of records in South Gippsland indicate 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. More details on this species are provided in Section 6.2.

Migratory Birds

Seven listed migratory bird species (excluding oceanic species and shorebirds) have been recorded or have the potential to occur near the wind farm site 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 wind farm site 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 in north-western Tasmania (Hull et al. 2013) 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; DoE 2015), so the loss of the occasional individual is expected to have negligible consequences for the species' populations. More details on these species are provided in Section 6.5 and 6.6.

- **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 temporary. Set-

backs of infrastructure from aquatic habitats (in most cases, a small number of access tracks excepted) of at least 200 metres make further degradation of these highly modified habitats highly unlikely. There will be no extensive of substantial modifications to its available habitat. For these reasons, the impacts of the project on the species will be minor. The Latham's Snipe occasionally flies at turbine height but not in numbers or with a frequency likely to result in consistent and regular collision with wind turbines. It is unlikely therefore that the project will represent a significant risk to the species' population.

- Red-necked Stint

  This species is 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 its overall. An important population (i.e. 0.1% of the flyway population, 400+ birds, DoE 2015) would not occur on the site as wetland habitats on the site are not extensive enough to support such numbers.

- Glossy Ibis

  The Glossy Ibis generally occurs in northern Victoria with occasional flocks appearing in coastal areas of Victoria after inland flood-induced breeding events or during droughts. There is one record in the search region from 2001. The nearest other records are near Jack Smith's Lake and in the Latrobe Valley, 30 to 40 kilometres north east and north of the site (Birdata, viewed May 2018). Given this, South Gippsland does not support the species regularly and the risk of an impact on an important population is considered negligible.

- Black-faced Monarch

  This species may occur in areas of remnant woodland during migration. The proposed turbines are situated away from woodland and forest habitats to minimise risk to woodland bird species. In Victoria, the Black-faced Monarch is confined to damp sub-tropical rainforest in gullies in the east of the state (Higgins *et al.* 2006). For this reason, it is expected to fly below RSA between forested areas. Therefore, this species is unlikely to experience an unacceptable impact from the proposed wind farm.

- Rufous Fantail

  This species could occur in remnant areas of native vegetation adjacent to the wind farm site and would confine its routine activities to these habitats. It does not occur regularly in cleared areas, except moving between wooded areas on migration when it has been observed flying low (Higgins *et al*. 2006). For this reason, it is expected to fly below RSA and generally confine its activities to wooded habitats where no turbines are proposed to be built. Therefore, this species is unlikely to experience an unacceptable 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; Bird Data 2018, accessed June 2018). 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 unlikely to experience an unacceptable impact from the proposed wind farm.

Mammals

Based on the assessment in Table 3, the following two listed ground-dwelling mammals have the potential to occur in suitable habitats in adjacent remnant blocks of vegetation. Very limited areas of such habitat occur on the wind farm site itself.

- **Southern Brown Bandicoot** (EPBC Act: endangered)
- **Long-nosed Potoroo** (EPBC Act: vulnerable)

These species prefer habitat with dense vegetation cover (Menkhorst 1995). Removal of vegetation that is potentially suitable has been avoided so the risk of unacceptable impacts should these species use these areas is negligible.

Reptiles

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

Frogs (Growling Grass Frog)

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.

Given the lack of suitable habitat and the lack of recent records (none since the 1970's), no targeted surveys for this species were deemed to be necessary so they 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. More information on this species is provided in Section 6.4.

Fish

One listed fish species was considered to have the potential to occur in the study area. The likelihood of occurrence in the study area and vulnerability of this species to possible impacts from the proposed development is 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 alternating 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. Given that there will be no

impacts on flows or water quality in the Albert River from construction and operation of the proposed wind farm, impacts are not expected on this species. This will 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 tributaries on the site.

5.3. Bird utilisation survey

5.3.1. Methodology and timing

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

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. 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.

Ten fixed survey points were established: eight impact points and two reference points in a variety of habitats. 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 surveys were 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 Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the latest Best Practice Guidelines (Clean Energy Council 2013).

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.

5.3.2. Results

- Species recorded during the formal 2015 bird utilisation survey from the 10 impact and reference sites included 52 species; 43 species at the impact sites and 27 species at the reference sites
- Raven spp., Australian Magpie, Common Mynah, Superb Fairy Wren and Common Starling dominated (over 60% of all birds counted at the site)
- At RSA height, the most frequently observed birds were White-throated Needletail, Common Starling, Magpie-lark, Straw-necked Ibis and Yellow-tailed Black Cockatoo, which accounted for over 59% of all birds recorded at this height. The site does not appear to be part of the regularly used territory of a Wedge-tailed Eagle pair.
- 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.

Full details of the results can be found in BL&A 2016). 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.

These are discussed in greater detail in section 6.5 and 6.6.

5.4. Migratory bird survey

5.4.1. Methodology and timing

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.

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).

More detail can be found in BL&A (2016).

5.4.2. Results

The following migratory shorebird/marine species recorded

- Eastern Curlew *EPBC (CE, m)*
- Whimbrel *VUL (DEPI), EPBC (m)*
- Bar-tailed Godwit *EPBC (m)*
- Common Greenshank *EPBC (m)*
- Red Knot EPBC (E, m) and
- Great Knot *EPBC (CE, m)*
- Red-necked Stint *EPBC (m)*
- Gull-billed Tern *EN (DEPI), EPBC (m)*

The migratory bird species recorded in this survey are strictly intertidal shore or marine birds unlikely to fly inland routinely to utilize dams or other wetlands within the wind farm site. This is supported by the lack of records in or near the wind farm site during intensive field investigations on the site at the correct time of year or in existing databases. The survey results and knowledge of the behaviour of these species indicates that routine movements in Corner Inlet involve low-level flights over water or mudflats between high

tide roosts and low tide, intertidal foraging areas. These flights do not cross the proposed wind farm site and the nearest areas where significant numbers of these species congregate is at least three kilometres from the wind farm site (see Figure 2).

In the present study, the concentrations of coastal migratory shorebirds were at least three kilometres from the boundary of the proposed Alberton Wind Farm so indirect impacts will not occur.

There is a possibility that, when migrating to and from the coastal habitats nearby, shorebirds may fly across the proposed Alberton Wind Farm site. This is explored below further.

Studies have been undertaken of coastal shorebirds when departing on long-distance migratory flights. Shorebird migration has been described by a number of authors (Lane & Jessop 1985; Piersma et al. 1990; Alerstam et al. 1990, Piersma et al. 1990, Hedenstrom et al. 1992, Swennen 1992; Hedenstrom and Alerstam 1994, Tulp et al 1994, Piersma et al, 1997, Alerstam and Gumundsson 1999). 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, together with the location of the nearest concentration of larger shorebirds to the site at the western end of Sunday Island, more than five kilometres away, it is highly unlikely that by the time they crossed the proposed wind farm site those migrating

northwards from the nearby intertidal habitats would remain low enough to interact with operating turbines.

Consequently, none of the populations of the above birds is likely to be affected by the construction and operation of the proposed wind farm.

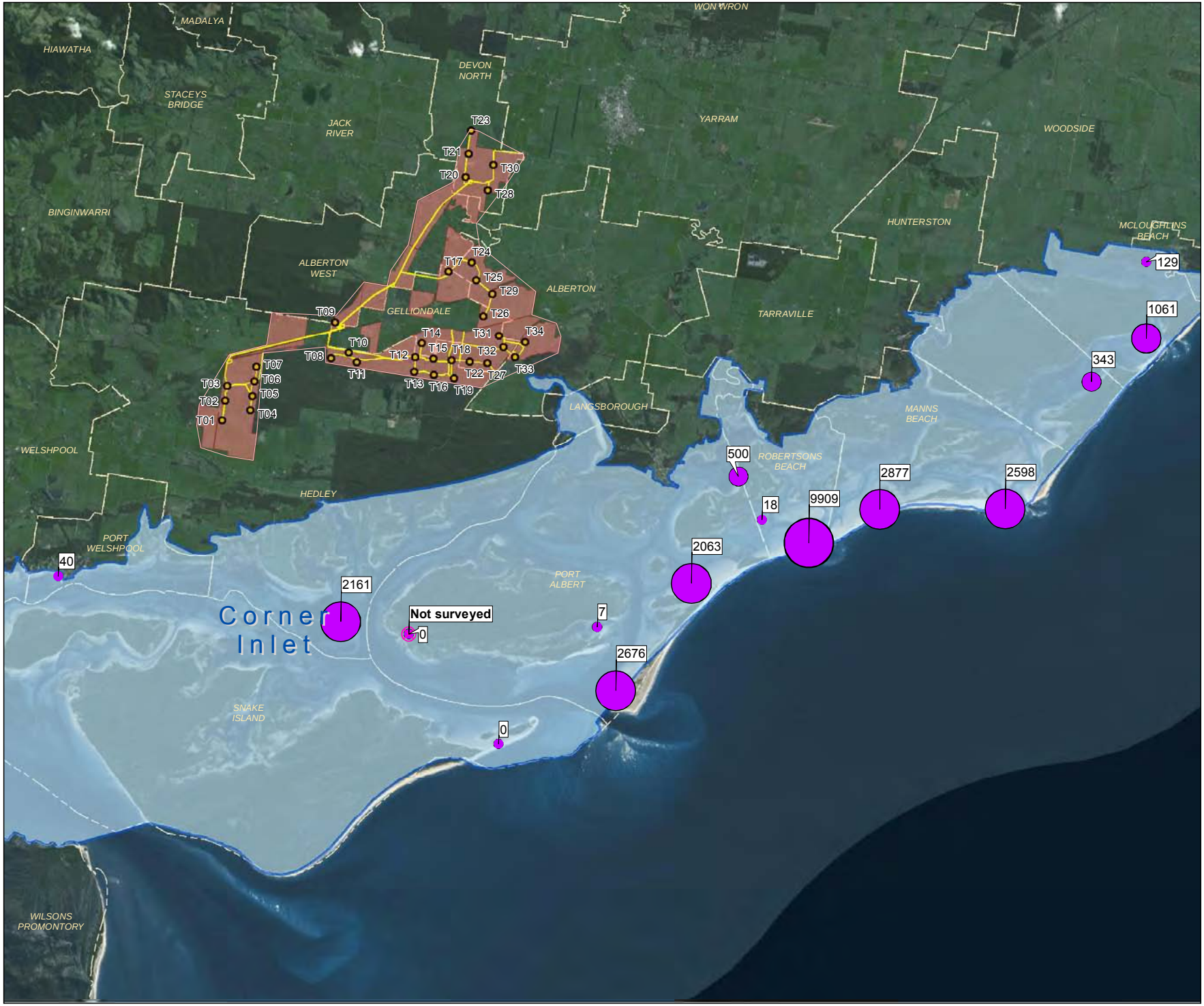
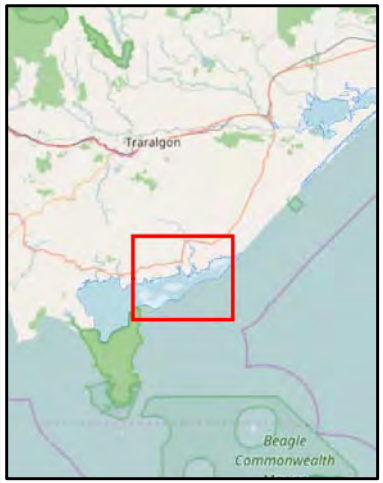


Figure 2: 2010-2016 sum of average migratory shorebird counts

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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5.5. Bat utilisation survey

5.5.1. Methodology and timing

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

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 above the ground and the other at ground level.

Eight species of bats and three species complexes were recorded from five locations within proposed Alberton Wind Farm site. Seven of these species are known to be widespread and common, while the Eastern Falsistrellus is uncommon, although widespread in its distribution (Menkhorst 1995). Three species complexes—unable to be distinguished—were also recorded and involved common and widespread species. No threatened bat species were recorded within the wind farm site. Full details of the bat study, including survey methods, are provided in BL&A (2016).

5.5.2. Results

Species and species complexes recorded

- White-striped Freetail Bat
- Southern Freetail bat
- Eastern Freetail Bat
- Gould's Wattled Bat
- Chocolate Wattled Bat
- Eastern Falsistrellus
- Large Forest Bat
- Little Forest Bat
- Gould's Wattled Bat / Freetail Bat sp.
- Long-eared Bat
- Forest Bat sp.

Bat activity during the nights of recording varied between the different species, time of recordings and the habitats at the recording sites.

The Large Forest Bat and Little Forest Bat were recorded most frequently, with their calls constituting about 49.4% and 25.0% of all bat calls respectively. 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 and was probably the product of site characteristics and the prevailing weather conditions.

6. DESCRIPTION OF POTENTIAL IMPACTS

6.1. Overview

The following species and listed communities that were initially assumed to potentially occur were assessed as not being impacted by the project due to them occurring in low numbers, being ruled out during targeted surveys or no impacts being expected (see Sections 5.1.2 and 5.2.2).

Listed ecological communities

- Natural Damp Grassland of the Victorian Coastal Plains (EPBC Act threatened community)

Flora species

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

Fauna species

- Latham's Snipe
- Eastern Great Egret
- Red-necked Stint
- Black-faced Monarch
- Rufous Fantail
- Satin Flycatcher
- Southern Brown Bandicoot
- Long-nosed Potoroo
- Australian Grayling

Five species have been identified as species of concern by the Department of Environment and Energy (Swift Parrot, Orange-bellied Parrot, Growling Grass Frog, White-throated Needle-tail and Fork-tailed Swift). Potential impacts on these species as well as on the adjacent Ramsar Wetland are described below including detailed descriptions of mitigation measures and residual risk.

6.2. Swift Parrot

6.2.1. 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 (Saunders and Tzaros 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, particularly during inland droughts, 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). They rarely occur in South Gippsland (Emison et al 1987; Birdata records May 2018).

Swift Parrots occur in areas where eucalypts are flowering profusely or where there is 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).

When moving about it's usual foraging habitat, the Swift Parrot generally moves within the canopy of the trees in which it lives (Smales 2005). It is not known how high it flies when making longer-distance migratory or nomadic movements. Smales (2005) indicated that flight height observations for other parrots suggested strongly that most Swift Parrot flights would be below turbine height, although in the absence of species-specific observations, they adopted a modelling input that assumed 25% of migratory/nomadic flights would be at turbine height. However, there is no empirical evidence to support this.

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).

6.2.2. Legislative protection

The Swift 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 Endangered in Victoria on the DSE *Threatened Species Advisory List* (2013a), as Endangered on the *Threatened Species Protection Act 1995* in Tasmania, as Endangered on the *National Parks and Wildlife Act 1972* in South Australia, as Endangered on the *Threatened Species Conservation Act 1995* in NSW, as Endangered on the *Nature Conservation Act 1992* in Queensland and Vulnerable on the *Nature Conservation Act 2014* in the ACT.

A National Recovery Plan has been prepared for this species (Saunders and Tzaros 2011). The Recovery Actions incorporate the aims of the Victorian Action Statement (DSE 2003)

as it relates to management activities and programs required in Victoria to meet conservation objectives.

6.2.3. Population

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 considering that some birds were probably missed during that count, 2,500 is the maximum recent population estimate (Garnett *et al*. 2011).

6.2.4. Records

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 4 and shown in Figure 3. Victorian records of the species are shown in Figure 5.

Table 4: 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 3.

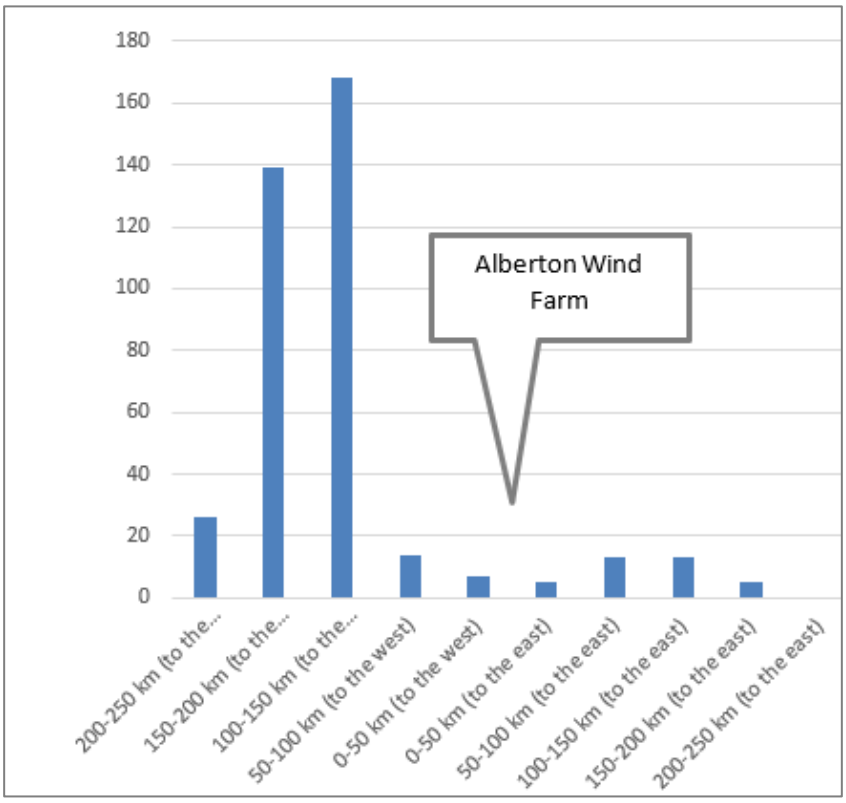


Figure 3: Number of Victorian Swift Parrot records within 60 kilometres of the coast from the VBA in 50 kilometre intervals east from Western Port, either side of the Alberton Wind Farm.

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 EVCs 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 Birdata records).

Consistent with the AusWEA (2005) best practice guidelines for wind farm and bird impacts (prepared with extensive regulator input), more detailed investigations such as site-specific surveys and collision risk modelling are triggered if the impacts are assessed to represent a moderate or high risk to the species. In this context, as the risk was assessed as low, targeted surveys were deemed unnecessary.

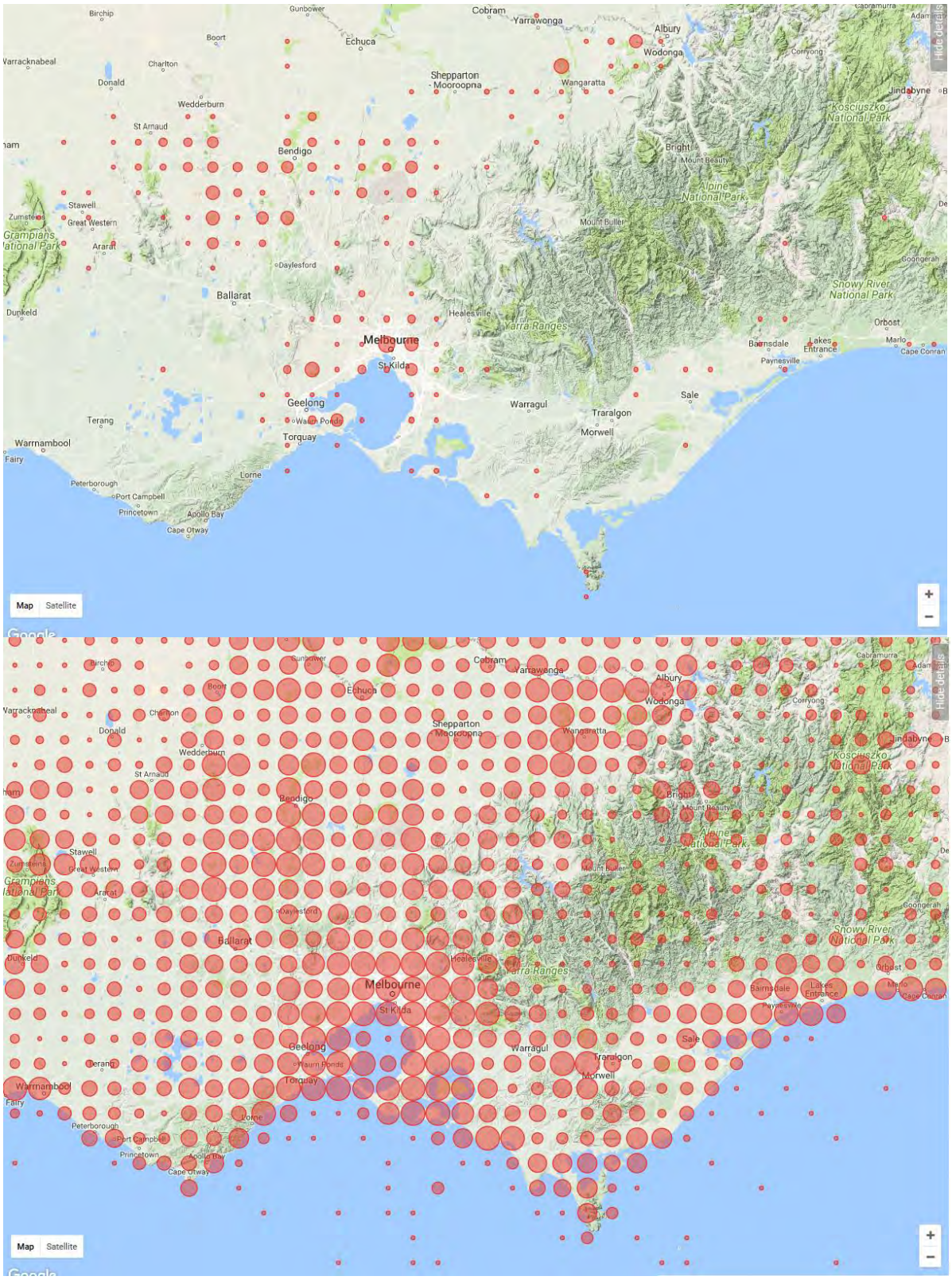
An additional source of information on the status of the Swift Parrot in the region and in Victoria is the Birdlife Australia 'Birdata' database (accessed May 2018). Figure 4 below compares the occurrence of the Swift Parrot in its Victorian range with the survey effort. This shows that survey effort in South Gippsland is comparable with other parts of the species' range yet there are many fewer records of the Swift Parrot in this region.

Comparison of this data source with the VBA database (see Figure 5) shows a similar lack of records in South Gippsland in these two independent sources of information, adding certainty to the conclusion that South Gippsland is not regularly frequented by the species compared with elsewhere in its range.

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.

Figure 4: Map of Swift Parrot distribution (reporting rate as percentage of all records – top map) and survey effort (bottom map)

source: Birdlife Australia Birdata database, accessed May 2018 (Used under license through Google Earth Pro®).



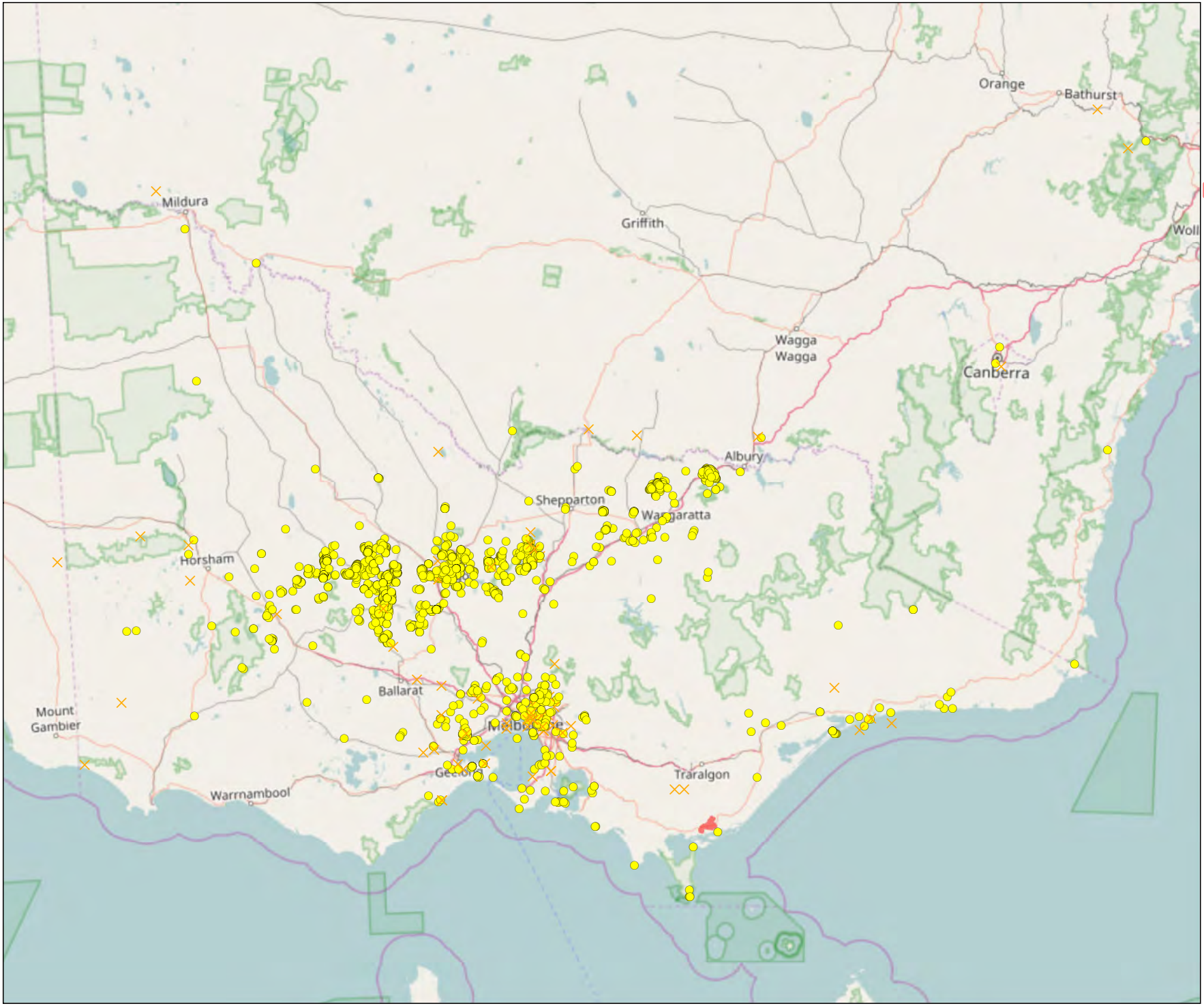


Figure 3: Records of the Swift Parrot in Victoria (source: VBA)

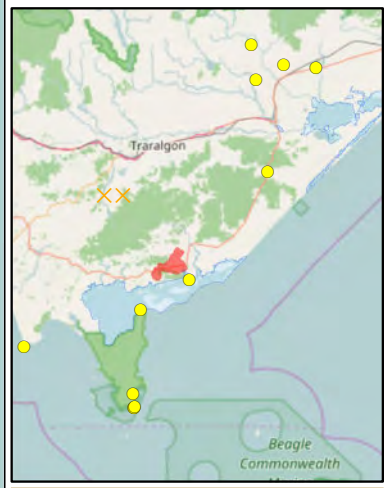
Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 29/06/2017

Legend

Wind Farm site

Swift parrot records

- 1980 - onwards
- Pre 1980



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6.2.5. 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 6 maps the areas of eucalypt woodland and forest and the Ecological Vegetation Class (EVC) to which they belong.

The National Recovery Plan for the Swift Parrot (Saunders and Tzaros 2011) outlines the preferred foraging habitat on mainland Victoria as:

- Yellow Gum *(Eucalyptus leucoxylon)*;
- Red Ironbark *(Eucalyptus tricarpa)*;
- Mugga *(Eucalyptus sideroxylon)*;
- Grey Box *(Eucalyptus macrocarpa)*; and
- Yellow Box *(Eucalyptus melliodora)*.

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 *(Eucalyptus viminalis* ssp. *pryoriana)*;
- Swamp Gum *(Eucalyptus ovata)*; and
- Yellow Stringybark *(Eucalyptus 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 5. Figure 6 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, as these support an abundance of the preferred species listed above, 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 3 and 4).

Although Golden Wattle was recorded from the study area it was only found, and at low cover, in one small, poor-quality grassland habitat (0.177 hectares) in the south-eastern corner of the site. This species does not comprise part of the vegetation typically associated with any of the EVCs present on the site. It is therefore not considered here to be a potential food source, and certainly not an attractant, for the Swift Parrot.

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). During periods of drought in central Victoria, Swift Parrots may concentrate in coastal drought refuge habitats in New South Wales, as observed in 2002 and 2009 (Tzaros *et al.* 2009, cited in Saunders and Tzaros 2011). 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.

The species can use a wider range of tree species than their preferred Eucalypt species listed above, including Lerp and Golden Wattle; however, this is done opportunistically when preferred sources are unavailable or scarce (Saunders and Tzaros 2011). For example, Golden Wattle is a significant component of the understorey in the preferred Box Ironbark forests on northern Victoria; it is not a common understorey component in the EVCs that occur on and around the Alberton Wind Farm. Swamp Gum could act as an opportunistic food source in the study area (Table 5). However, although Swamp Gum flowers in winter, the extent of its occurrence near the proposed wind farm is limited to less than three hectares of vegetation over the 2,900-hectare site. Swamp Gum has also been extensively cleared from the wider area (most of the land that once supported this species has been drained and cleared in the region and is used now for agriculture, representing as it does the most fertile soils in the region). Therefore, the site and its surrounds are unlikely to provide a significant and regular food resource for the parrot. For this reason, the forests and woodlands near Alberton would not act as a drought refuge for the species.

Table 5: 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: Autumn, Winter (Gippsland)																

PGF = Plains Grassy Forest (EVC 151)

FRW = Floodplain Riparian Woodland (EVC 56)

HW = Heathy Woodland (EVC 48)

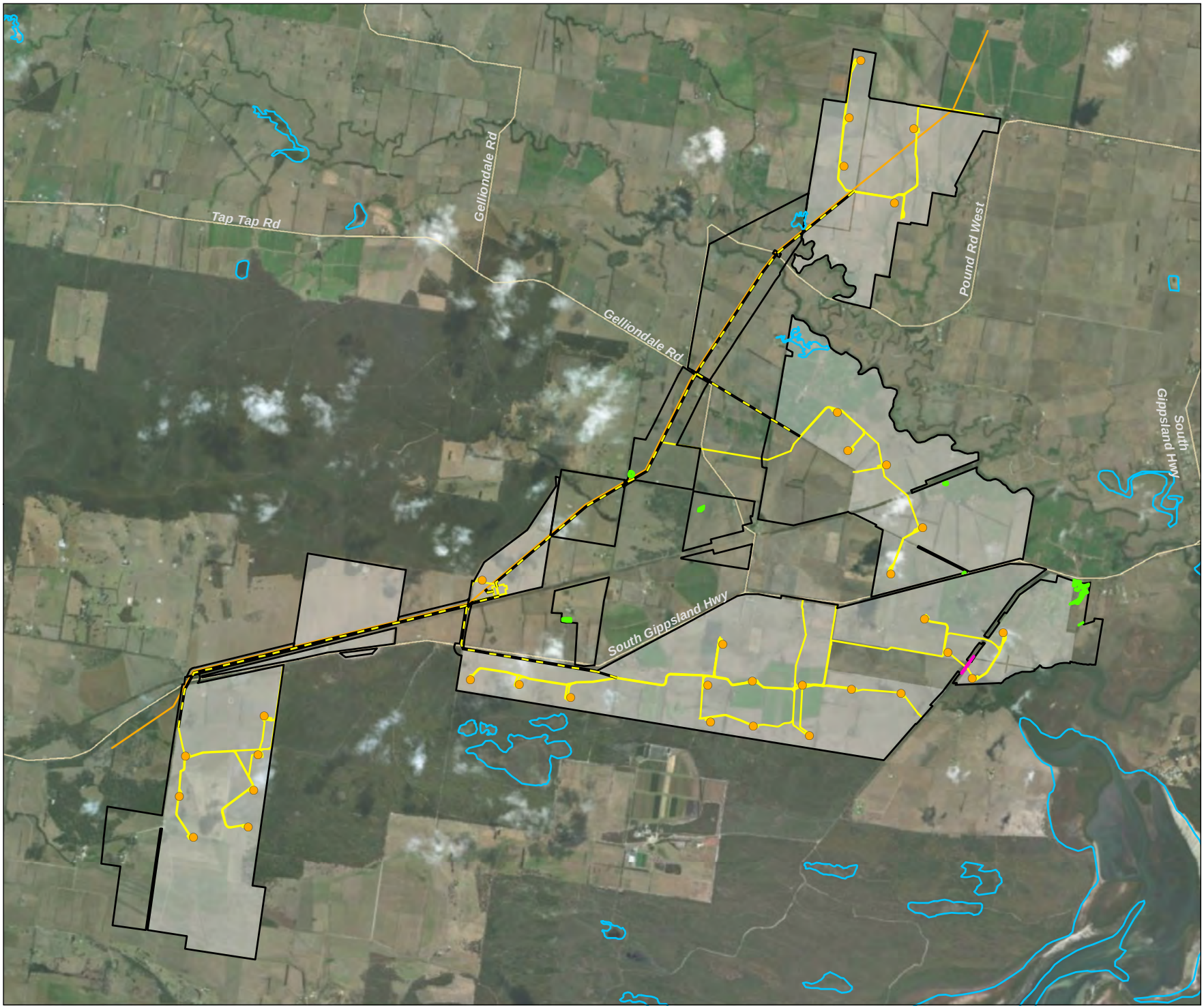

Figure 6: Extent and location of Swamp Gum and Golden Wattle occurrence

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Grassland with Golden Wattle
- Swamp Gum area
- DELWP wetlands
- Freehold land
- Upgrade & augment existing powerline
- Development footprint
- Existing powerline
- Turbines

N

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14107.3 - Date: 22/06/2018 - Created by: nmay / dcoppolino - E:\GIS\2014 Jobs\14107\14107.3 FIG 5 Swamp gum 180622.mxd

6.2.6. Potential Impacts

The National Recovery Plan (Birds Australia 2011) mentions the following major threats to the survival of the Swift Parrot population:

- the loss and alteration of foraging and nesting habitat through
  - forestry activities, including firewood harvesting; and
  - residential, industrial and agricultural development;
- climate change impacts;
- competition for foraging and nesting resources;
- mortality from collisions with human-made objects;
- Psittacine beak and feather disease; and
- illegal bird capture and trade.

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. As discussed in the previous section habitat on and around Alberton Wind Farm is not suitable for the species. Consequently, despite good survey effort, there are very few records of it in the region. The information on the suitability of the area for the Swift Parrot is corroborated by the distribution information. The lack of Swift Parrot use of the area means that the risks to the species from wind farm impacts, such as habitat removal, indirect disturbance and barrier effects are negligible.

The National Recovery Plan for Swift Parrot (Saunders and Tzaros 2011) cites wind energy turbines in south-eastern Australia in poorly sited areas as having implications for Swift Parrot conservation. Smales (2005) modelled the collision risk of 39 wind farm proposals in south eastern Australia for the Federal government to determine their cumulative impact on this species. 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 collide with a wind turbine. This indicated that the risk of wind farms to this species is low. Collision risk would be low in the Alberton region due to the infrequent use of the area by the species. Examination of Smales (2005) modelling indicates very small numbers of flights were modelled in this region compared to other parts of the species' range where it is known to occur more consistently. This is expected given knowledge then and now of the distribution of the species within its broad range. The Alberton Wind Farm is therefore not poorly sited and will not contribute to the decline of the Swift Parrot. For this reason, collision risk modelling was not considered necessary and nor would it be possible to generate a local, empirical basis for model inputs as surveys would be unlikely to detect the species.

The Department of Environment and Energy has asked that consequential impacts, including potential impacts from making the site more accessible (such as firewood harvesting/theft, poaching and any incidental recreational use of land or roads) be considered. The wind farm site is located on private land and private land access controls will continue to apply as they do currently. The project will therefore not lead to any increase in consequential impacts of concern raised by the Department.

6.2.7. Monitoring and mitigation measures

The following measures have been adopted by the proponent to mitigate impacts on birds:

- 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.

A Bat and Avifauna Management Plan (BAMP) will be prepared as a framework for monitoring and mitigating impacts from the operation of the wind farm. Responsibility for implementing this will rest with the wind farm owner and operator. At Victorian wind farms approved in the last fifteen years, BAM Plans have been a condition of approval, to be prepared and approved by the Responsible Authority prior to construction commencing. Many of these have been implemented. The Victorian BAM Plan model has been developed over this period through extensive consultation between proponents, experts/consultants and DELWP (and its predecessors). These plans include two components:

- The on-ground monitoring investigations; and
- The adaptive management framework.

These are discussed below.

Monitoring

The BAM plan of the Alberton Wind Farm will include a rigorous carcass monitoring regime, including monthly carcass-searches around all turbines for bats and birds that have collided. The effectiveness of this method in relation to listed threatened bird species of concern can be assured by increasing search frequency to fortnightly or weekly in the event that Swift Parrot or Orange-bellied Parrot is found inhabiting the wind farm site (based on seasonally appropriate searching of the site and nearby suitable habitats) The consistent application of this protocol will ensure that statistically robust, spatially and temporally consistent data on all bird and bat mortality are collected. Seasonally appropriate surveys will determine if the two species of concern are present triggering an increased carcass search frequency.

Estimates of carcass removal by scavengers (expressed as the average carcass duration) are used to correct for the fact that scavenging reduces the number of detected bird and bat carcasses under wind turbines. Scavenger trials will be conducted to estimate the length of time bird and bat carcasses remain detectable before being scavenged.

Searcher efficiency trials will be conducted concurrently with scavenger trials. The efficiency trial will enable an estimate of the percentage of carcasses found by searchers.

Adaptive Management

In addition to routine and seasonally targeted monitoring, the BAMP will set up a management and reporting framework to respond to particular 'impact triggers'. Relevant to EPBC Act -listed threatened species (i.e. Swift Parrot and Orange-bellied Parrot), the BAMP will include the following impact trigger (consistent with recently approved plans in both Victoria and New South Wales):

Impact trigger for threatened species - A threatened bird/bat species (or recognisable parts thereof) listed under the EPBC Act or FFG Act is found dead or injured under or close to a wind turbine during any mortality search or incidentally by wind farm personnel.

If a threatened species impact trigger event occurs, further investigation will immediately be required and the decision-making framework outlined in Figure 7 will be followed. This will be

the responsibility of the wind farm project owner and operator in accordance with the timeframes indicated in this Figure.

As the mitigation measures need to respond to a specific set of circumstances for a species of concern, it is difficult to predict exactly what measures would work best until the triggered investigations provide greater understanding. In the past, mitigation measures approved BAM plans have included but not been limited to:

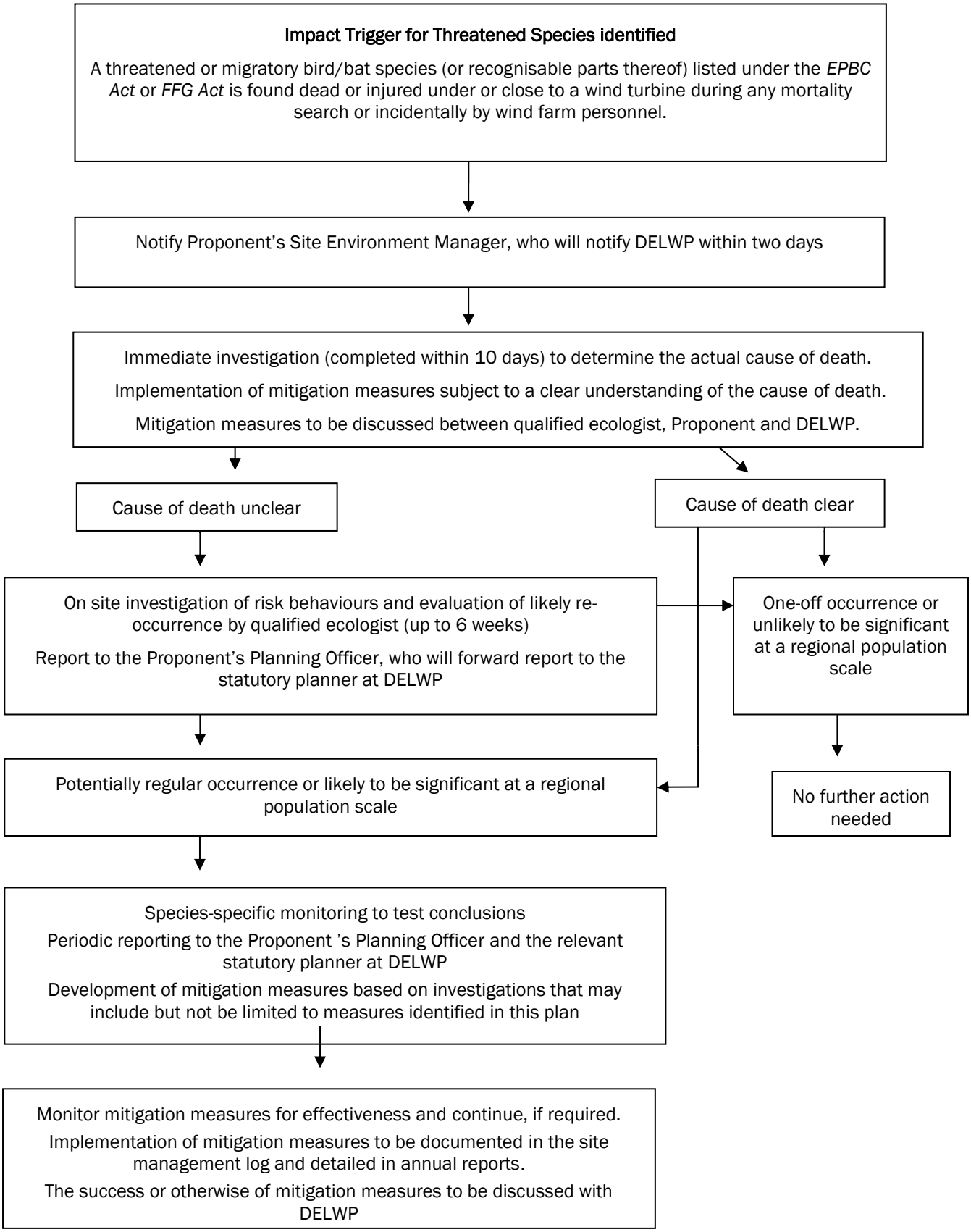
- Encourage species into alternative areas outside of the wind farm boundary, where available, through the use of social attraction techniques offsite (decoys and audio playback systems) – this would remove the species from the area of risk;
- Investigate and, if considered appropriate, remove foraging habitat for the species of concern from the wind farm site – this would remove the species from the area of risk;
- Discuss and consult with the appropriate landowner about halting farming practices that attract a species of concern and removing the attraction – this is most likely to involve ceasing or relocating grain feeding that attracts rare birds, a measure that would remove the species from the area of risk;
- Discuss and consult with the appropriate landowner about filling in any dam that attracts a species of concern and providing alternative stock watering arrangements – this would remove any waterbird of concern from the area of risk;
- If lighting is contributing to the risk, switch off any lighting temporarily while species is on or near the wind farm site – this would ensure any disorientation of flying birds resulting from bright lighting wold no longer affect the species in the area of risk; and
- Informed by an understanding of the behaviour of the species of concern, selective turbine shut down during high risk periods – this would remove the risk from the aera and period of concern.

6.2.1. Residual impacts

The adaptive management and decision-making framework established through the BAMP for the project will ensure a thorough and timely response to any detected residual impact, involving a combination of targeted investigations and adaptive management measures undertaken in close consultation with DELWP and, if required, DoEE.

Should unanticipated impacts occur to the two threatened bird species of concern then the relevance of the mitigation measures above will be evaluated in consultation with the relevant regulators and a targeted mitigation program developed, informed by the results of a thorough investigation of the circumstances leading to the unanticipated impact. Where an offset is required, the form of this offset will be discussed with the relevant regulator and any mitigation will implemented in a timely manner to the regulator's satisfaction. Any contingency offset required would be calculated in accordance with the EPBC Act Environmental Offsets Policy Offset Guide (DSEWPAC 2012) and be to the satisfaction of the Commonwealth government.

Figure 7: Decision making framework for identifying and mitigating impact triggers for threatened species



6.3. Orange-bellied Parrot

6.3.1. 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).

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.

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.

On the mainland, they mainly inhabit saltmarshes dominated by Beaded Glasswort, Southern Sea-heath, 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.

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.

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.

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 8).

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).

6.3.2. 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 Victoria on the DSE *Threatened Species Advisory List* (2013a), 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).

6.3.3. 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. Since then, that number has dropped down to 36 individuals in the wild.

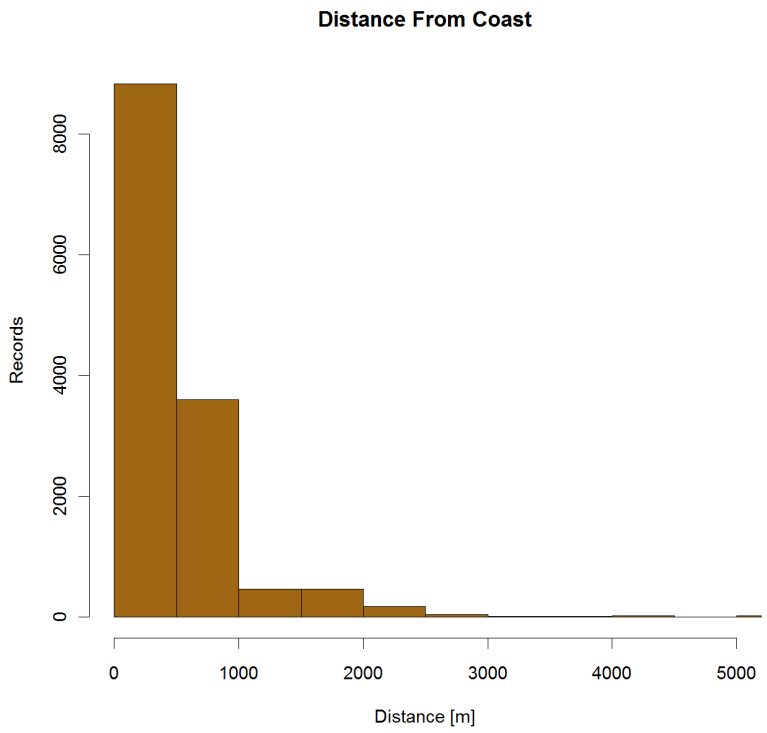


Figure 8: Total number of individual OBP counted versus distance from coast

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 have been 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 remain in the wild, supplemented in the last three years by released captive-bred birds (released in both south west Tasmania and at Werribee in central Victoria). 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).

6.3.4. Records

In Corner Inlet, 17 records of the parrot were found, mostly between 1980 and 1991, with one record since then (10 kilometres south of the wind farm site) in 2004. These records are shown in Figure 9 and listed in Table 6. Most involved one or two birds, with one record of three and one of five. There have been no records in the last 14 years in Corner Inlet.

Table 6: 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

Locality	Latitude	Longitude	Date	Count
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 is 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 – see Figure 9).

Available information on the species' ecology, current distribution and movements, combined with the habitat assessment of the site is sufficient to determine the likelihood of occurrence of the Orange-bellied Parrot on the wind farm site. This has concluded that it is unlikely to occur in a way that puts it at risk of impacts. As only 2% of individuals in Victoria have been recorded greater than two kilometres from the coast and given a lack of suitable habitat on the Wind Farm site, the risk to the species was considered low.

This conclusion is corroborated by the information presented in Figure 10. This shows records of the OBP from Victoria versus the number of bird records subsisted to the Birdata data base (accessed May 2018). This shows a comparable level of observer effort in coastal South Gippsland to elsewhere in the species' range yet no recent records of the species east of Wilsons Promontory. This adds to the certainty of the conclusion that the species is unlikely to occur regularly in the region or on the wind farm site.

Consistent with the AusWEA (2005) best practice guidelines for wind farm and bird impacts (prepared with extensive regulator input), more detailed investigations are triggered if the impacts are assessed to represent a moderate or high risk to the species. As the risk was assessed as low, targeted surveys were deemed unnecessary.

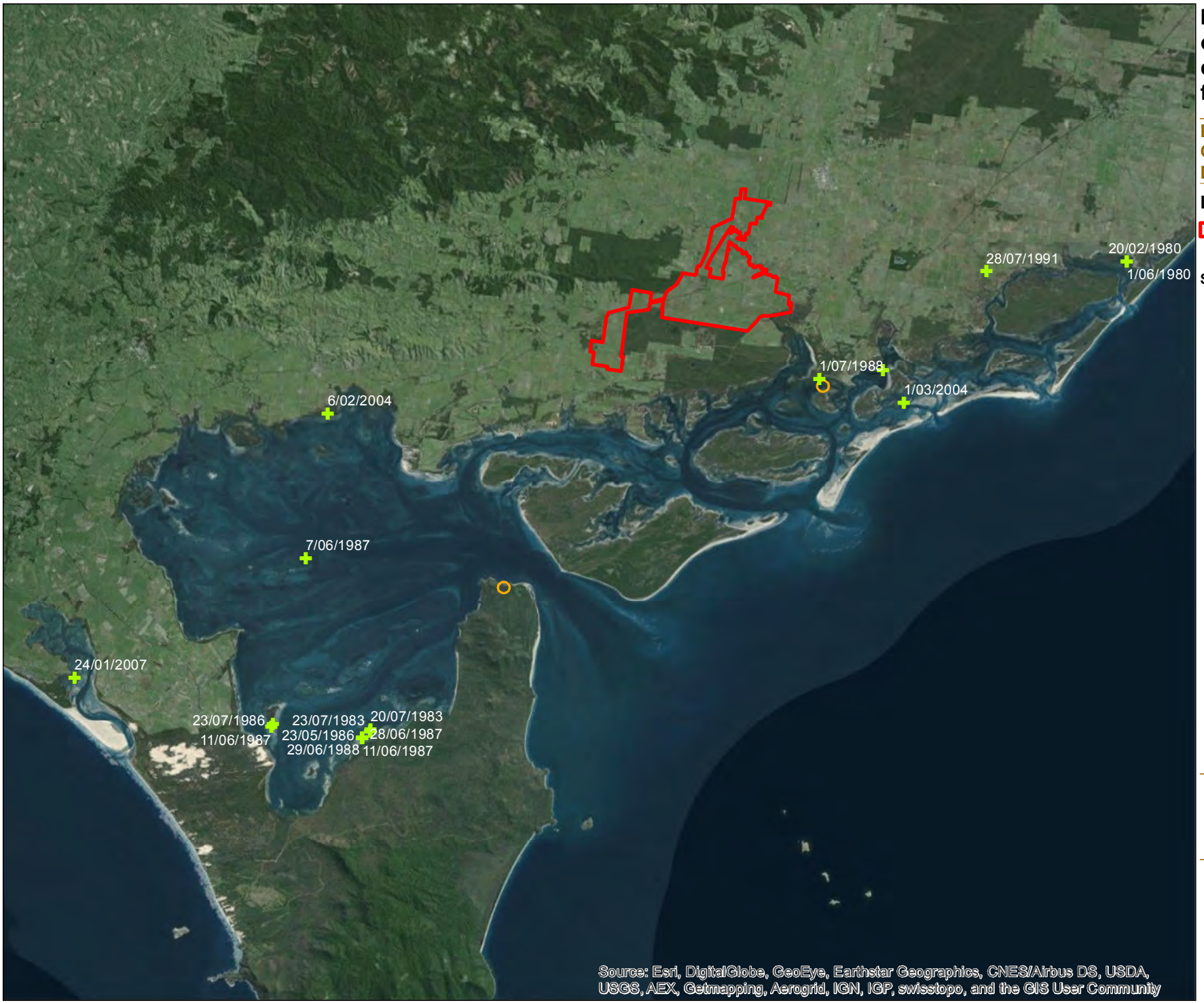


Figure 9: Total number of individual OBP counted versus distance from coast.

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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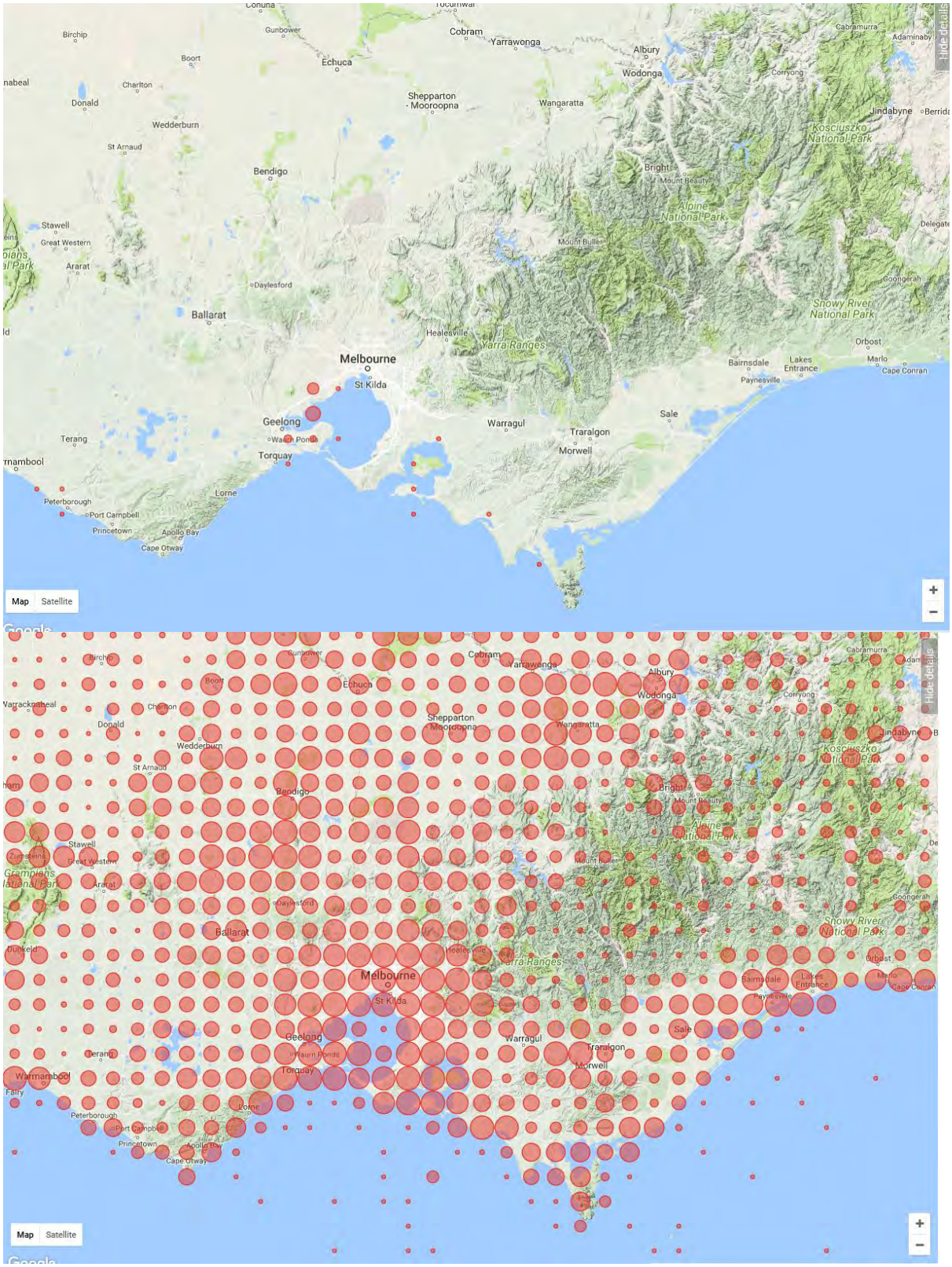
Figure 10: Map of Orange-bellied Parrot distribution – reporting rate as percentage of all records (top map) and survey effort (bottom map)
(source: Birdlife Australia Birdata database, accessed May 2018, used under licence from Google Earth Pro®).



6.3.5. *Habitat at the Alberton Wind Farm*

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 2016). 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.

6.3.6. *Potential Impacts*

The recovery plan for the Orange-bellied Parrot (DELWP 2016) tabulates the key threats to the species. These are summarised in Table 6 below.

Table 7: Threats to the Orange-bellied Parrot listed in the OBP Recovery Plan (source: DELWP 2016)

Threat	Cause	Evidence for impact	Risk Rating
Degradation and loss of habitat	Development and land use change	Strong	Very High
	Inappropriate hydrological regimes	Strong	Very High
	Inappropriate grazing regimes	Weak	Moderate
	Inappropriate fire regimes	Moderate	Very High
	Invasive weeds	Strong	Very High
	Disturbance from human activities	Moderate	Moderate
Loss of genetic diversity and inbreeding		Strong	Very High
Disease		Moderate	High
Stochastic environmental events		Moderate	Very High
Climate change		Moderate	Very High
Predators and competitors		Moderate	Very High
Barriers to migration and movement		Weak	Moderate
Consumption of toxic food plants		Weak	Low
Hybridisation with Blue-winged Parrots		Weak	Low
Negative effects of management activities		Moderate	Moderate

The plan comments that wind turbines may represent barriers to migration and movement particularly if located on the main migration route. Based on recent records, Corner Inlet has not been used by migrating Orange-bellied Parrots, particularly given the significant decline in the population since the 1990's when the species was last recorded periodically there. South Gippsland represents the edge of the original migration route for this species (DELWP 2016) and it is less used now than in the past compared with the Victorian coast north from King Island, their main migration staging site (see Figure 10).

The maximum total 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% of individuals using this part of its range) and assuming a maximum population of 200 individuals, the number of individual

Orange-bellied Parrots expected to migrate through the eastern part of its range per year has been calculated to be up to two individuals (1% of 200).

For this reason, collision risk modelling was not considered necessary and nor would it be possible to generate a local, empirical basis for model inputs as surveys would be unlikely to detect the species.

Notwithstanding this, given this low level of occurrence and potential risk, the project will 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 and distribution. 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 as it lies outside the area where habitat protection and management actions should be targeted (i.e. further west).

6.3.7. Mitigation measures

No specific mitigation measures for the Orange-bellied Parrot are warranted given the negligible risk involved and the location of the wind farm away from the usual coastal saltmarsh habitats used by the species. Notwithstanding this, the required Bat and Avifauna Management Plan (BAMP) for the project will provide a clear procedure (used at other wind farms in Victoria) in the event that an impact is detected. This procedure is set out for the Swift Parrot in Section 6.2.7 above. It will also apply if an Orange-bellied Parrot is found under a turbine. The BAMP covers ongoing monitoring, impact triggers and action responses following the decision-making pathway outlined in Figure 7. Mitigation measures discussed in Section 6.2.7 above would also apply.

6.3.8. Residual Impacts

Due to the rigorous monitoring program and decision-making framework proposed (as described for the Swift Parrot), residual impacts on the Orange-bellied Parrot are considered acceptably low. Should an impact be detected then a thorough and timely investigation and subsequent management effort will be triggered consistent with the Bat and Avifauna Management Plan, which will include the impact trigger and procedure for reporting and investigation shown in Figure 6.

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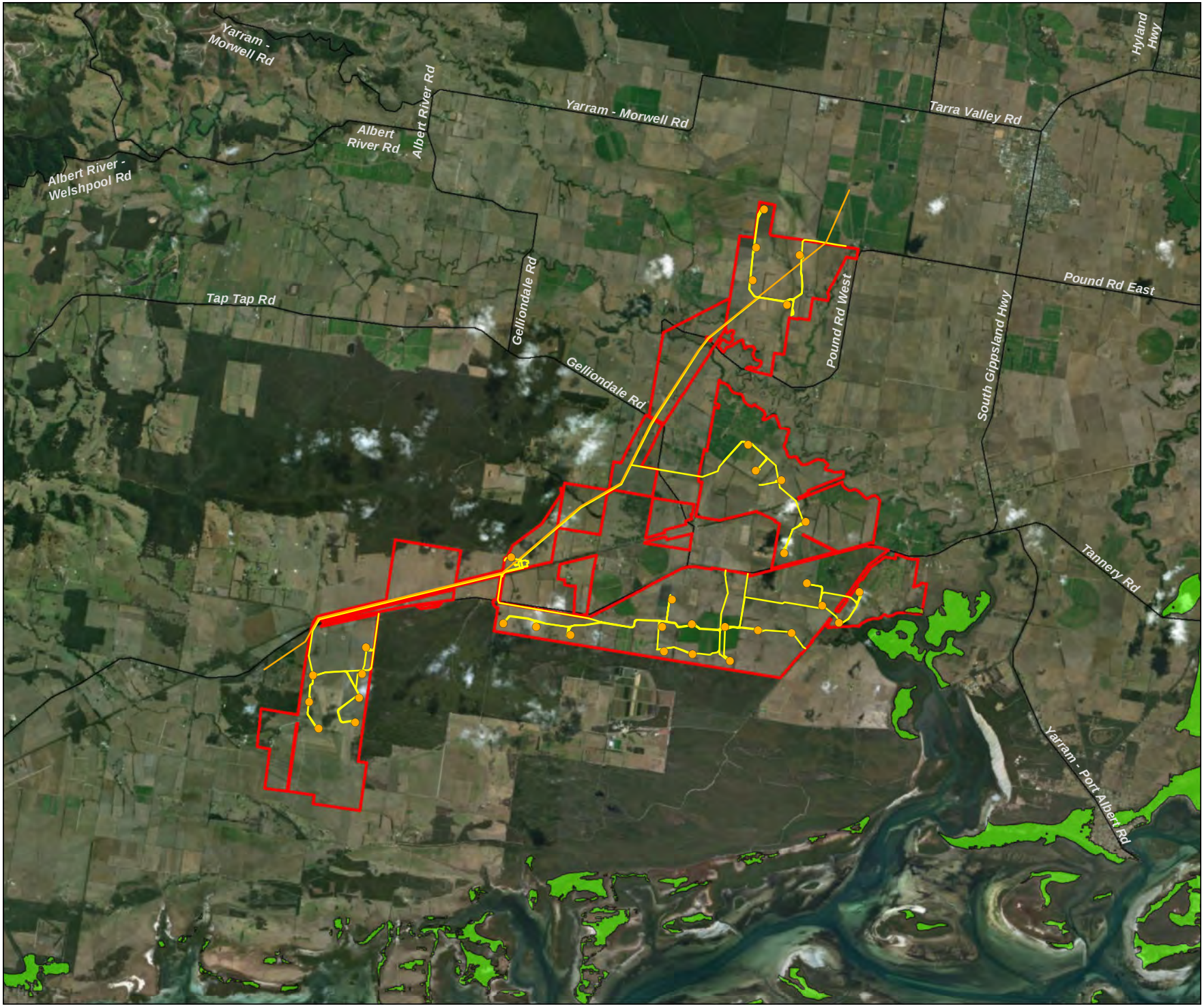

Figure 11: Study area and modelled Coastal Saltmarsh

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd

Legend

- Study area
- Development footprint
- Existing powerline
- Turbines
- Coastal Saltmarsh

N

Kilometers
0 3

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6.4. Growling Grass Frog

6.4.1. 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 12.

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.

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.

6.4.2. Habitat at the Alberton Wind Farm

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.

6.4.3. Legislative protection

The Growling Grass Frog is listed as Vulnerable under the EPBC Act 1999 and is protected under relevant state legislation across its range throughout south-eastern Australia. In Victoria it is listed under the FFG Act 1998 and considered Endangered according to the *Threatened Species Advisory List* (DSE 2013a).

6.4.4. Potential impacts

The significant impact guidelines for the nationally vulnerable Growling Grass Frog (DEWHA 2009) state that the principal threats most relevant to judgements on significance include:

- Habitat loss, degradation and modification.
    - Draining, infilling or changes to flooding patterns of permanent and non-permanent water bodies, or their adjoining watercourses and surrounding vegetation.
    - Alteration of wetland hydrology, diversity and structure.

  - Removal of aquatic vegetation.
  - Clearing of terrestrial vegetation, fallen logs and ground debris surrounding water bodies.
  - Deterioration of water quality and any introduction of pollutants and biocides.
  - Introduction of domestic stock or feral animals (for example rabbits, goats and pigs) causing damage to banks or terrestrial habitat.
- Fragmentation and isolation of populations.
  - Construction of barriers that limit frog movements between waterbodies (for example buildings, fences, roads, industrial estates etc.).
- Introduced predators and disease.
  - Introduction of exotic fish species.
  - Introduction of feral predators such as foxes and cats.
  - Introduction of the waterborne chytridiomycosis disease caused by the fungal pathogen *Batrachochytrium dendrobatidis*.

The lack of proximity to previously recorded occurrences and known populations, and absence of suitable breeding and/or dispersal habitats within the Alberton Wind Farm site indicate that the Growling Grass Frog is unlikely to occur within the area of the proposed development. Further consideration of the above-mentioned impacts is therefore unwarranted at this stage.

6.4.5. Mitigation measures

Provided a suitable buffer of at least 50 metres is provided from waterways and wetland habitats impacts on frog habitat in general are not expected.

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:

- Apart from a small number of minor drainage line crossings (see next point), all infrastructure associated with the development is at least 200 metres from a natural waterway. This will retain an appropriately sized buffer zone in accordance with the specifications outlined in the EPBC Act policy statement (DEWHA 2009) and the state government's species strategy (DEPI 2013);
- 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, which will require the approval of the CMA.
- Access tracks will typically be 4.5 metres wide and crossings will involve a single drainage pipe under the track surface and will be constructed with crushed rocks. 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 relocation protocol will be developed and implemented to avoid impacts on this species. Species are to be relocated away from future harm but within the same waterway to avoid the spread of chytrid fungus.

These measures will be incorporated into a construction environmental management plan for the project that will be prepared as a condition of approval.

6.4.6. Residual impacts

The mitigation measures outlined above will make sure that the project will have no unacceptable residual risk to the Growling Grass Frog, should it occur in the area.

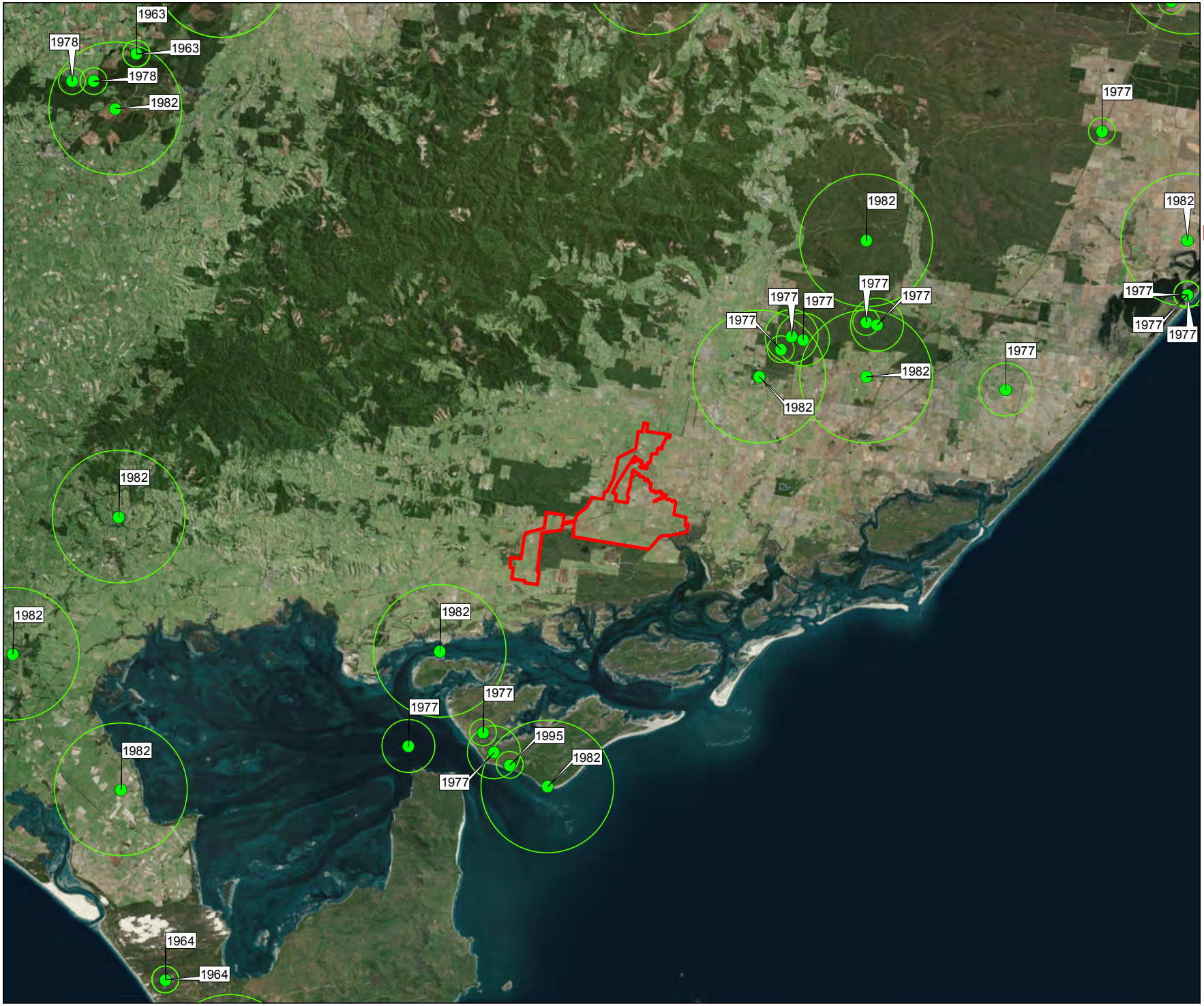

Figure 12: VBA Growling Grass Frog records

Project: Alberton Wind Farm
Client: Synergy Wind Pty Ltd
Date: 6/03/2018

Legend

- Study area
- GGF records, recorded date and estimated accuracy (circles)

N

Metres

0 4,000 8,000

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6.5. White-throated Needletail

6.5.1. 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.

6.5.2. 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 2013a).

6.5.3. 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 10 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.

6.5.4. Records

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 (Table 8), including the BL&A record from within the wind farm site.

Table 8: 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

6.5.5. Potential impacts

According to the Commonwealth significant impact guidelines (DoE 2013a), 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 at an operating wind farm involving a small number annually (Hull et al. 2013). This is much less than an ecologically significant proportion of the population, defined as 0.1% of 10,000, or 10 birds per year (DoE 2015). With 34 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 an unacceptable impact will occur at the Alberton Wind Farm.

Although White-throated Needletails are known to roost in trees, this tends to occur in areas of dense forest rather than in agricultural landscapes. Therefore, the trees on on the Alberton Wind Farm site are unlikely to be used for roosting.

6.5.6. Mitigation measures

The White-throated Needletail may occasionally pass through the area during migration. 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.

6.5.7. Residual impacts

As mentioned above, mitigating impacts from wind turbines on the White-throated Needletail is unlikely to be possible due to its aerial lifestyle and presence at the site dependent on responses to fluctuating environmental conditions.

Notwithstanding this, the required Bat and Avifauna Management Plan (BAMP) for the project will provide a clear procedure (used at other wind farms in Victoria) in the event that an impact is detected. This procedure is set out for the Swift Parrot in Section 6.2.7 above. It will also apply if a White-throated Needletail is found under a turbine. The BAMP covers ongoing monitoring, impact triggers and action responses following the decision-making pathway outlined in Figure 7.

6.6. Fork-tailed Swift

6.6.1. Biology

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.

6.6.2. 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).

6.6.3. Records

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 Utilisation 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 in the VBA 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.

6.6.4. Potential impacts

The infrequency with which the Fork-tailed Swift occurs in the region suggests that it would interact with the proposed Alberton Wind Farm only occasionally, when passing through the area.

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 100 birds per year, which is highly unlikely to occur given the species' limited occurrence 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.

6.6.5. Mitigation measures

During migration the Fork-tailed Swift may occasionally pass through the area in response to varying weather conditions. The unpredictability of these movements, together with the aerial habit of the species, means that mitigating impacts from wind turbines is unlikely to be possible. Regardless of this, the potential scale of the impact on this species is not considered to represent an unacceptable risk to its population.

6.6.6. Residual impacts

As mentioned above, mitigation measures for impacts from wind turbines on the Fork-tailed Swift is unlikely to be possible due to its aerial nature and its presence at the site being dependent on particular and changing environmental conditions.

Notwithstanding this, the required Bat and Avifauna Management Plan (BAMP) for the project will provide a clear procedure (used at other wind farms in Victoria) in the event that an impact is detected. This procedure is set out for the Swift Parrot in Section 6.2.7 above. It will also apply if a Fork-tailed Swift is found under a turbine. The BAMP covers ongoing monitoring, impact triggers and action responses following the decision-making pathway outlined in Figure 7.

6.7. Ramsar Wetlands

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 13 and 13a. This indicates

that the proposed wind farm will be constructed mostly well away from the Ramsar site (i.e. greater than one kilometre).

The Corner Inlet Ramsar site was nominated in 1982 and comprises an extensive marine embayment and sand barrier system east of Wilson's Promontory. The Corner Inlet Ramsar Site ecological character description describes the wetland as follows (DSEWPAC 2011):

"Corner Inlet Ramsar site is located approximately 200 kilometres south-east of Melbourne and is the southern-most marine embayment and intertidal flat location on mainland Australia. The site is located at latitude 38 degrees south within the temperate warm summer – cool winter climatic zone …. [It] includes the marine waters and foreshores of Corner Inlet, its sand barrier islands and adjoining catchment areas. The Inlet is bounded by:

- *the South Gippsland coastline to the west and north*
- *a series of barrier islands, sandy spits and Bass Strait to the south-east*
- *the hills of Wilsons Promontory to the south….*

The site is essentially one large area of marine embayment, tidal channels and sandy barrier islands that includes: marine/estuarine areas within Corner Inlet; land areas (above the high water mark) covering the sand islands and spits along the south eastern site boundary; and nearshore coastal areas fringing the mainland …. The site excludes most of the rivers and creeks that flow into the Inlet from the mainland catchments, but does include river and creek mouths. Mainland drainages that flow into the site include (counter-clockwise from northern tip of the site): Bruthen Creek, Neils Creek, Tarra River, Albert River, Muddy Creek, Nine Mile Creek, Shady Creek, Agnes River, Franklin River, Bennison Creek, Stockyard Creek, Poor Fellow Me Creek, Dead Horse Creek, Silver Creek, Golden Creek, Cow Creek, Barry Creek, Chinaman Creek and Tin Mine Creek …. Drainages and other freshwater wetland systems on the sand barrier islands are also included in the site."

Two turbines and associated access tracks and underground power cabling will be located between 600 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.

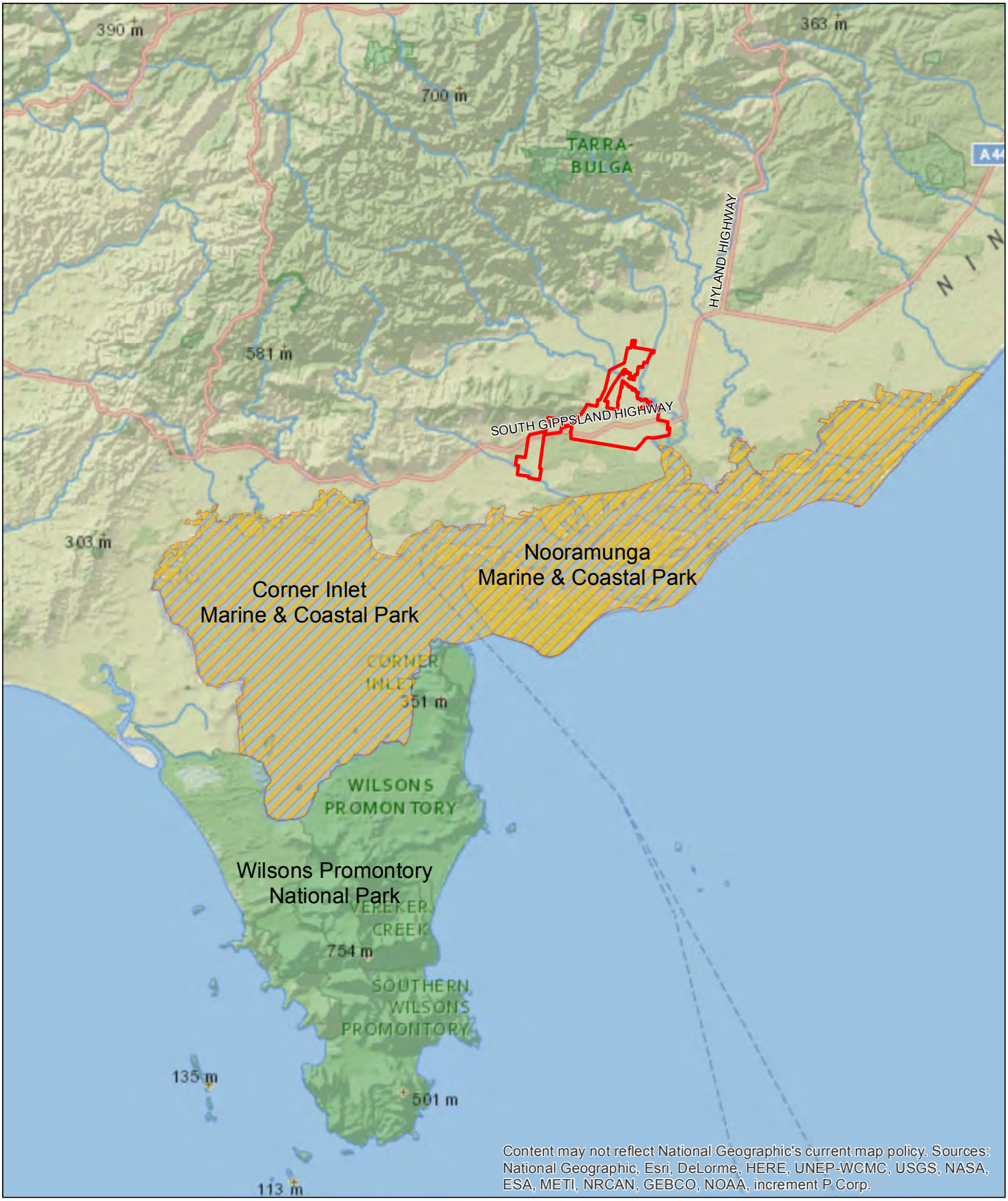

Figure 13: The Corner Inlet Ramsar site and the proposed Alberton Wind

Project: Alberton Wind Farm **Client**: Synergy Wind Pty Ltd **Date**: 25/05/2018

Study area

Ramsar Wetlands

N

Metres

0 6,500 13,000

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6.7.1. Hydrological Assessment (provided by Beveridge Williams)

The proponent has sought the advice of the West Gippsland Catchment Management Authority (CMA) in relation to the proposal. The CMA made the following request in relation to any planning permit which may issue as per the following condition.

All works within 30 metres of a designated waterway require a Works on Waterways permit from the West Gippsland Catchment Management Authority, issued under the Water Act 1989. This includes (but is not limited to) construction of any vehicle access over a designated waterway, and installation of any turbine or associated infrastructure.

A copy of the response from the West Gippsland Catchment Management Authority is contained in Appendix 3.

Hydrology

Golders and Associates undertook a preliminary geotechnical investigation of the site area and their results were presented in their report of the 17 of January 2017 which is contained in Appendix 4.

The report involved:

- A desk top study including a review of:
    - Geological Information
    - Groundwater information; and
    - Aerial Photography
- A Site Walkover Visit; and
- Test Pit Investigations.

Specifically, the site walkover involved a senior geological engineer from Golder Associates visiting the site of the proposed HGA WF development on 14 October 2016 to undertake a general assessment of site access, site topography, surface geology exposures, slope stability and observe evidence of surface and ground water. Visits were made to selected wind turbine generator sites on the basis of information obtained during the desk study.

The Golders report based on observations of the wind farm area made from air photos, during the site inspection and test pit investigations, the following sections summarise the conditions expected within each of the 5 identified zones.

Zone 1

A total of seven wind turbines are proposed within Zone 1.

The topography of Zone 1 has an overall gentle slope in a north to south direction, ranging from an elevation of about RL 12 m AHD at the north (south of South Gippsland Highway) to an elevation of about RL 6 m AHD in the south area around the proposed T01 location.

An inferred alluvial terrace extends across the zone, extending from immediately south of Birds Road South, in a north easterly direction to south of T06 where a gravel road on the eastern boundary terminates. In places there is a reduction in elevation of about 2 m to the south, and the ground appeared to be wet (at the time of our site visit) where this elevation reduction occurs and where it is closer proximity to Nine Mile Creek (oriented east-west in the southern end of the property).

No evidence of slope instability was observed in this zone during our site visit. The area is currently agricultural land used for livestock and cropping. The area is well grassed with trees on the boundaries of paddocks. The area is mostly bounded to the east by the Gelliondale State Forest.

The subsurface materials encountered in Test Pit TP1 located near the proposed T02 comprised high plasticity clay ranging from firm to stiff consistency to the maximum investigation depth of 2.7 m. Sandy silty clay (topsoil) was encountered to 0.2 m depth. Groundwater was encountered at 2.4 m depth.

Zone 2

A total of four wind turbines are proposed within Zone 2.

The topography in Zone 2 has an overall gentle slope in a north to south direction. The area around the proposed T09 location is at an elevation of about RL 16 m AHD, and drops to an elevation of about RL 10 m AHD above sea level to the south around the proposed wind turbines T08, T10 and T11 locations.

No evidence of slope instability was observed in this zone. Some surface water ponding was present at the time of our site visit as shown in Photograph 2. Site observations suggest that the proposed T08 location could be positioned in a low lying marsh type feature.

Vehicle access to near this site was not possible during the site visit due to wet ground surface conditions. The area is currently agricultural land used for livestock and cropping. The paddocks are thickly grassed and is bounded to the south and west by the Gelliondale State Forest.

The subsurface materials encountered in Test Pit TP3 located near the proposed T10 and T11 comprised high plasticity clay of mostly firm consistency to the maximum investigation depth of 2.6 m. Sandy silty clay (topsoil) was encountered to 0.2 m depth. Groundwater was encountered at 1.9 m depth.

Photograph 2 below shows the ground surface condition looking in a southerly direction towards the proposed T10 and T11 locations from the South Gippsland Highway and Coal Mine Road intersection.

Zone 3

A total of thirteen wind turbines are proposed within Zone 3.

The topography in Zone 3 has an overall gentle slope in a north to south direction, ranging from about RL 8 m AHD to RL 5 m AHD.

No evidence of slope instability was observed in this zone. The ground surface was observed to become wetter to the south.

The area is currently agricultural land used for livestock and possibly cropping. The area is mostly bounded to the south by the Gelliondale State Forest.

The subsurface materials encountered in Test Pit TP4 located near the proposed T18 included silty sand (topsoil) to 0.2 m depth, overlying medium dense to dense sand to 0.5 m depth. Stiff sandy clay of high plasticity clay was then encountered to 1.4 m depth, overlying very dense sand and clayey sand to the maximum investigation depth of 2.5 m.

The subsurface materials encountered in Test Pit TP5 located near the proposed T34 encountered silty sandy clay of high plasticity to 0.4 m depth, overlying stiff high plasticity clay to 2.4 m, then very dense clayey sand to the maximum investigation depth of 2.6 m.

No groundwater was encountered Test Pit TP4. Groundwater was encountered in Test Pit TP5 at a depth of 2.4 m.

Zone 4

A total of five wind turbines are proposed within Zone 4.

The topography within Zone 4 is relatively flat with local undulations and gentle slopes towards localised drainage channels. Overall the ground surface between elevations of about RL 6 m AHD to RL 10 m AHD.

Albert River is located on the north boundary of this zone, and is oriented in a northwest to southeast orientation.

The area is currently agricultural land used for livestock and possible cropping.

No evidence of slope instability was observed in this zone.

The subsurface materials encountered in Test Pit TP6 located near the proposed T17 and T25 encountered silty sandy clay of high plasticity to 0.3 m depth, overlying stiff high plasticity clay to the maximum investigation depth of 2.5 m.

No groundwater was observed in Test Pit TP6.

Zone 5

A total of five wind turbines are proposed within Zone 5.

The topography in Zone 5 undulates due to the presence of numerous drainage channels that feed into Stony Creek. In general the ground surface elevation ranges from about RL 14 m AHD to RL 18 m AHD.

During the site visit sections of this zone had ponded surface water present.

The area is currently agricultural land used for livestock and possible cropping. The proposed northern most T21 and T23 locations were not accessible with a vehicle during the site visit due to the presence of saturated and 'boggy' ground surface conditions. These proposed wind turbine positions are located in a lower lying area of the site.

No evidence of slope instability was observed in this zone.

The subsurface materials encountered in Test Pit TP7 located near the proposed T28 encountered sandy silty clay (topsoil) of high plasticity to 0.2 m depth, overlying high plasticity clay having a consistency increasing with depth, ranging from firm to very stiff to the maximum investigation depth of 2.5 m.

No groundwater was encountered in Test Pit TP7.

Significantly no evidence of slope instability was observed in any of the 5 identified zones. The subject land is also not recognised in the planning scheme as being susceptible to erosion as there are no planning overlays, such as the Erosion Management Overlay, which apply to the site area.

In relation to road design, Golder have recommended that construction of the roads for this project be planned for drier times of the year. The report also recommended the pavements should be designed to shed water and to the extent possible runoff should not be allowed to form concentrated flows. Construction activities which have the potential to

create sediment flow issues, such as road construction, the laying of cable and the construction of turbine footings will be planned in the dryer half of the year when seasonal rainfall is lower.

The functional layout plans show that no Turbine is closer than 250m to either the Jack or Albert Rivers and that underground cabling and access roads are generally not closer that 200m from the river banks. We therefore contend that the generally flat to gently undulating terrain, coupled with lack of visible erosion and observed vegetation, and the absence or Planning Scheme overlays relating to erosion of land instability provides an environment where any potential sediment or erosion can be managed so that impacts on the river system will be negligible.

A review of the recommended riparian setbacks from statutory authorities found that their recommendations were in the order 20 to 50m. As noted earlier the West Gippsland Catchment Management Authority has a requirement for a minimum 30m setback, while Melbourne Water in their publication "Guidelines for greenfield development areas within the Port Phillip and Westernport Region" recommended development setbacks of between 20m and 50m.

Buffer distances to streams and rivers was also discussed in the Report to the Office of Water (DSE) April 2010 by Monash University (Birgita Hansen, Paul Reich, P. Sam Lake, Tim Cavagnaro, School of Biological Sciences). Their report explored minimum width recommendations (in metres) for riparian zones in Victoria for some common management objectives under a range of landscape contexts.

Each recommended width was accompanied by a level of scientific confidence (green=high, yellow=moderate, red=low), based upon published evidence from Australia and overseas.

Table 9 highlights that the typical management objectives can be achieved in a buffer area of 200m or less.

Table 9: Buffer distances from waterways for achieving conservation outcomes (source: Monash University School of Biological Sciences).

Landscape context / Management Objective	Land Use Intensity High	Land Use Intensity Moderate	Land Use Intensity Low	Wetland/ lowland floodplain/ off-stream water bodies	Steep catchments/ cleared hillslopes/ low order streams
Improve water quality	60	45	30	120	40
Moderate stream temperatures	95	65	35	40	35
Provide food and resources	95	65	35	40	35
Improve in-stream biodiversity	100	70	40	Variable *	40
Improve terrestrial biodiversity	200	150	100	Variable *	200

* Variability in width is related to the lateral extent of hydrological connectivity and thus, any recommendation will be site specific.

Turbines T34 and T28 and some of their associated road and cabling infrastructure are located within Land Subject Inundation Overlays. Silt Fencing will specifically be used for these locations as shown typically in Appendix 5.

A Stormwater Quality Management Plan similar to that suggested by the International Erosion Control Association of Australia will also be implemented as part of compliance with relevant planning permit conditions. The draft plan specifies performance criterial, responsibilities, implementation strategy, monitoring, auditing, identification of incidents or failures, corrective actions and reporting. A copy of the example of a typical Stormwater Quality Management Plan is contained in Appendix 6.

The performance measures outlined in the example Stormwater Quality Management Plan require a range of water quality criteria to be measured and monitored during the course of establishment, commissioning and working life of the project. Prior to the commencement of the project the water quality in the Albert and Jack Rivers will be tested by the following parameters:

- pH,
- dissolved oxygen,
- turbidity; and
- electrical conductivity (salinity)

These parameters are highlighted in the EPA Publication 791 "Information Bulletin for the State Environment Protection Policy (Waters of Victoria) (S. 107) - Water Quality Objectives for Rivers and Streams", as important indicators of ecosystem health.

Monitoring will commence prior to construction and will continue for the life of the project.

Standard drawings from the International Erosion Control Association of Australia have also been provided in Appendix 7. These drawings show sediment control measures to control sheet flow of water around constructions zones. Ten difference control measures are detailed. In the typical drawing showing a grassed buffer zone the drawing shows varying dimension between 15 to 50m where the gradient is 10%. There are no areas in the proposed work sites where the gradient would be in excess of 10%. Therefore, the average buffer areas of 250m will provide ample setback to establish and maintain sediment control measures.

A comprehensive Construction / Environmental Management Plan will be produced using the techniques and expertise from the follow guidelines:

- Water quality objectives for rivers and streams – ecosystem protection - EPA Publication No 791.1
- Environmental Guidelines for Major Construction Sites - EPA Publication No 480
- Construction techniques for sediment pollution control - EPA Publication No 275
- Doing it right on subdivisions: Temporary environmental protection measures for subdivision construction sites – EPA Guideline Publication No 960

Management of the construction zones using the techniques and management tools discussed will ensure that the Albert and Jack Rivers will not see a reduction in water quality parameters in terms of pH, dissolved oxygen, turbidity and electrical conductivity (salinity).

6.7.2. Potential Impacts

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 10 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.

Table 10: 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 pass across the wind farm on north western or north-eastern migration paths (see Section 9 of this report).	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
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.

Based on the foregoing findings, Table 11 summarises the impacts of the proposal on the ecological characteristics of the Corner Inlet Ramsar site. These characteristics have been summarised from the Ecological Character description for this Ramsar site prepared for the Commonwealth government (DSEWPAC 2011; Hale 2017). They comprise three types:

- Components;
- Processes; and
- Services/Benefits

Critical and supporting processes that underpin the wetland services and benefits of the Corner Inlet Ramsar site are considered separately in Table 11, based on Table 3-1 in DSEWPAC (2011).

As this table demonstrates, no critical or supporting components or processes that make up the ecological characteristics of the Corner Inlet Ramsar site will be altered or adversely affected by the project. Therefore, the important services and benefits (i.e. threatened species, fish habitat values, recreational and tourism values or scientific research opportunities) of the wetland will not be compromised.

Table 11: Impacts on the ecological characteristics of the Corner Inlet Ramsar Site (based on DSEWPAC 2011)

Ecological characteristic	Impact and Explanation
Critical Components	
Wetland mega-habitat types: ▪ Seagrass ▪ Intertidal sand or mudflats ▪ Mangroves ▪ Saltmarshes ▪ Permanent shallow marine water	The condition of these habitats depends partly on water quality, which partly relates to catchment sediment inputs. As the project footprint represents an extremely small proportion of the catchment of waterways entering the Ramsar site and best practice construction environmental management measures will be adopted, sediment input to catchment waterways as a consequence of the project will be negligible and within the Limits of acceptable change in DSEWPAC (2011). The same environmental management measures will ensure that any fuels and chemicals are stored on site in a manner that limits the chance of spillage into the surrounding environment.
Waterbirds	As described in earlier sections, the key waterbirds of significance at Corner Inlet occur well away from the project site (three to five kilometres) and there is little habitat for them on the project site itself. Therefore, impacts on waterbirds will be well within the Limits of acceptable change.
Supporting Components	
Geomorphological features that control habitat extent and types include: ▪ sand barrier island and associated tidal delta system; ▪ the extensive tidal channel network; and ▪ mudflats and sandflats.	The stability and ecology of these features is partly dependent on water quality and sedimentation rates. As the project footprint represents an extremely small proportion of the catchment of waterways entering the Ramsar site and best practice construction environmental management measures will be adopted, sediment input to catchment waterways as a consequence of the project will be negligible and within the Limits of acceptable change in DSEWPAC (2011).
Invertebrate megafauna in seagrass beds and subtidal channels	The species diversity, spatial patterns of occurrence and relationship to tidal inundation of invertebrates depend partly on the maintaining sedimentation rates and water quality within the Limits of acceptable change as detailed in DSEWPAC (2011). As described above, As the project footprint represents an extremely small proportion of the catchment of waterways entering the Ramsar site and best practice construction environmental management measures

Ecological characteristic	Impact and Explanation
	will be adopted, sediment input to catchment waterways as a consequence of the project will be negligible and within these limits.
Diverse fish communities	Fish communities depend on maintaining habitats and migration pathways intact and within the Limits of acceptable change in DSEWPAC (2011). As described earlier in this table, habitats will not be affected by sedimentation and water quality beyond these limits. The major waterways likely to be used for fish migration on and near the proposed wind farm will not be affected through any additional barriers to migration. Minor drains that may be affected do not represent significant fish habitat. Therefore, the diverse fish communities of the Ramsar site will not be affected by the wind farm.
Critical Processes	
Waterbird breeding	According to DSEWPAC (2011), critical waterbird breeding occurs on the outer, sand barrier islands of the Ramsar site. These islands lie approximately 10 kilometres from the proposed wind farm and the bird species concerned forage over marine habitats a minimum of three kilometres from the project site. Impacts on this critical process are therefore not expected from the project.
Supporting Processes	
Climate	Climate will be positively affected by the project through the replacement of fossil-fuel based greenhouse-gas producing power generation with zero-carbon emission renewable power generation.
Hydraulic and hydrological processes, including: ▪ Fluvial hydrology - patterns of inundation and freshwater flows to wetland systems; ▪ Physical coastal processes - Hydrodynamic controls and marine inflows that affect	For the reasons explained earlier in this table, impacts on fluvial hydrology from the project will be insignificant given the extremely small proportion of the catchment of the Ramsar site occupied by the project footprint. Coastal processes will not be affected as the site is not in the wetland itself. The limited project footprint is an extremely small proportion of the catchment of the wetland so its construction and operation are highly unlikely to affect groundwater infiltration rates. Apart from the turbine bases themselves, all other infrastructure will be of permeable, unsealed materials permitting rainfall to infiltrate. Therefore, changes in these processes as a consequence of the project are not expected.

Ecological characteristic	Impact and Explanation
habitats through tides, currents, wind, erosion and accretion; and ▪ Groundwater - for those wetlands influenced by groundwater interaction, the level of the groundwater table and groundwater quality.	
Water quality, including: ▪ salinity; ▪ turbidity; ▪ dissolved oxygen; and ▪ nutrients.	As explained earlier in this table, the project will not result in unacceptable changes in any of these key water quality parameters.
Biological processes, including nutrient cycling and food webs.	These processes would be at risk from significant changes in water quality (in particular sedimentation and nutrients). As explained earlier in this table, the project will not result in unacceptable changes in any key water quality parameters that underpin biological processes. All key habitats and ecosystems within the Ramsar site will not be physically removed or reduced in extent given the project is not located within the Ramsar site. Therefore the proposed wind farm will not lead to an unacceptable impact on the biological processes in the Ramsar site.

6.7.3. Mitigation measures

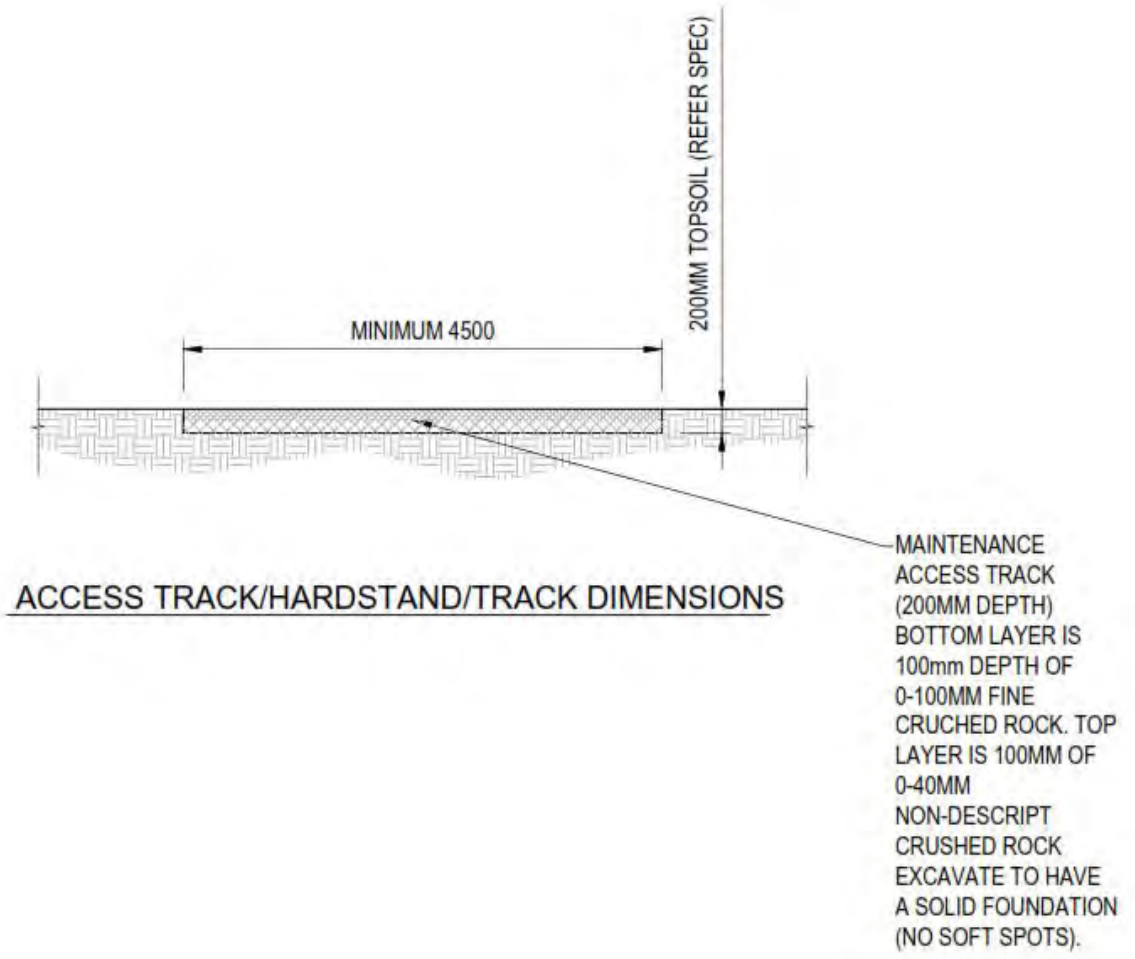
Most infrastructure is located well away from existing waterways including the Jack and Albert Rivers. Figures 15a to 15d show the proposed infrastructure in relation to the Land Subject to Inundation, and Flood Overlays from the Wellington Planning Scheme.

Works which will require additional engineering mitigation measures are listed below.

- 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.
- Turbine 28 and 34 are located within the Land Subject Inundation Overlay

Access tracks will typically be 4.5 metres wide and crossings will involve a single drainage pipe under the track surface and will be constructed with crushed rock and as noted below. This type of crossing of mostly ephemeral drains will not impede the movement of any frogs along these channels.

- All access tracks will be designed at the detailed design stage, however the typical profile is described below. The profile and crushed rock specifications are based upon Melbourne Waters guidelines for construction of access/ maintenance tracks near waterways.



ACCESS TRACK/HARDSTAND/TRACK DIMENSIONS

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 and detailed in an Environmental Management Plan / Construction Management Plan (EMP/CMP).

Typical management measures to be contained in the EMP/CMP are as follows (provided by Beveridge Williams):

General principles for effective soil and water management for the proposed access tracks will be as follows.

- EMP/CMP to be approved by the Responsible Authority in consultation with relevant agencies.
- Install effective sediment and erosion control structures prior to construction commencing.
- Conduct regular inspections to check that the road formation is performing adequately.
- Ensure that drainage is working and the road and discharge areas are stable.
- Inspect sediment and erosion control structures during and after heavy rainfall and minimise traffic where possible.
- Maintain effective erosion and sediment control measures.
- Ensure road usage is commensurate with road design.
- Minimise the area of soil disturbed and exposed to erosion when conducting maintenance operations.
- Stabilise and rehabilitate disturbed soil as soon as possible.

Works to be undertaken in weather conditions which will result in minimal impact on the surrounding environment. Vehicles and equipment will also be restricted to key access tracks and construction zones to avoid potential for the spread of invasive species.

Dust Suppression

a) Water exposed areas when visible dust is likely to occur with either water-cart or hand-held hoses.
b) Use geo-textile fabrics to cover any loose stockpiles or un-vegetated areas.
c) Limit access tracks & haul roads to designated areas & maintain dust suppression with water-cart.
d) use dust suppressants if directed or required.

Drainage Management

a) Identify stormwater lines which are vulnerable to erosion & sediment run-off from construction areas.
b) Design and install appropriate control measures within areas likely to produce erosion & sediment run-off.
c) Design and install appropriate sediment control measures at new and existing drainage structures where designated.
d) Maintain, inspect & monitor sediment control measures.
e) Divert water flows and slow run-off where appropriate.
f) Install catch drains where appropriate to control run-off.

Soil Stabilisation

During Construction:

a) Minimise areas of stripping & vegetation removal particularly on steeper slopes or areas with highly erodible soils.
b) Minimise length of exposure of stripped areas & complete works as soon as possible.
c) Minimise impacts on acid sulphate soil and were unavoidable ensure measures are in place to avoid release of sulfuric acid.
d) Install & maintain soil stabilisation measures where designated.

Post-construction Works:

e) Re-topsoil and seed and/or stabilise cut & fill batters as soon as possible.

Acid Sulfate Soils

Coastal acid sulfate soils (CASS) occur naturally along many parts of Victoria's coastal zone. There are two mapping tools which provide details as to where CASS are likely to occur.

- Australian Soil Resource Information System (ASRIS) – Atlas of Australian Soils
- Victorian Resources Online – Coastal Acid Sulfate Soil Distribution Maps

The Victorian Coastal Acid Sulfate Soils Distribution Map, Map 4 for South Coast of Victoria, shows the potential for Acid Sulfate Soils at the very eastern end of the site. The ASRIS mapping rates land from High Probability through to Extremely Low Probability. The land occupied by the turbines and associated infrastructure is shown as shown on the ASRI map to be Low Probability to Extremely Low Probability in terms of the likelihood for the presence of CASS.

Assessment and management of matters concerning CASS will be undertaken in accordance with the Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils (BPMG), October 2010.

Synergy Wind will undertake CASS testing prior to commencement of works associated with the development. Should any CASS be found to be present at the site, Synergy Wind will prepare a project specific Environmental Management Plan for CASS which will be submitted to the Environment Protection Authority and the Responsible Authority for approval.

Stockpile Protection

a) Minimise the number of stockpiles and period of exposure.
b) Locate stockpiles away from stormwater inlets/pits or waterways as far as practicable.
c) Install sediment fencing at base of stockpiles if designated.
d) Compact stockpiles to minimise erosion during rain events.
e) Ensure stockpiles have slopes no greater than 1:2.

Sediment Traps

a) Install & maintain sediment traps where designated. (i.e. silt fencing, straw bales, gravel sausage etc)
b) Inspect & maintain sediment traps on a regular basis. Excess sediment to be clean-out and traps kept in good working order.

Dewatering

a) Treat turbid water to remove sediment prior to being pumped into storm-water system or natural waterway.
b) De-water by pumping water, wherever practicable on to vegetated areas of sufficient width to remove suspended soil or to sediment control devices.
c) Carry out water quality testing to ensure compliance if necessary.

Vehicle and Road Management

Site Access

a) Restrict site access to designated points for entry & exit.
b) Restrict construction equipment to defined haul roads.
c) Restrict site access during wet/muddy conditions.

Cleaning Vehicles

d) Clean excess material from wheels of construction vehicles prior to leaving the site.

Street Cleaning

e) Adjoining roads to be monitored and kept clean at all times.
f) Protect drainage inlets from washed material from roads.

Waste Minimisation Methods

a) Ensure waste & litter are collected immediately and stored in designated storage areas.
b) Contain waste materials so they cannot be washed or blown away.
c) Trees nominated for removal to be mulched. Burning of trees not allowed within the Municipality.
d) Re-use on site topsoil for topdressing of nature strips & allotments

Waste Storage and Disposal

a) Litter and waste from construction activities to be placed in bin/skip.
b) Waste concrete from demolition works to be sent to recycling plant if possible.
c) Washout from concrete trucks to be carried out in designated area.

Storage

a) Storage of any chemicals to be kept at factory and only taken to site when needed.
b) Storage of fuels & chemicals in secure and appropriately bunded area. Ensure storage location is away from creeks, drainage lines or channels.
c) Restrict the area in which hazardous materials can be stored during the construction period

Spill Management

a) Spill kits area carried by re-fuelling truck. (Petrogas and Mini- Tankers)
b) If spill occurs, immediate action and clean-up is required.

Refuelling Procedure

a) Refuelling to be carried out in designated bunded area only.
b) Machinery to group together and be fuelled in 1 location if possible.
c) Extreme care to be taken when re-fuelling equipment or carrying out servicing of equipment where oils or chemicals may be used.

6.7.4. Residual Impacts

The project is sufficiently distant from the Ramsar site and of low intensity (see Table 7). It will be executed in an environmentally sensitive manner according to the EMP/CMP management actions listed above. This will ensure that there will be no unacceptable residual impacts on and risks to the Corner Inlet Ramsar site.

Figure 14: State Resource Overlay

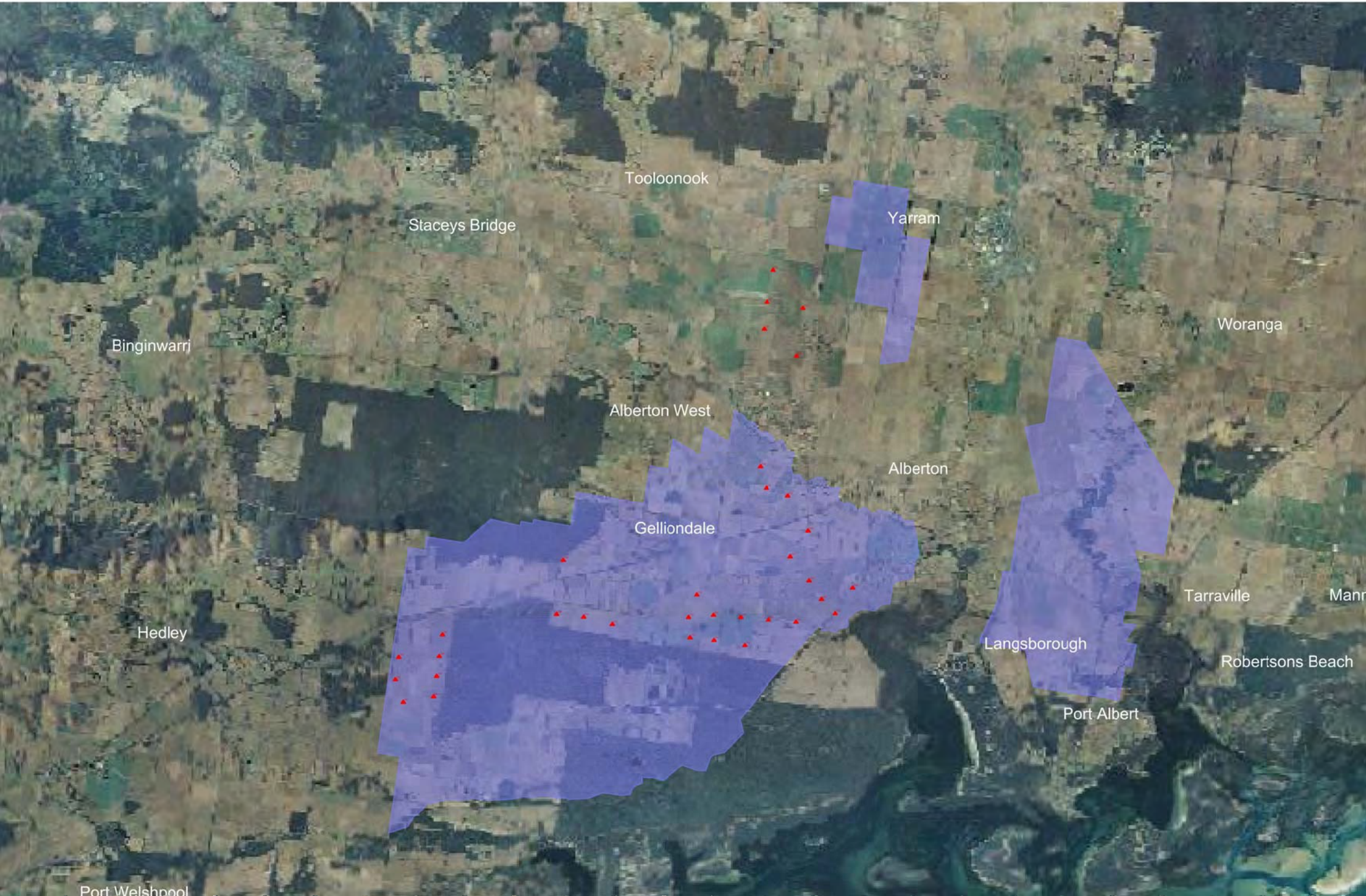

Tooloonook
Staceys Bridge
Yarram
Woranga
Binginwarrj
Alberton West
Alberton
Gelliondale
Tarraville
Hedley
Langsborough
Robertsons Beach
Port Albert
Port Welshpool

Figure 15a-d: Inundation Overlay and Infrastructure

LEGEND

- Existing River/ Creek/Coastline
- Road
- Lot Boundaries
- Wind Turbine (NAME)
- R1 Shareholder Dwelling
- D1 3rd Party Dwelling
- Flood Overlay
- Land Subject to Inundation Overlay
- Proposed crane pad
- Proposed Access track
- Upgrade existing power line
- Proposed overhead power line
- Proposed sub station
- Proposed MV cable
- 1km Radius (from wind turbine)
- 3km Radius (from wind turbine)

ROAD
NORTH
RD
JAMES
GIPPSLAND
HWY
D84
D13
SOUTH
R03
RAILWAY
HWY
ROAD
COALMINE
SOUTH
T07
T03
T06
T02
T05
T01
T04
R02
BIRDS
ROAD
PEARSONS
D10
D09
D08
D12
D11
D07
D14
MCPHAILS
RD
TELEGRAPH
D16
D15
ROAD
D19
D18
D20
SEE SHEET 2

200 0 200 400 600 800 1000 1200m

Functional Layout Plan
Sheet 1 of 4
Alberton Wind Farm

Synergy Wind

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Version	Date	Description	Drafted	Approved
01	24.05.18	Initial issue	TG	BS
02	25.05.18	Plan updated	TG	BS

Date: 25.05.18
Version No: 02
Job No: 1600439
Scale (A1): 1:10,000
(A3): 1:20,000

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LEGEND

- Existing River/ Creek/Coastline
- Road
- Lot Boundaries
- Wind Turbine
- Shareholder Dwelling
- 3rd Party Dwelling
- Flood Overlay
- Land Subject to Inundation Overlay
- Proposed crane pad
- Proposed Access track
- Upgrade existing power line
- Proposed overhead power line
- Proposed sub station
- Proposed MV cable
- 1km Radius (from wind turbine)
- 3km Radius (from wind turbine)

Alberton West

Gelliondale

Alberton West Recreation Reserve

CFA

T08 T09 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19 T22 T24

R01 R02 R03 R04 R05 R06 R07 R08 R09 R10 R11 R12 R13

D22 D24 D25 D27 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D40 D42 D45 D48 D49 D51 D52 D53 D54 D55 D56 D57 D58 D59 D60 D85

SEE SHEET 1

SEE SHEET 3

200 0 200 400 600 800 1000 1200m

Functional Layout Plan
Sheet 2 of 4
Alberton Wind Farm

Synergy Wind

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development & environment consultants

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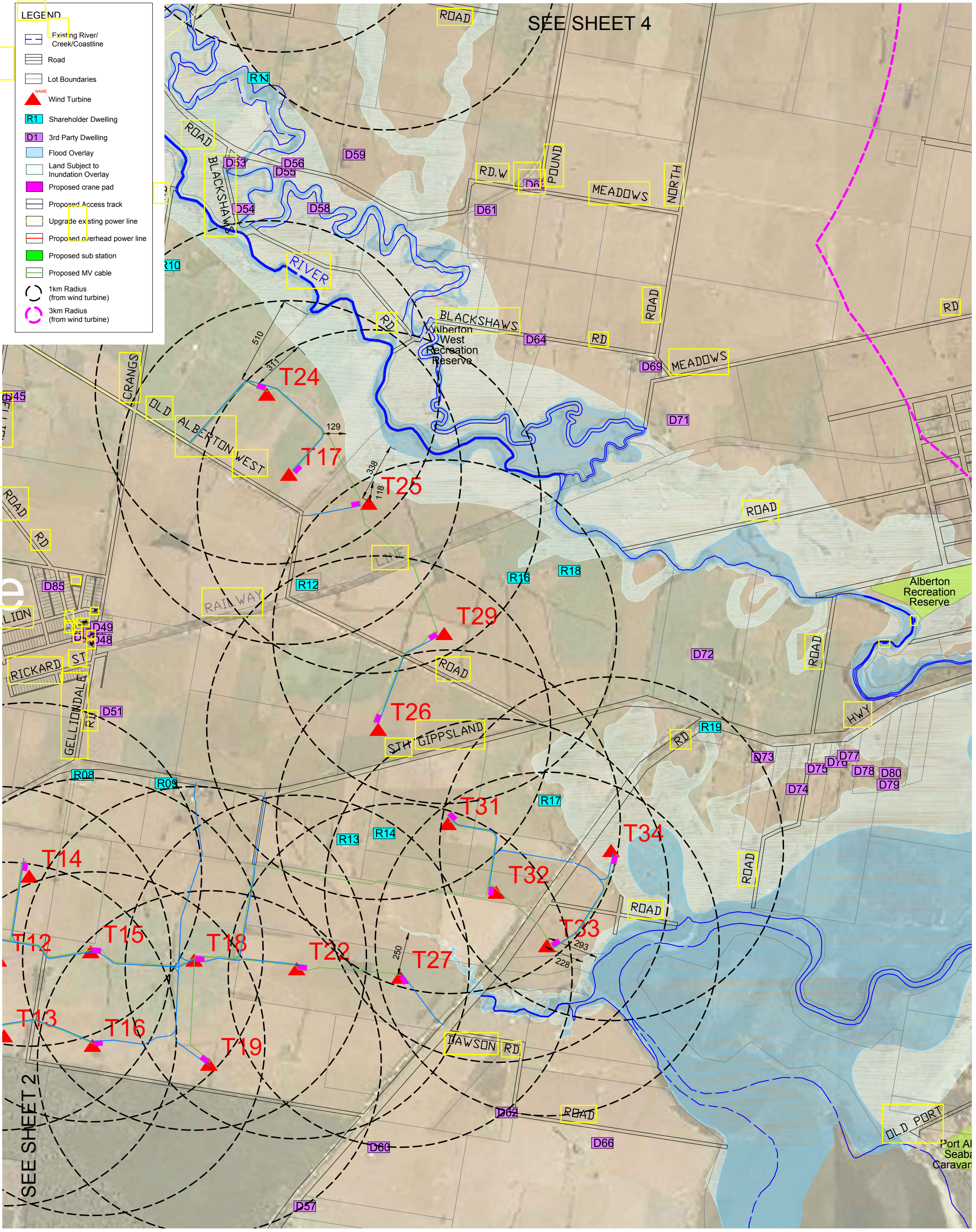

Functional Layout Plan
Sheet 3 of 4
Alberton Wind Farm

Synergy Wind

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LEGEND

- Existing River/ Creek/Coastline
- Road
- Lot Boundaries
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- R1 Shareholder Dwelling
- D1 3rd Party Dwelling
- Flood Overlay
- Land Subject to Inundation Overlay
- Proposed crane pad
- Proposed Access track
- Upgrade existing power line
- Proposed overhead power line
- Proposed sub station
- Proposed MV cable
- 1km Radius (from wind turbine)
- 3km Radius (from wind turbine)

Tooloonook

Alberton West

T23 T21 T30 T20 T28 T24 T17 T25

797 930 627 724 510 371 129 338 118

SEE SHEET 3

200 0 200 400 600 800 1000 1200m

Functional Layout Plan
Sheet 4 of 4
Alberton Wind Farm

Synergy Wind

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Job No: 1600439
Scale (A1): 1:10,000
(A3): 1:20,000

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7. ADDITIONAL AVOIDANCE AND MITIGATION MEASURES/ ALTERNATIVES

There are no alternative locations for the proposed Alberton Wind Farm project. The development has been through a rigorous site analysis and design process, incorporating all of the technical studies undertaken to date to determine the current turbine and infrastructure layout. Additional avoidance and mitigation measures are provided below.

The project was designed to meet the strategies outlined in the Victorian Environment Protection Authority's *Environmental Guidelines for Major Construction Sites* (EPA 1996). 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.
- 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 on site vegetation and habitats.

Any required investigation, and recommended management and mitigation measures, will be documented in a Bat and Avifauna Management Plan (BAM Plan) consistent with the consent conditions. This management plan will be discussed with and approved by relevant authorities as a condition of project approval. A monitoring program to determine the effectiveness of any ongoing mitigation measures will be included.

Construction exclusions zones will be prepared as part of the detailed design process and will be included in the CMP/ EMP approval process. Exclusions areas will include areas of Cultural Heritage Sensitivity, Native Vegetation or highlighted fauna habitat.

It is not anticipated that the cost of mitigation measures will exceed 5% of the civil construction cost of the project and that the costs associated with mitigation will not be significant or likely to significantly impact on the projects viability.

8. SOCIAL AND ECONOMIC CONSIDERATIONS

The proponent has provided the information below on the social and economic aspects of the project.

8.1. Pre-planning approval phase

Consultation has included briefing key economic, social and environmental community stakeholders such as Wellington Shire Councillors and relevant Council Officers, Council Officers from the South Gippsland Shire, Community Groups, Latrobe Valley Authority, and Local Members of Parliament.

All residents and other stakeholders within 3 kilometres of a proposed turbine were invited to view information displayed at the Yarram District Hub (a community meeting place at 156 Grant Street, Yarram) for two weeks, and attend a Community Information Day at the Hub attended by representatives from Synergy Wind and Beverage Williams Planners. This took place during August 2017 and finished with the consultation day on the 25th of August 2017.

The outcomes of this consultation were presented with and also informed the Planning Permit Application.

8.2. Planning approval phase - public exhibition of planning application

All Planning Permit documentation will be on public exhibition during the Planning Permit process, available for public review and comment – physically and electronically – via the DELWP website, and the Wellington Shire website (via a link). Public notices will be placed in the local newspapers and landholders and occupiers will be notified within a 5km radius. DELWP has advised that the adverting period is likely to be undertaken over a 4-week period.

8.3. Operation phase - community fund

A Community Fund will be established by the Proposed Alberton Wind Energy Facility once construction begins that will consist of a committee of local volunteers, active in the community, to evaluate annual submissions for funding for events, projects or groups within the community. The aim of the fund is to ensure the benefits of the Proposed Alberton Wind Energy Facility are distributed across the local community throughout the life of the project rather than being concentrated solely with participating land owners.

8.4. Indigenous stakeholders

Biosis undertook a Cultural Heritage Assessment for the proposed development and subject study area and spoke to both Indigenous Stakeholders.

The Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is the Registered Aboriginal Party (RAP) for the study area.

The protection and management of Aboriginal archaeological places and sites is addressed under the provisions of the *Aboriginal Heritage Act 2006* and *Aboriginal Heritage Regulations 2007.*

Following the completion of the initial desktop assessment, GLaWAC was invited to participate in the detailed cultural heritage assessment stage of the project. A cultural heritage officer representing the RAP took part in the survey at each location. At the

completion of the survey, the results for each location were discussed between the CHA and the GLaWAC cultural heritage officer.

A request has been submitted to GLaWAC for appropriate names for the two Aboriginal places which were recorded during the field survey stage of the assessment.

After discussions with relevant state government stakeholders it was decided to complete a Voluntary CHMP for the project.

A Notice of Intention to prepare a voluntary CHMP was lodged with Aboriginal Victoria (CHMP Plan ID. 15167). Works were then commenced to undertake the voluntary CHMP on the project. After further works were undertaken on the project the CHMP was submitted to the GLaWAC.

On the 22-Feb-2018, the Secretary, Department of Premier and Cabinet received for lodgement an approved Cultural Heritage Management Plan CHMP Plan ID: 15167 for Synergy Wind Pty Ltd - Alberton Wind Farm, Alberton, Victoria.

The conditions in this management plan are now compliance requirements.

8.5. Consultation with Heritage Victoria

Before undertaking surveys for historical heritage places there is a statutory requirement to notify Heritage Victoria – the State government agency responsible for historical cultural heritage places.

Biosis consultants have been communicating with Heritage Victoria in this regard.

One historic place, Gelliondale Briquette Plant (H8220-0008/ H1058/ H081), is situated within the Study Area. This place will be avoided by the Proposed Wind Energy Facility Area.

As the assessment was primarily directed to assessing the potential for Aboriginal cultural heritage at the proposed turbine locations submission of a 'Notice of intention to carry out an Archaeological Survey' to Heritage Victoria under Section 131(1) of the Heritage Act 1995 was not considered necessary.

8.6. Mitigation Measures

The Environmental Management Plan/ Construction Management Plan (EMP/CMP) will include the following measures:

a) Any archaeological salvage areas (if applicable) are marked on the plan in RED. Site location is to be fenced off by Developer. Access to this zone is NOT PERMITTED.
b) Works must cease immediately upon the discovery of any Aboriginal cultural material and Aboriginal Affairs Victoria shall immediately be notified of any such discovery.

8.7 Overall Benefits

The project cost is estimated to be $450 million and will contribute towards the local and wider Victorian community.

Employment in the region during construction phase is anticipated to be around 115 construction workers plus additional employment generated by procuring local services including civil works, electrical works, receiving Port, stevedoring, storage, craneage, transportation, supply of materials and equipment, accommodation, security, traffic management.

Indirect employment during the construction process is expected generate jobs for 270 people locally, 870 state jobs and 1360 nationwide jobs. Each worker is expected to spend approximately $25,000 in the local area in shops, restaurants, hotels and other services, ie $2.875M.

Employment during the operations phase including maintenance and tourism is expected to be 12 staff – a total input of $300,000 spent in the local economy per annum.

Renewable, locally generated electricity added to the grid that will contribute to the reduction of carbon emissions associated with electricity generation.

9. ENVIRONMENTAL RECORD OF PERSON(S) PROPOSING TO TAKE THE PROJECT

The proponent has had no adverse action or finding recorded against them.

The proponent, Synergy Wind is a project development company which identifies and develops viable renewable energy sites throughout Australia. Upon securing planning and environmental approvals, the project will be taken over by a specialist wind farm construction and operations company, who will build the wind farm and associated infrastructure and operate it.

It is standard practice as per the Guidelines for the Development of Wind Energy Facilities in Victoria to include conditions in relation to the preparation of an Environmental Management Plan (EMP). It is also specified in the guidelines that the EMP must include:

- Construction and work site management plan;
- Sediment, erosion and water quality management plan;
- Hydrocarbon and hazardous substances plan;
- Wildfire prevention and emergency response plan;
- Blasting management plan (only relevant where blasting is proposed);
- Vegetation management plan;
- Biosecurity management plan;
- Environmental management plan training program;
- Environmental management plan reporting program;
- Implementation timetable; and
- Review of the environmental management plan.

An EMP will be implemented during the detailed design and construction phase and an Operational Management Plan for the operations phase to monitor and control residual environmental issues associated with the Proposed Alberton Wind Energy Facility. A site specific EMP will be prepared post Planning Permit approval, incorporating any condition of that permit, as well as the measures as outlined within the existing investigations already undertaken.

10. INFORMATION SOURCES PROVIDED IN THE ASSESSMENT DOCUMENTATION

The information for this Assessment Report was taken from the following.

- EPBC Protected Matters Search, dated November 2015
- Victorian Biodiversity Atlas
- Field surveys for flora and fauna conducted on the following dates
    - 25th to 27th February 2015 (migratory bird survey at Corner Inlet)
    - 23rd to 27th March 2015 (initial overview assessment)
    - 7th to 11thDecember 2015 (flora and fauna assessment)
    - 6th to 10th June 2016 (flora and habitat hectare surveys)
    - 2nd to 4th November 2016 (targeted flora surveys)
- BL&A Report No. 14107 (3.3) written in December 2016 (flora and fauna assessment)
- BL&A Report No. 14107 (1.3) written in August 2016 (bird and bat assessment)
- BL&A Report No. 14107 (5.0) written in December 2016 (targeted flora survey)
- BL&A Report No. 14107 (6.0) written in December 2016 (shorebird data analysis)
- BL&A Report No. 14107 (7.2) written in July 2017 (MNES report)

The reliability of the information is expected to be high and was tested against the compiler's sound knowledge of the flora and fauna of the area of concern.

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Appendix 1: Statement of Reasons for a Decision on Controlled Action under section 75 of the EPBC Act 1999

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: Offset Quote for state offsets

vegetationlink

04 May 2018

Our Reference: ESLS-3201
Your Reference: Alberton Wind Farm (14107)

Inga Kulik
Brett Lane & Associates

By Email: IKulik@ecologicalresearch.com.au

Dear Inga,

RE: Quotation for the supply of Native Vegetation Credits

Thank you for your request for a fee proposal to provide native vegetation credits in accordance with *Permitted Clearance of Native Vegetation: Biodiversity Assessment Guidelines.* We are an accredited organisation with the Department of Environment, Land, Water & Planning (DELWP).

Based upon the information provided, I understand you require the following native vegetation offset:

Table 1 – Offset Targets

Offset Type	Attributes	Biodiversity Equivalence Units (BEU)	Minimum Strategic Biodiversity Score (SBS)
General	West Gippsland CMA	0.386	0.286

To make available credits to offset vegetation clearance, landowners are required to:

- Enter into a Landowner Agreement for the specified area. A landowner agreement:
  - Is in perpetuity and is binding upon the landowner and the landowners successors in title;
  - Permanently restricts use of the site, including but not limited to preventing agricultural use, vegetation clearance and the erection of a structure or dwelling; and,
  - Requires fencing to be erected and effectively maintained to protect the site.

- Implement a detailed 10-year Management Plan endorsed by the DELWP Native Vegetation Credit Register.

The landowner provides the following quotation based upon the 10-year Management Plan prepared for the site. The quotation represents a one off lump sum for all management costs associated with the offset, which is paid into a DELWP trust account. It is subsequently paid to the landowner in instalments (over 10 years), subject to the satisfactory implementation of the management actions. The credit owner's price is inclusive of:

1. Landowner agreement and monitoring fees;

2. Legal & Accounting Costs;

3. Brokerage Fees;

4. Land depreciation and lost opportunity cost arising from the permanent restrictive covenant;
5. Contractor costs for pest plant & animal suppression works over ten years;
6. Fencing establishment &/or maintenance;
7. Environmental risk – especially that which arises from fire, flood or drought;
8. Insurance, rates & taxes;
9. Monitoring and compliance costs;
10. Inflation over ten years; and,
11. An allowance to cover management and compliance costs associated with the Landowner Agreement in perpetuity.

Quotation

Native Veg Credits equal to a gain of 0.386 BEUs with an SBS>0.286		$30,880.00
Vegetation Link Transaction Fees^		$770.00
	Total (ex GST)	**$31,650.00**
	Total (Inc. GST)	$34,815.00

^Includes DELWP NVCR transfer and allocation fees introduced in July 2016. Note, if credits are not allocated to a planning permit at the time of purchase, a further $50 DELWP NVCR fee applies

The quotation is valid for 14 days, subject to credit availability.

Upon receipt of written acceptance of this quotation, we will immediately reserve the credits before proceeding to prepare a Credit Agreement to enable the transfer of the credits to you or your nominee.

We will then lodge the agreement with DELWP / Trust for Nature who will raise an invoice for the Credits, and we will issue an invoice for the transaction fees. Once both payments are made, you will receive an Allocated Credit Extract from the Native Vegetation Credit Register as evidence of meeting your offset requirement.

Should you have any queries, please do not hesitate in contacting us on (03) 5470 5232 or email offsets@vegetationlink.com.au.

Sincerely

Jen Irlam
Biodiversity Offset Coordinator

Appendix 3: Response from the West Gippsland CMA

West Gippsland
Catchment Management Authority

WGCMA Ref: WGCMA-F-2018-00327
Document No: 1
Date: 20 June 2018

Tim Doolan
Acting Senior Planner Wind Farms
DELWP
8 Nicholson Street East Melbourne 3002
tim.doolan@delwp.vic.gov.au

Dear Tim,

Planning Permit Application No.: PA1700284

Property **Street:** Various
Cadastral: Various

Applicant(s): Synergy Wind Pty Ltd, C/- Bernard Stewart, Beveridge Williams & Co Pty Ltd

I refer to your correspondence received at the West Gippsland Catchment Management Authority ('the Authority') on 08 June 2018 in accordance with the provisions of Section 55 of the *Planning and Environment Act 1987*. The Authority notes that the application is for the development of the Alberton Wind Energy facility.

The wind energy facility will be located over numerous properties and includes land that is subject to inundation from either riverine or coastal flooding. Information supplied with the application indicates that most of the proposed wind turbines are on higher land, with only T34 likely to be on floodprone land. The Authority notes that the presence of a wind turbine in unlikely to increase the flood hazard at the site.

As shown in Figure 1, a considerable number of designated waterways traverse the area. This includes ephemeral waterways and (in some cases) constructed farm drains. While these waterways may be low in ecological value, they do provide an important drainage function within the landscape and are directly connected to Corner Inlet. Any adverse impact on the waterways will result in an adverse impact on Corner Inlet itself.

The Authority is a recommending referral authority for this application. Pursuant to Section 56(1) of the *Planning and Environment Act 1987*, the Authority **does not object** to the issue of a Planning Permit, subject to the following condition being included in the permit:

- A Construction Management Plan must be developed to the satisfaction of the West Gippsland Catchment Management Authority to identify how all the designated waterways will be protected during the construction phase of the project. This must identify:
  a. any earthworks required within 30 metres of a designated waterway
  b. any vegetation to be removed within 30 metres of a designated waterway
  c. sediment and erosion control measures to prevent discharge of poor quality waste water and runoff

The Authority also requires that the following note be placed on the permit:

> All works within 30 metres of a designated waterway require a Works on Waterways permit from the West Gippsland Catchment Management Authority, issued under the *Water Act 1989.* This includes (but is not limited to) construction of any vehicle access over a designated waterway, and installation of any turbine or associated infrastructure.

Pursuant to Sections 64 to 66 of the *Planning and Environment Act 1987*, please ensure that you provide the Authority a copy of your decision in a timely manner to allow for an application for review to VCAT if required.

The Authority **objects** to the issue of the Planning Permit if these conditions are not included.

The attached **explanatory report** provides further detail regarding the Authority's assessment.

Should you have any queries, please do not hesitate to contact Penny Phillipson on 1300 094 262. To assist the Authority in handling any enquiries please quote **WGCMA-F-2018-00327** in your correspondence with us.

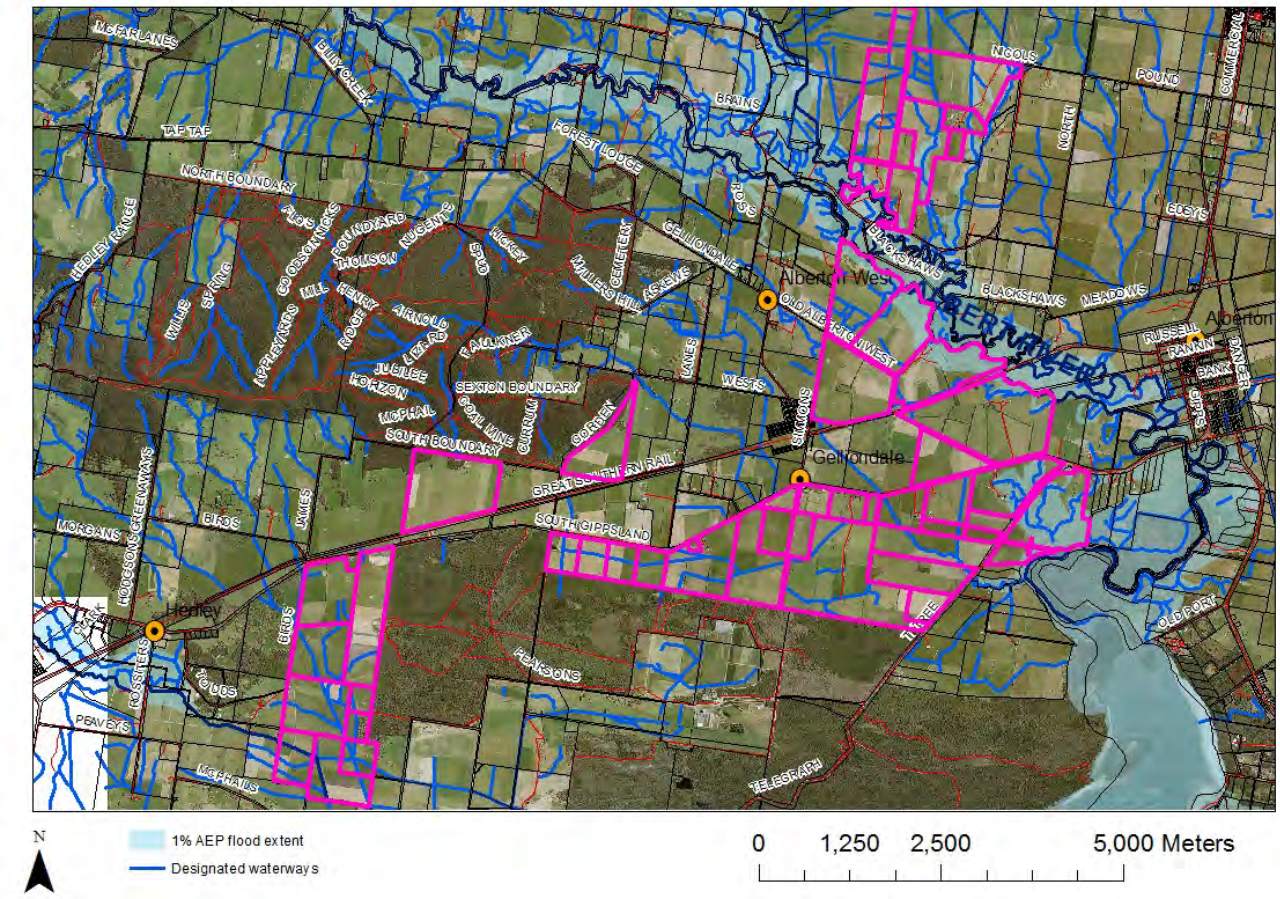
Yours sincerely,

Linda Tubnor
Acting Statutory Planning Manager

Cc: Bernard Stewart, Beveridge Williams & Co Pty Ltd (stewartb@bevwill.com.au)

EXPLANATORY REPORT

Figure 1 – Designated waterways and 1% AEP flood extent



Decision Guidelines

The West Gippsland Catchment Management Authority assesses all applications against the following National, State and Local Policies, Guidelines and Practice Notes:

1. 'Technical Flood Risk Management Guideline: Flood Hazard' (Australian Emergency Management Institute, 2014)
2. 'Victorian Floodplain Management Strategy' (Victoria State Government, 2016)
3. Council Planning Schemes (Planning Schemes Online), including the:
    i. State Planning Policy Framework
    ii. Local Planning Policy Framework
    iii. Relevant Zones and Overlays
4. 'Guidelines for Coastal Catchment Management Authorities: Assessing development in relation to sea level rise' (DSE, 2012)
5. 'Applying for a Planning Permit under the Flood Provisions – A Guide for Councils, Referral Authorities and Applicants' (DELWP, 2015)
6. 'Flood Guidelines - Guidelines for development in flood prone areas' (West Gippsland Catchment Management Authority, 2013)
7. 'West Gippsland Waterway Strategy' (2014-2022)
8. 'West Gippsland Regional Catchment Strategy' (2013-2019)

Definitions and Disclaimers

1. The area referred to in this letter as the 'proposed development location' is the land parcel(s) that, according to the Authority's assessment, most closely represent(s) the location identified by the applicant. The identification of the 'proposed development location' on the Authority's GIS has been done in good faith and in accordance with the information given to the Authority by the applicant(s) and/or the local government authority

2. While every endeavour has been made by the Authority to identify the proposed development location on its GIS using VicMap Parcel and Address data, the Authority accepts no responsibility for or makes no warranty with regard to the accuracy or naming of this proposed development location according to its official land title description.

3. **AEP** as Annual Exceedance Probability – is the likelihood of occurrence of a flood of given size or larger occurring in any one year. AEP is expressed as a percentage (%) risk and may be expressed as the reciprocal of ARI (Average Recurrence Interval).

   Please note that the 1% probability flood is not the probable maximum flood (PMF). There is always a possibility that a flood larger in height and extent than the 1% probability flood may occur in the future.

4. **AHD** as Australian Height Datum - is the adopted national height datum that generally relates to height above mean sea level. Elevation is in metres.

5. **ARI** as Average Recurrence Interval - is the likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. For example, floods with a discharge as large as or larger than the 100 year ARI flood will occur on average once every 100 years.

6. Nominal Flood Protection Level – is the minimum height required to protect a building or its contents, which includes a freeboard above the 1% AEP flood level.

7. No warranty is made as to the accuracy or liability of any studies, estimates, calculations, opinions, conclusions, recommendations (which may change without notice) or other information contained in this letter and, to the maximum extent permitted by law, the Authority disclaims all liability and responsibility for any direct or indirect loss or damage which may be suffered by any recipient or other person through relying on anything contained in or omitted from this letter.

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9. The flood information provided represents the best estimates based on currently available information. This information is subject to change as new information becomes available and as further studies are carried out.

10. Please note that land levels provided by the Authority are an estimate only and should not be relied on by the applicant. Prior to any detailed planning or building approvals, a licensed surveyor should be engaged to confirm the above levels.

Appendix 4: Geotechnical Report (Golders and Associates)

17 January 2017

PRELIMINARY GEOTECHNICAL INVESTIGATION

Hedley, Gelliondale, Alberton (HGA) Wind Farm, South Gippsland, Victoria

Submitted to:
Synergy Wind Pty Ltd
PO Box 327
Balaclava VIC 3183

REPORT

Report Number. 1666035-001-R-Rev1

Distribution:

Synergy Wind Pty Ltd - 1 copy
Golder Associates Pty Ltd - 1 copy

Golder Associates

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APPENDICES

1.0 INTRODUCTION

Synergy Wind Pty Ltd (Synergy Wind) has engaged Golder Associates Pty Ltd (Golder) to perform a preliminary geotechnical investigation for the proposed Hedley, Gelliondale, Alberton (HGA) Wind Farm (HGA WF) to be located near Gelliondale township in South Gippsland, Victoria. The investigation was undertaken in general accordance with our proposal (reference: P1666035-001-Rev0) dated 29 September 2016. Authorisation to proceed with the investigation was provided by Synergy Wind in an email dated 3 October 2016.

We understand the proposed wind farm will be located near Gelliondale in Gippsland. The site is located about 170 km south east of Melbourne.

This report presents the results and findings of a desktop study of expected subsurface conditions and a site visit performed, and a preliminary geotechnical investigation performed for the proposed wind farm development. The report includes discussion on geotechnical considerations for the proposed wind farm development, and includes discussion and preliminary comment regarding the design and construction of wind turbine footings at the site.

2.0 PROPOSED DEVELOPMENT

We understand the proposed wind farm will be located about 170 km south east of Melbourne and will include 34 wind turbine generators which will be located both north and south of the South Gippsland Highway at various locations within an approximate 8 km radius of Gelliondale township. The location of the HGA WF development is presented in Figure 1 – Site location and layout.

Based upon the preliminary information provided by Synergy, we understand the HGA WF will be located across a number of individual properties held by various landowners. At this stage we have not been provided with details of the proposed turbine structures or the locations of substations and other supporting infrastructure.

3.0 AIMS OF THE INVESTIGATION

Based on our understanding of the proposed development, the aims of the preliminary geotechnical investigation are as follows:

- Assess the expected subsurface and groundwater conditions to allow characterisation of the expected subsurface units and hydrogeological conditions at the sites relevant to the proposed wind turbine developments.
- Assess the foundation materials in which the wind turbines footings will be constructed and provide preliminary information relevant to the design of the footings.
- Provide commentary on indicative foundation design parameters.
- Provide preliminary comment on suitability of the site materials for hardstand, cable trench and access road construction.
- Provide comment on other likely geotechnical issues which may impact upon the design of the proposed wind farm.

4.0 PRELIMINARY INVESTIGATION WORKS

4.1 Desk Study

As part of the preliminary geotechnical investigation a desk study has been undertaken to review readily available information regarding the site. This work included the following:

- A search of relevant geological information including geological maps, published information and previous studies.
- A search of the Australian Groundwater Explorer database maintained by the Bureau of Meteorology.
- Review of available aerial photography of the site.

4.1.1 Geological Information

Geological information from a number of sources has been assessed, including:

- The Department of Economic Development, Jobs, Transport and Resources 'GeoVic' online database.
- The 1:31,680 scale 'Alberton West' geological mapsheet published by the Geological Survey of Victoria.
- The 1:50,000 scale 'Alberton' geological mapsheet published by the Geological Survey of Victoria.
- The 1:250,000 scale 'Warragul' geological mapsheet published by the Geological Survey of Victoria.
- Birch W.D. (Editor), 2003. 'Geology of Victoria'. Geological Society of Australia. Special Publication 23. Geological Society of Australia (Victoria Division).
- Geological Survey of Victoria Report No. 57 'Explanatory Notes on the Warragul 1:250,000 Geological Map.

4.1.2 Groundwater Information

A search was conducted within publically available groundwater databases for registered bores in the vicinity of the site. The information available for individual groundwater bores can include:

- The date of bore completion.
- The location of the bores in AMG coordinates.
- Ground surface level of the bore.
- The depth of the bore, depth range of the bore screened interval and depth to water in the bore.
- Basic lithological information.
- Results of bore pumping tests (test type, pump depth, flow rate, electrical conductivity and test duration).

4.1.3 Aerial Photography

Using available aerial photography the following has been assessed as part of the preparation of this report:

- Evidence of previous slope instability including slip scars, scarps and landslide debris.
- Surficial evidence of the underlying geology. This information can be useful in assessing potential borrow areas.
- Evidence of erosion.

4.2 Site Walkover Visit

A senior geological engineer from Golder Associates visited the site of the proposed HGA WF development on 14 October 2016 to undertake a general assessment of site access, site topography, surface geology exposures, slope stability and observe evidence of surface and ground water. Visits were made to selected wind turbine generator sites on the basis of information obtained during the desk study.

4.3 Test Pit Investigation

A total of six test pits (TP1 and TP3 to TP7) were excavated in general areas of proposed wind turbines as part of the preliminary geotechnical investigation of the site. The locations of test pits are shown on Figure 2 – Test pit location plan. The test pits were excavated on 17 November, 2016.

Test pits were excavated using a backhoe supplied and operated by a specialist contractor to depths ranging from about 2.5 m to 2.7 m. Upon completion, the test pits were backfilled with the excavated spoil, tamped using the excavator bucket and wheel rolled at the surface.

A Dynamic Cone Penetrometer (DCP) test was performed at each test pit location to assess the in situ strength of near surface soil. These tests were performed to depths ranging from about 1.0 m to 1.7 m.

A geotechnical engineer from Golder located the test pits using a hand held GPS unit, described the materials encountered in the test pits, performed field tests including the DCP tests and photographed the test pit excavations and test pit spoil.

The subsurface conditions encountered in the test pits are presented in Appendix A as Reports of Test Pits TP1 and TP3 to TP7. Photographs of the test pit excavations and test pit spoil, and DCP test results, are included in the reports along with the following information sheets relevant to the interpretation of the reports:

- Explanation of notes, abbreviations and terms used on borehole and test pit reports
- Method of soil description used on borehole and test pit reports

5.0 RESULTS OF PRELIMINARY GEOTECHNICAL INVESTIGATION

5.1 General Conditions within HGA Wind Farm Area

5.1.1 Site Geology

At a regional scale, the location of the proposed HGA WF lies within the south eastern area of the Gippsland Basin. At a more local scale, the site is within the Alberton Depression, on the south western fringe of the Strzelecki Ranges (Southern Uplands of Victoria).

Geological maps indicate the surface geology mostly includes Quaternary age sediments where the wind turbines are proposed. These sediments include the following:

- Stream alluvium deposits;
- River and coastal terraces and flood plain deposits;
- Swamp and lagoonal deposits;
- Dune, beach and estuarine deposits; and
- Aeolian sand sheets.

The surface geology of the site, as shown on the Geological Survey of Victoria Alberton 1:50,000 scale mapsheet, along with the positions of the proposed wind turbines, is presented on Figure 3, Wind turbine location and regional geology.

For the purpose of the following discussion the wind farm area has been sub-divided into five geographic zones, as shown on Figure 3. The wind turbine locations falling within each zone are presented in Table 1.

Table 1: Wind turbine zone

Zone	Zone location description	Wind Turbine Number
1	South of South Gippsland Highway, east of Birds Road	T01 to T07
2	North and south of South Gippsland Highway, east of Coal Mine Road	T08 to T11
3	South of South Gippsland Highway, west of Ti Tree Road	T12 to T16, T18, T19, T22, T27, T31 to T34
4	North of South Gippsland Highway, adjacent to Old Alberton West Road	T17, T24 to T26, T29
5	North of Pound Road West	T20, T21, T23, T28, T30

A summary of the geological units expected at or near ground surface throughout the proposed wind farm area (based on the Alberton 1:50,000 scale mapsheet) is presented in Table 2.

Table 2: Geology at (or near) surface based on Alberton 1:50,000 scale mapsheet

Geological Unit	Summary Description	Zones where mapped at Surface
Qra	Stream Alluvium and very low level terraces. Grey carbonaceous clay, silt, fine sand and peat. Minor basaltic clay, basalt and quartz gravels.	3, 4 and 5
Qrm	Swamp and marsh deposits. Black carbonaceous muds with organic material, extensive peats.	1, 2 and 3
Qd	Coastal barrier deposits of low irregular beach and dune ridges and hummocks consisting of fine to medium quartz sand with minor carbonate.	1 and 3
Qpa	High level alluvium, grey carbonaceous clay, silty clay and minor sand.	1, 2, 3, 4 and 5
Tvo (Older Volcanics)	Basalt and tuff often extremely weathered. Claystone and siltstone possibly present.	4

The surficial alluvial deposits described in Table 2 are expected to be generally of low thickness across the site, typically being less than about 5 m thick.

Across the wind farm site, the surficial alluvium deposits are expected to be mostly underlain by Tertiary age Haunted Hill Gravels (Tph) materials which typically include clayey and sandy gravel, coarse sand, minor clay, fine sand and silt. These deposits are expected to be mostly between about 5 m and 10 m thick beneath the site area.

Underlying the Haunted Hill Gravels, Tertiary age Latrobe Valley Coal Measures (Tel) materials are expected to be present beneath some areas of the site, particularly beneath Zones 1 to 4. Figure 3 shows the extent of the 'Gelliondale Coalfield' area, where numerous historical boreholes were drilled to investigate the extent of the coal reserve. This formation includes thick brown coal seams, ligneous clay, sand and minor gravel. Historical records and the Alberton mapsheet suggest that the top of this formation is at an average depth of about 8 m in the area of the proposed T08, T10 and T11 turbines. This coal formation is indicated to be about 60 m thick in the area of these proposed turbines.

Beneath the Latrobe Valley Coal Measures formation, Tertiary age Older Volcanics (Tvo) basalt and Cretaceous age Strezleki Group (Kls) sandstone, siltstone and mudstone is expected. It is noted that the Older Volcanics are expected at ground level in the area immediately south of the proposed T17 turbine in

Zone 4. The Strezleki Group materials are expected to be at least 20 m depth below ground level over the site.

5.1.2 Groundwater

Table 3 presents groundwater levels recorded in bores within close proximity to proposed wind turbine locations (from publically available databases). The bores listed in Table 3 have been measured at various intervals (bi-monthly to quarterly) over a period of seventeen years.

Table 3: Groundwater levels measured in bores

Bore ID	Depth to Groundwater (m)			Comment on vicinity to proposed wind Turbine location
	May 2016	Minimum recorded	Maximum recorded	
WRK957612	1.8	0.1 (Jul 2001)	2.78 (Apr 2001)	In Zone 2, within a distance of about 0.5 km - 0.75 km from T08 to T11.
WRK957613	1.7	0.07 (Jul 2001)	2.72 (Apr 2000)	
WRK957539	1.8	0.07 (Aug 2001)	2.22 (Aug 2008)	
WRK957540	1.6	0.04 (Jul 2001)	2.42 (Jul 2008)	
WRK957607	0.7	+0.06 (Jun 2013)	1.32 (Feb 2007)	In Zone 2, within a distance of about 0.5 km - 1 km from T31 to T34.
WRK957608	0.6	+0.05 (Jun 2013)	1.32 (Oct 2008)	
WRK957609	0.4	0.8 (Aug 2008)	+0.3 (Jan 2013)	
WRK957601	4.8	1.9 (Jan 2007)	5.28 (Sept 2007)	In Zone 4, within a distance of about 0.5 km from T17
WRK957602	7.3	2.99 (Oct 2000)	7.6 (July 2014)	
WRK957603	7.1	2.43* (Jun 2002)	7.3 (Mar 2013)	

Note: *Bore WRK957603 recorded 0 m depth in June 2013 and 0.05 m in August 2009. These readings appears to be an anomalous reading given observed trends and measurements in nearby bores.

The available groundwater data indicates that the groundwater levels can be relatively high (less than 1 m below ground level), particularly south of the South Gippsland Highway. Some areas where the WTGs are proposed may be subject to seasonal flooding. Evidence of this was observed during the site visit where extensive areas of saturated ground and surface water were evident, making some areas inaccessible for vehicles.

5.2 Site Conditions within each Zone

Based on observations of the wind farm area made from air photos, during the site inspection and test pit investigations, the following sections summarise the conditions expected within each zone.

5.2.1 Zone 1

A total of seven wind turbines are proposed within Zone 1.

The topography of Zone 1 has an overall gentle slope in a north to south direction, ranging from an elevation of about RL 12 m AHD at the north (south of South Gippsland Highway) to an elevation of about RL 6 m AHD in the south area around the proposed T01 location.

An inferred alluvial terrace extends across the zone, extending from immediately south of Birds Road South, in a north easterly direction to south of T06 where a gravel road on the eastern boundary terminates (see Figure 3). In places there is a reduction in elevation of about 2 m to the south, and the ground appeared to be wet (at the time of our site visit) where this elevation reduction occurs and where it is closer proximity to Nine Mile Creek (oriented east-west in the southern end of the property).

No evidence of slope instability was observed in this zone during our site visit.

The area is currently agricultural land used for livestock and cropping. The area is well grassed with trees on the boundaries of paddocks. The area is mostly bounded to the east by the Gelliondale State Forest.

The subsurface materials encountered in Test Pit TP1 located near the proposed T02 comprised high plasticity clay ranging from firm to stiff consistency to the maximum investigation depth of 2.7 m. Sandy silty clay (topsoil) was encountered to 0.2 m depth. Groundwater was encountered at 2.4 m depth.

Photograph 1 below shows the ground surface condition looking in a southerly direction towards the proposed T05 and T04 locations from just east of the proposed T06 location.

Photograph 1: Looking in a southerly direction towards T05 and T04 locations from just east of T06 location

5.2.2 Zone 2

A total of four wind turbines are proposed within Zone 2.

The topography in Zone 2 has an overall gentle slope in a north to south direction. The area around the proposed T09 location is at an elevation of about RL 16 m AHD, and drops to an elevation of about RL 10 m AHD above sea level to the south around the proposed wind turbines T08, T10 and T11 locations.

No evidence of slope instability was observed in this zone.

Some surface water ponding was present at the time of our site visit as shown in Photograph 2. Site observations suggest that the proposed T08 location could be positioned in a low lying marsh type feature. Vehicle access to near this site was not possible during the site visit due to wet ground surface conditions.

The area is currently agricultural land used for livestock and cropping. The paddocks are thickly grassed and is bounded to the south and west by the Gelliondale State Forest.

The subsurface materials encountered in Test Pit TP3 located near the proposed T10 and T11 comprised high plasticity clay of mostly firm consistency to the maximum investigation depth of 2.6 m. Sandy silty clay (topsoil) was encountered to 0.2 m depth. Groundwater was encountered at 1.9 m depth.

Photograph 2 below shows the ground surface condition looking in a southerly direction towards the proposed T10 and T11 locations from the South Gippsland Highway and Coal Mine Road intersection.

Photograph 2: Looking in a southerly direction towards T10 and T11 from South Gippsland Highway and Coal Mine Road Intersection

5.2.3 Zone 3

A total of thirteen wind turbines are proposed within Zone 3.

The topography in Zone 3 has an overall gentle slope in a north to south direction, ranging from about RL 8 m AHD to RL 5 m AHD.

No evidence of slope instability was observed in this zone. The ground surface was observed to become wetter to the south.

The area is currently agricultural land used for livestock and possibly cropping. The area is mostly bounded to the south by the Gelliondale State Forest.

The subsurface materials encountered in Test Pit TP4 located near the proposed T18 included silty sand (topsoil) to 0.2 m depth, overlying medium dense to dense sand to 0.5 m depth. Stiff sandy clay of high plasticity clay was then encountered to 1.4 m depth, overlying very dense sand and clayey sand to the maximum investigation depth of 2.5 m.

The subsurface materials encountered in Test Pit TP5 located near the proposed T34 encountered silty sandy clay of high plasticity to 0.4 m depth, overlying stiff high plasticity clay to 2.4 m, then very dense clayey sand to the maximum investigation depth of 2.6 m.

No groundwater was encountered Test Pit TP4. Groundwater was encountered in Test Pit TP5 at a depth of 2.4 m.

Photograph 3 below shows the ground surface condition looking in a westerly direction towards the proposed T18 and T22 locations from the intersection of the northern boundary of Gelliondale State Forest and Ti Tree Road.

Photograph 3: Looking in a westerly direction towards T18 and T22 from northern boundary of Gelliondale State Forest and Ti Tree Road

5.2.4 Zone 4

A total of five wind turbines are proposed within Zone 4.

The topography within Zone 4 is relatively flat with local undulations and gentle slopes towards localised drainage channels. Overall the ground surface between elevations of about RL 6 m AHD to RL 10 m AHD. Albert River is located on the north boundary of this zone, and is oriented in a northwest to southeast orientation.

The area is currently agricultural land used for livestock and possible cropping.

No evidence of slope instability was observed in this zone.

The subsurface materials encountered in Test Pit TP6 located near the proposed T17 and T25 encountered silty sandy clay of high plasticity to 0.3 m depth, overlying stiff high plasticity clay to the maximum investigation depth of 2.5 m.

No groundwater was observed in Test Pit TP6.

Photograph 4 below shows the ground surface condition looking in a north easterly direction towards the proposed T25 location from the entrance gate off Old Alberton Drive.

Photograph 4: Looking in a north easterly direction towards WTG T25 from gate off Old Alberton Drive

5.2.5 Zone 5

A total of five wind turbines are proposed within Zone 5.

The topography in Zone 5 undulates due to the presence of numerous drainage channels that feed into Stony Creek. In general the ground surface elevation ranges from about RL 14 m AHD to RL 18 m AHD. During the site visit sections of this zone had ponded surface water present.

The area is currently agricultural land used for livestock and possible cropping. The proposed northern most T21 and T23 locations were not accessible with a vehicle during the site visit due to the presence of saturated and 'boggy' ground surface conditions. These proposed wind turbine positions are located in a lower lying area of the site.

No evidence of slope instability was observed in this zone.

The subsurface materials encountered in Test Pit TP7 located near the proposed T28 encountered sandy silty clay (topsoil) of high plasticity to 0.2 m depth, overlying high plasticity clay having a consistency increasing with depth, ranging from firm to very stiff to the maximum investigation depth of 2.5 m.

No groundwater was encountered in Test Pit TP7.

Photograph 5 below shows the ground surface condition looking in a north direction towards the proposed T20, T21 and T23 locations from a private access road.

Photograph 5: Looking in a north direction towards T20, T21 and T23 from private access road

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 Wind Turbine Generator Footings

6.1.1 Site Subsurface Conditions

The preliminary geotechnical investigations performed at the proposed wind farm site show that the near surface conditions comprise mostly alluvial high plasticity clay ranging from firm to stiff consistency to a depth of about 2.5 m. In the Zone 3 area, the high plasticity clay was interbedded with sand and clayey sand layers ranging from medium dense to very dense. Alluvial soils are expected to be mostly less than about 5 m thick at the site.

The alluvial soils are expected to be mostly underlain by Haunted Hill Gravel materials comprising clayey and sandy gravel, coarse sand, minor clay, fine sand and silt. We anticipate that these deposits will likely be mostly between about 5 m and 10 m thick beneath the site area. Materials expected beneath the Haunted Hill Gravel materials include materials of the Latrobe Valley Coal Measures (brown coal, ligneous clay, sand), Older Volcanics (basalt) and Strezleki Group (sandstone, siltstone, and mudstone).

The desktop review and preliminary geotechnical investigations show the presence of a generally high groundwater at some locations, particularly on the lower lying areas located south of the South Gippsland Highway. Historical measurements of borehole standpipes indicate the groundwater level to be close to ground surface during wetter months in the areas south of the South Gippsland Highway. The recent test pit investigations in this area (TP1, TP3 to TP5) mostly showed groundwater to be present at depths ranging from 1.9 m to 2.4 m. North of the railway line, historical measurements in borehole standpipes showed groundwater to be at a minimum depth of about 2 m below ground level. The recent test pit investigations in this area (TP6 and TP7) did not encounter groundwater (during the period that test pits remained open) within a 2.5 m depth.

6.1.2 Footing Options

The design of footings for wind turbines needs to take into account a number of factors that are not always significant for other structures. The wind turbines, by their nature, are relatively light structures that are subjected to extreme overturning loads due to their height and the applied wind loads. As a result, resisting over turning under the ultimate wind load is a major function of the foundation system and this aspect generally governs the size of footing required.

A number of footing options are available. The traditional footing system is a large concrete pad footing buried below the surface. This option provides additional weight, from the concrete footing and the overlying soil, to resist the overturning forces. In our experience square footings are often adopted to simplify the layout of the reinforcement in the footing. Octagonal or round footings are also commonly used instead of square footings to save on concrete. Concrete pad footings for support of wind turbines are typically founded at a depth of about 2 m, having a nominal thickness of about 1.5 m and overlain by 0.5 m thickness of soil. The width of pad footings can be up to 20 m, or greater.

Alternate footing systems involve the use of anchors or piles to increase overturning resistance and stiffness or where mass gravity footings are unsuitable. These alternatives are less common and require certain subsurface conditions. Ground anchors are usually only suitable where rock foundation conditions occur, and used to reduce the size of a mass gravity footing. Pile footings are suitable when low strength founding materials are present near the surface which preclude the use of a mass gravity footing. These options can result in use of a smaller footing, but they require careful attention to the structural design to ensure that the loads are transmitted through the footing.

The preliminary geotechnical investigations performed indicate that pad footings may not be a suitable footing option for many of the turbine sites, particularly those where a high ground water level is expected and where low strength soils are present. We expect that pad footings will only be a suitable footing option when soil foundations comprise clay of at least stiff consistency or sand which is at least medium dense. The foundation conditions encountered at Test Pits TP1 (Zone 1) and TP3 (Zone 2) which included firm clay are unlikely to be suitable for use of pad footings to support wind turbines.

Where pad footings are an unsuitable footing option, it is envisaged that either driven precast concrete piles or Continuous Flight Auger (CFA) piles could be used, with the turbine being supported on a pile cap. Given the likely magnitude of the loads it is expected that multiple piles would be required for each footing. Based upon the results of the desktop review and preliminary geotechnical investigation the Quaternary alluvial soils may be expected to be only generally shallow, of less than about 5 m thickness. We would therefore expect that the piles will need to be installed to found into the expected underlying higher strength soil or rock, possibly being installed to reach effective refusal into dense or very dense Haunted Hill Gravels materials or into rock of the Older Volcanics or Strezleki Group formations. Turbine locations where foundations are expected to comprise a shallow thickness of alluvial soil and Haunted Hill Gravels materials overlying Latrobe Valley Coal Measures materials (e.g. coal) are expected to require special consideration. We would expect that founding piles in the Haunted Hill Gravels materials will be preferable to founding in the underlying expected lower strength Latrobe Valley Coal Measures materials.

6.1.3 Preliminary Footing Design Parameters

6.1.3.1 Pad Footings

Table 4 presents indicative maximum ultimate bearing pressures that may be considered for preliminary design of pad footings for support of wind turbines. It should be noted that these pressures are related to the footing dimensions and the values will need to be confirmed once the actual loads on the structure are known and the footing sizes are assessed. These pressures are unfactored and appropriate geotechnical strength reduction factors or factors of safety will need to be applied for design of the footing.

Table 4: Indicative Maximum Ultimate Bearing Pressures (Unfactored)

Founding Material	Maximum Ultimate Bearing Pressure (kPa)
At least Medium Dense Sand/Silty Sand/Clayey Sand	400
Stiff or stronger Clay	300

6.1.3.2 Pile Footings

Given the presence of lower strength soils at typical pad founding depths and the relatively shallow groundwater level piles could be used to increase the stiffness of the profile below the pad footing and to increase the available bearing pressures (thereby reducing pad sizes). Either driven precast concrete piles or CFA piles could be used which are installed to effective refusal into dense or very dense soil or rock or potentially shallower depending upon the subsurface profile. Precast concrete piles in Victoria are typically supplied with either 350 mm or 400 mm square cross sections. CFA piles are mostly constructed using 600 mm, 750 mm or 900 mm diameter augers. CFA piles therefore have the advantage of a larger cross sectional area which increases the capacity of the piles.

For preliminary design of precast driven concrete piles installed to effective refusal, we recommend a maximum allowable design working load of 1.5 MN for 350 mm square piles and 2 MN for 400 mm square piles.

The successful installation of CFA piles and their ability to achieve stated design loads relies on the nature and size of the equipment and procedures used in their installation. For preliminary design purposes, for individual 600 mm, 750 mm and 900 mm diameter CFA piles installed to effective refusal we recommend maximum design geotechnical strengths (factored ultimate axial load capacity) of 3 MN, 4.5 MN and 6 MN, respectively.

The design loads achieved for driven precast piles and CFA piles will need to be confirmed by dynamic load testing and subsequent CAPWAP analysis.

6.1.4 Possible founding conditions by zone

We understand Synergy Wind is considering potential turbine footing options including shallow pad or deeper piled footings. The selection of a preferred footing option at each turbine location will depend on a number of factors including the design loads to be supported, the likely founding materials for shallow and deep founding options, groundwater conditions and constructability considerations. As requested by Synergy Wind we have made a preliminary assessment of potential founding conditions that may be encountered in each of the zones referred to in Section 5 with respect to the following founding options/conditions:

- pad footing with deep groundwater level
- pad footing with shallow ground water level
- pad footing combined with piles

For the purpose of assessing the likely shallow founding and groundwater conditions in each area we have primarily relied on information obtained from the test pits excavated in each area. We note that the subsurface conditions within each zone are likely to vary between turbine locations so the following assessment should be considered preliminary only. Furthermore the pits, by their nature, have only intersected the shallow soil profile. Table 5 presents a summary of turbine locations within each zone, a summary of near surface soil and groundwater conditions encountered during the preliminary geotechnical investigation and possible founding options that may be satisfactory.

Table 5: Wind turbine zone and possible founding conditions/options

Zone	Wind Turbine Numbers	Summary shallow subsurface conditions	Possible founding options
1	T01 to T07	Firm to stiff clay Shallow groundwater	Pad footing combined with piles
2	T08 to T11	Firm clay Shallow groundwater	Pad footing combined with piles
3	T12 to T16, T18, T19, T22, T27, T31 to T34	Stiff clay / very dense clayey sand Shallow groundwater	Pad footing combined with piles
4	T17, T24 to T26, T29	Stiff clay Groundwater not encountered in test pit however historic bore information indicates the potential for shallow groundwater	Pad footing or pad footing combined with piles
5	T20, T21, T23, T28, T30	Very stiff clay Groundwater not encountered in test pit however surface conditions in some areas were observed to be boggy	Pad footing or pad with piles

A more detailed assessment of footing options will need to be undertaken once information regarding design loads is available and a detailed geotechnical investigation, including the drilling of deeper boreholes, has been completed.

6.2 Crane Pads

At this time the size of cranes proposed for construction of the wind turbines and the magnitude of the likely loads is unknown. It is expected that a crane pad to provide a working platform for the cranes will be required at each turbine location. Crane pads will need to be constructed using VicRoads Class 4 crushed rock or an equivalent quality locally quarried material. The thickness of crane pads required will depend on the sizes of the cranes used and the ground bearing pressures imposed during lifting. Based on the ground conditions assessed to date at the site, crane pads ranging up to about 1 m thickness are expected to be required.

6.3 Road Design

It is expected that the project will involve the construction of a number of roads, some for construction purposes and others for ongoing maintenance requirements. The construction traffic is likely to include cars, utilities, four-wheel drive vehicles, large semi trailers, B-double, concrete trucks and large cranes. The post construction traffic is expected to be limited to light vehicles and an occasional maintenance vehicle.

Pavement construction procedures would be likely to consist of stripping the surface topsoil prior to placement of road pavement materials. The underlying subgrade will need to be proof rolled in order to identify any unstable areas requiring treatment prior to pavement construction. We have noted during our site visit that there are many poorly drained areas at this site, with some areas subject to flooding. It is clearly preferable that construction of the roads for this project be planned for drier periods.

The pavement may be prone to erosion in periods of heavy rainfall. This may be particularly pronounced in steeper sections of the roads. It will therefore be important that close attention is paid to drainage of the pavements. The pavements should be designed to shed water and to the extent possible runoff should not be allowed to form concentrated flows.

The materials used for road construction are likely to consist of materials won from local borrow areas.

6.4 Further Investigations

The subsurface conditions across the site at the proposed wind turbine locations are expected to be generally highly variable. To date, the geotechnical investigations performed have only extended to about 2.5 m depth. It is recommended that prior to detailed design borehole investigations are undertaken at each turbine site to assess foundation conditions. The boreholes will need to extend to sufficient depth to investigate suitable founding layers for the turbine footings. The investigations should include measurement of groundwater depths.

7.0 IMPORTANT INFORMATION

Your attention is drawn to the document - 'Important Information' (LRG04, RL2) which is included in Appendix B of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who may use this report aware of the responsibilities each assumes in so doing.

We would be pleased to answer any questions the reader may have regarding this 'Important Information'.

Report Signature Page

GOLDER ASSOCIATES PTY LTD

Andrew Russell
Associate

IJH/ASR/ijh

A.B.N. 64 006 107 857

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MURPHYS ROAD
BILLY CREEK ROAD
MCGALLIARDS ROAD
LOWER JACK ROAD
BRAINS ROAD
SILVER GATES ROAD
TAP TAP ROAD
NUGENTS ROAD
GELLIONDALE ROAD
FOREST LODGE ROAD
MILLERS HILL ROAD
POUND ROAD W
MEADOWS
NORTH ROAD
ASKEWS ROAD
WESTS ROAD
OLD ALBERTON WEST ROAD
JAMES ROAD N
COAL MINE ROAD
MCPHERSONS ROAD
SOUTH GIPPSLAND HIGHWAY
BIRDS ROAD
BIRDS ROAD S
PEARSONS ROAD
TI TREE ROAD
TELEGRAPH ROAD
MCPHAILS ROAD
JAMES ROAD

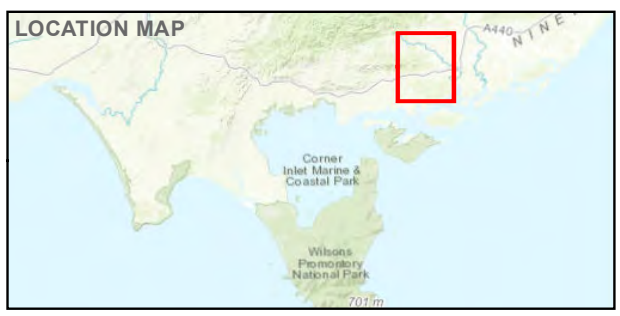
T01 T02 T03 T04 T05 T06 T07 T08 T09 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19 T20 T21 T22 T23 T24 T25 T26 T27 T28 T29 T30 T31 T32 T33 T34

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

- Proposed Wind Turbine
- Site Property Boundary

LOCATION MAP



0 500 1,000 1,500 2,000
METRES

REFERENCE SCALE: 1:40,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
SYNERGY WIND PTY LTD

PROJECT
HGA WIND FARM, SOUTH GIPPSLAND - PRELIMINARY GEOTECHNICAL INVESTIGATION

TITLE
SITE LOCATION AND LAYOUT

CONSULTANT
Golder Associates

YYYY-MM-DD	2/12/2016
PREPARED	AFE
DESIGN	-
REVIEW	ASR
APPROVED	ASR

PROJECT No.	CONTROL	REVIEW	FIGURE
1666035	001-R	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3

0 25mm

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MURPHYS ROAD
LOWER JACK ROAD
BILLY CREEK ROAD
BRAINS ROAD
GELLIONDALE ROAD
TAP TAP ROAD
NUGENTS ROAD
NORTH ROAD
POUND ROAD W
ASKEWS ROAD
WESTS ROAD
COAL MINE ROAD
SOUTH GIPPSLAND HIGHWAY
OLD ALBERTON WEST ROAD
TI TREE ROAD
BIRDS ROAD
BIRDS ROAD S
PEARSONS ROAD
TELEGRAPH ROAD
JAMES ROAD
MCPHAILS ROAD

T23 T21 T30 T20 TP07 Zone 5 T28
T24 T17 TP06 T25 T29 Zone 4 T26
T09 Zone 2
TP05 T31 T34 T32 Zone 3 T33
T14 TP03 T08 Zone 2 T10 T11 T12 T15 T18 T22 T27 TP04 T13 T16 T19
T07 T06 T03 T05 T02 TP01 T04 T01 Zone 1

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

- Approximate Test Pit Location
- Proposed Wind Turbine
- Wind Farm Zone
- Site Property Boundary

LOCATION MAP

0 500 1,000 1,500 2,000 METRES

REFERENCE SCALE: 1:40,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
SYNERGY WIND PTY LTD

PROJECT
HGA WIND FARM, SOUTH GIPPSLAND - PRELIMINARY GEOTECHNICAL INVESTIGATION

TITLE
TEST PIT PLAN

CONSULTANT
Golder Associates

YYYY-MM-DD	2/12/2016
PREPARED	AFE
DESIGN	-
REVIEW	ASR
APPROVED	ASR

PROJECT No.	CONTROL	REVIEW	FIGURE
1666035	001-R	0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3
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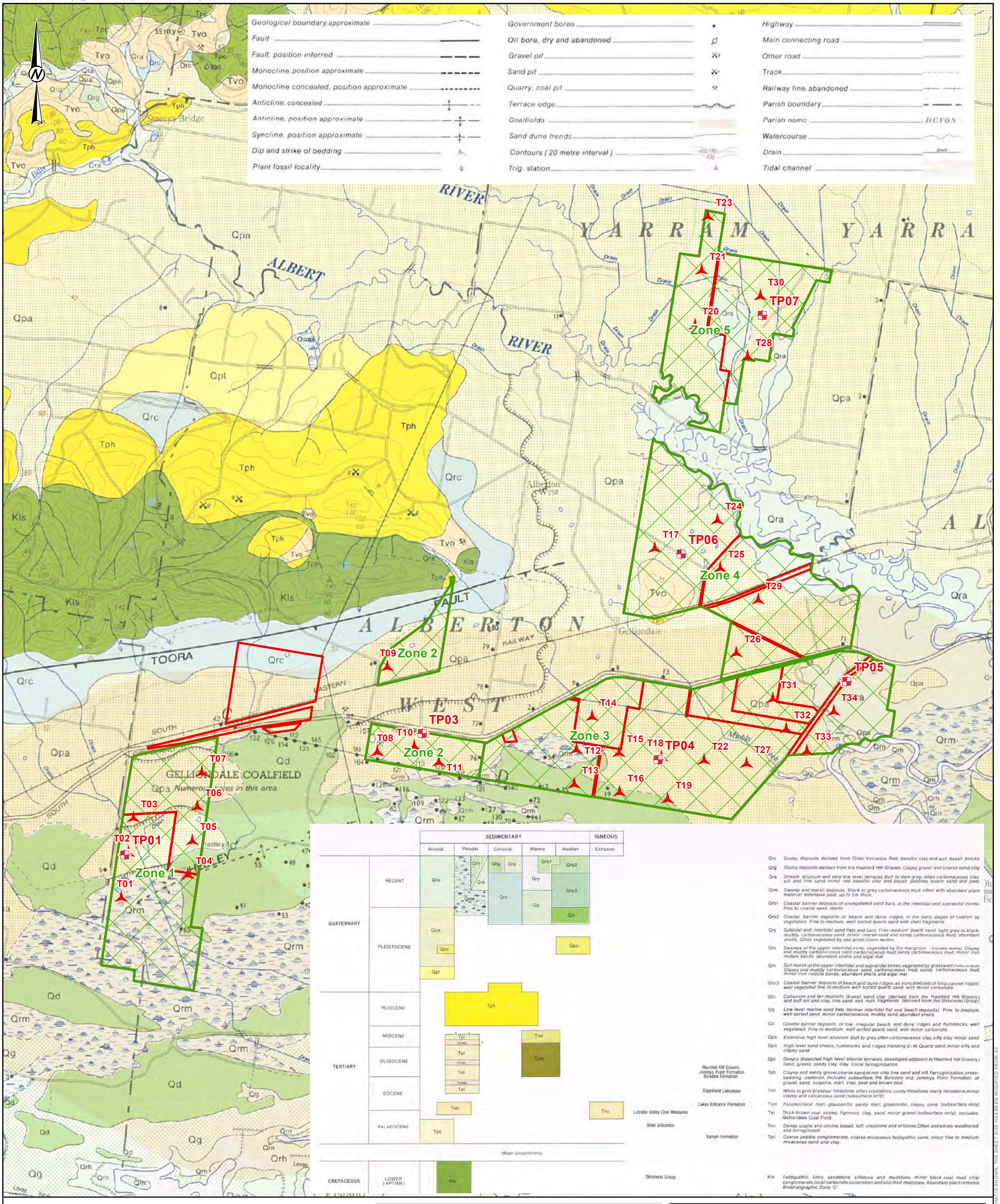
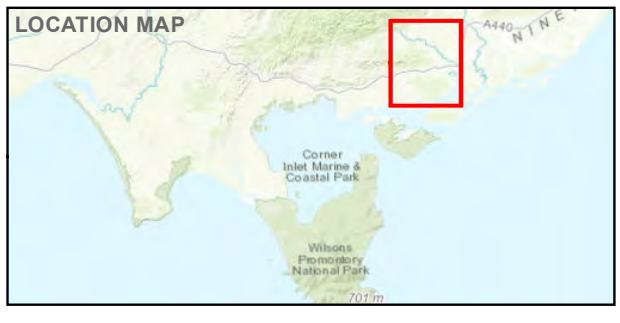


LEGEND

- Approximate Test Pit Location
- Proposed Wind Turbine
- Wind Farm Zone
- Site Location

LOCATION MAP



0 500 1,000 1,500 2,000 METRES

REFERENCE SCALE: 1:50,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
SYNERGY WIND PTY LTD

PROJECT
HGA WIND FARM, SOUTH GIPPSLAND - PRELIMINARY GEOTECHNICAL INVESTIGATION

TITLE
WIND TURBINE LOCATION AND REGIONAL GEOLOGY

CONSULTANT
Golder Associates

YYYY-MM-DD	2/12/2016
PREPARED	AFE
DESIGN	-
REVIEW	ASR
APPROVED	ASR

PROJECT No.	CONTROL	REVIEW	FIGURE
1666035	001-R	0	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: A3

0 25mm

APPENDIX A

Reports of Test Pits TP1 and TP3 to TP7

Photographs of Test Pits TP1 and TP3 to TP7

Explanation of notes, abbreviations and terms used on borehole and test pit reports

Method of soil description used on borehole and test pit reports

REPORT OF TEST PIT: TP1

Golder Associates

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: Birds Road South
JOB NO: 1666035

POSITION: Birds Road South
COORDS: 458631 m E 5722033 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.45 m
PIT DEPTH: 2.70 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	M		0.0					CH	Sandy Silty CLAY high plasticity, dark grey, fine sand	M (c PL)		rootlets and organics near surface	0 5 10 15 20 25
				0.20				CH	CLAY high plasticity, dark grey		F - St		
			0.5		0.50 m PP = 150 kPa					M (>PL)			
				0.80					pale grey and orange				
			1.0		1.00 m PP = 150 kPa								
			1.5							M			
											St		
			2.0		2.00 m PP = 100 kPa								
		▽		2.40					trace fine sand				
			2.5		2.50 m PP = 100 kPa					W			
									TEST PIT DISCONTINUED @ 2.70 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 2.40 m DEPTH BACKFILLED				
			3.0										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i
RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP1

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: Birds Road South
JOB NO: 1666035

POSITION: Birds Road South
COORDS: 458631 m E 5722033 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.45 m
PIT DEPTH: 2.70 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

1.

2.

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP3

Golder Associates

CLIENT:	Synergy Wind Pty Ltd	POSITION: South Gippsland Hwy	
PROJECT:	HGA Wind Farm	COORDS: 462825 m E 5723740 m N MGA94 56 (hhGPS)	SHEET: 1 OF 1
LOCATION:	South Gippsland Hwy	SURFACE RL: DATUM: AHD	MACHINE: Takeuchi TB180 FR
JOB NO:	1666035	LENGTH: 3.00 m WIDTH: 0.50 m	CONTRACTOR: Latrobe Excavation
		PIT DEPTH: 2.60 m	LOGGED: TCD DATE: 17/11/16
		BUCKET TYPE: 450 mm	CHECKED: ASR DATE: 25/11/16

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	M		0.0					CH	Sandy Silty CLAY high plasticity, dark grey, fine sand	M (c PL)		rootlets and organics near surface	0 5 10 15 20 25
				0.20				CH	CLAY high plasticity, dark grey		F - St		
			0.5		0.50 m PP = 100 kPa								
			1.0	1.00	1.00 m PP = 100 kPa				grey and orange	M (>PL)			
	L	▽	1.5								F		
			2.0		2.00 m PP = 50 kPa					W			
			2.5						TEST PIT DISCONTINUED @ 2.60 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 1.90 m DEPTH BACKFILLED				
			3.0										

REPORT OF TEST PIT PHOTOGRAPHS: TP3

CLIENT:	Synergy Wind Pty Ltd	POSITION: South Gippsland Hwy	
PROJECT:	HGA Wind Farm	COORDS: 462825 m E 5723740 m N MGA94 56 (hhGPS)	SHEET: 1 OF 1
LOCATION:	South Gippsland Hwy	SURFACE RL: DATUM: AHD	MACHINE: Takeuchi TB180 FR
JOB NO:	1666035	LENGTH: 3.00 m WIDTH: 0.50 m	CONTRACTOR: Latrobe Excavation
		PIT DEPTH: 2.60 m	LOGGED: TCD DATE: 17/11/16
		BUCKET TYPE: 450 mm	CHECKED: ASR DATE: 25/11/16

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2.

REPORT OF TEST PIT: TP4

Golder Associates

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: South Gippsland Hwy
JOB NO: 1666035

POSITION: South Gippsland Hwy
COORDS: 466154 m E 5723370 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.50 m
PIT DEPTH: 2.50 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L		0.0					SW-SM	Silty SAND fine to medium grained, dark grey			rootlets and organics near surface	0 5 10 15 20 25
				0.20									
	L							SW	SAND fine to medium grained, yellow grey, trace silt	M	MD - D		
			0.5	0.50				CH	Sandy CLAY high plasticity, orange grey, fine sand				
	M		1.0							M (>PL)	St		
				1.40				SW	SAND fine to medium grained, yellow pale grey, with some silt				
	L		1.5							M	VD		
			2.0										
				2.40					Clayey SAND fine to medium grained, yellow pale grey, high plasticity clay				
			2.5						TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH GROUNDWATER NOT OBSERVED BACKFILLED				
			3.0										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP4

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: South Gippsland Hwy
JOB NO: 1666035

POSITION: South Gippsland Hwy
COORDS: 466154 m E 5723370 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.50 m
PIT DEPTH: 2.50 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

1.

2.

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP5

Golder Associates

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: Ti Tree Road
JOB NO: 1666035

POSITION: Ti Tree Road
COORDS: 468816 m E 5724475 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.50 m
PIT DEPTH: 2.60 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L		0.0					CH	Silty Sandy CLAY high plasticity, dark grey, fine sand	M (c PL)	F	rootlets and organics near surface	0 5 10 15 20 25
				0.40				CH	CLAY high plasticity, orange and pale grey, with some fine sand				
			0.5		0.50 m PP = 150 kPa								
			1.0		1.00 m PP = 100 kPa					M (>PL)	St		
			1.5										
			2.0										
		▽		2.40				SW	Clayey SAND fine to coarse grained, orange, high plasticity clay	W	VD	300 mm of water accumulated in base of test pit after 45 min	
			2.5						TEST PIT DISCONTINUED @ 2.60 m TARGET DEPTH GROUNDWATER ENCOUNTERED @ 2.40 m DEPTH BACKFILLED				
			3.0										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP5

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: Ti Tree Road
JOB NO: 1666035

POSITION: Ti Tree Road
COORDS: 468816 m E 5724475 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.50 m
PIT DEPTH: 2.60 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

1.

2.

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP6

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: Old Alberton West Road
JOB NO: 1666035

POSITION: Old Alberton West Road
COORDS: 466479 m E 5726274 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.50 m
PIT DEPTH: 2.50 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	M		0.0					CH	Sandy Silty CLAY high plasticity, dark grey, fine sand	M (c PL)	St	rootlets and organics near surface	0 5 10 15 20 25
				0.30				CH	CLAY high plasticity, dark grey	M (c PL)			
			0.5	0.60	0.40 m PP = 250 kPa				pale grey and orange				
			1.0		0.80 m PP = 150 kPa								
			1.5		1.50 m PP = 200 kPa					M (>PL)			
			2.0		2.00 m PP = 150 kPa								
			2.5						TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH GROUNDWATER NOT OBSERVED BACKFILLED				
			3.0										

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP6

CLIENT:	Synergy Wind Pty Ltd	POSITION: Old Alberton West Road	
PROJECT:	HGA Wind Farm	COORDS: 466479 m E 5726274 m N MGA94 56 (hhGPS)	SHEET: 1 OF 1
LOCATION:	Old Alberton West Road	SURFACE RL: DATUM: AHD	MACHINE: Takeuchi TB180 FR
JOB NO:	1666035	LENGTH: 3.00 m WIDTH: 0.50 m	CONTRACTOR: Latrobe Excavation
		PIT DEPTH: 2.50 m	LOGGED: TCD DATE: 17/11/16
		BUCKET TYPE: 450 mm	CHECKED: ASR DATE: 25/11/16

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This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF TEST PIT: TP7

Golder Associates

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: Pond Road West
JOB NO: 1666035

POSITION: Pond Road West
COORDS: 467624 m E 5729643 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.50 m
PIT DEPTH: 2.50 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L		0.0	0.20				CH	Sandy Silty CLAY high plasticity, dark grey	M		rootlets and organics near surface	
	M		0.5	0.50	0.60 m PP = 150 kPa			CH	CLAY high plasticity, dark grey orange and pale grey	M (>PL)	F St VSt		
			1.0										
			1.5		1.80 m PP = 200 kPa								
			2.0										
			2.5		2.50 m PP = 250 kPa				TEST PIT DISCONTINUED @ 2.50 m TARGET DEPTH GROUNDWATER NOT OBSERVED BACKFILLED				
			3.0										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01i RL3

REPORT OF TEST PIT PHOTOGRAPHS: TP7

CLIENT: Synergy Wind Pty Ltd
PROJECT: HGA Wind Farm
LOCATION: Pond Road West
JOB NO: 1666035

POSITION: Pond Road West
COORDS: 467624 m E 5729643 m N MGA94 56 (hhGPS)
SURFACE RL: DATUM: AHD
LENGTH: 3.00 m WIDTH: 0.50 m
PIT DEPTH: 2.50 m
BUCKET TYPE: 450 mm

SHEET: 1 OF 1
MACHINE: Takeuchi TB180 FR
CONTRACTOR: Latrobe Excavation
LOGGED: TCD DATE: 17/11/16
CHECKED: ASR DATE: 25/11/16

1.

2.

This report of test pit photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	HMLC	Diamond Core – 63mm
HA	Hand Auger	PT	Push Tube	BH	Tractor Mounted Backhoe
ADH	Hollow Auger	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	JET	Jetting	EE	Existing Excavation
WB	Washbore or Bailer	NDD	Non-destructive digging	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (s_v = peak value, s_r = residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Static cone penetration test
CPTu	Static cone penetration test with pore pressure (u) measurement

Ranking of Visually Observable Contamination and Odour (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum \text{Axial lengths of core} > 100 \text{ mm}}{\text{Length of core run}} \times 100$$

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS


FILL


GRAVEL (GP or GW)


SAND (SP or SW)


SILT (ML or MH)


CLAY (CL, CI or CH)


ORGANIC SOILS (OL or OH or Pt)


COBBLES or BOULDERS

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

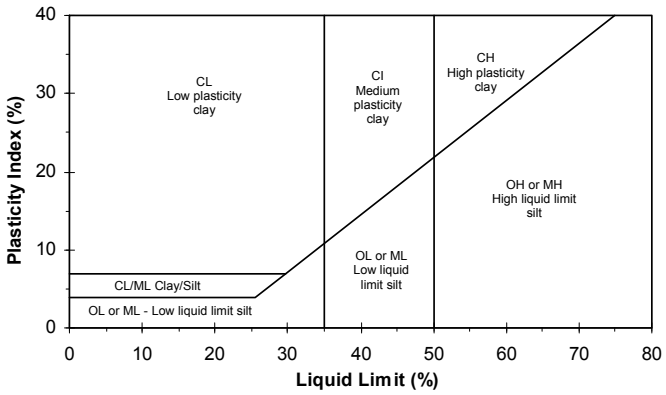
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 – 1993, (Amdt1 – 1994 and Amdt2 – 1994), Appendix A. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 1993

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

SPT correlations are not stated in AS1726 – 1993, and may be subject to corrections for overburden pressure and equipment type.

APPENDIX B

Important information

IMPORTANT INFORMATION RELATING TO THIS REPORT

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

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Appendix 5: Example for Silt Fencing

MATERIALS

GEOTEXTILE FABRIC: NON-WOVEN FILTER CLOTH (MINIMUM 'BIDIM' A34 OR THE EQUIVALENT), WIDE STRIP TENSILE STRENGTH (AS3706.2) MINIMUM 15kN/m IN BOTH DIRECTIONS, PORE SIZE (EOS, O95, AS 3706.7) LESS THAN 110mm, MASS PER UNIT AREA (AS3706.1) MINIMUM 200GSM.

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

BACKING MESH: PLASTIC OR STEEL MESH WITH A MAXIMUM MESH OPENING OF 200mm.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. UNLESS OTHERWISE DIRECTED BY THE RESPONSIBLE ON-SITE OFFICER, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE PROPOSED ALIGNMENT OF THE FILTER FENCE, PLACING THE EXCAVATED MATERIAL UP-SLOPE OF THE FENCE.

3. IF THE FILTER FENCE IS TO BE STAKED WITHOUT A MESH BACKING, THEN SECURE THE SUPPORT POSTS INTO THE GROUND AT A SPACING NO GREATER THAN 1.5m.

4. IF THE FILTER FENCE IS TO BE STAKED WITH A MESH BACKING, SECURE THE SUPPORT POSTS INTO THE GROUND AT A SPACING NO GREATER THAN 2.0m, THEN SECURELY ATTACH THE BACKING MESH TO THE UP-SLOPE SIDE OF THE SUPPORT POSTS FROM A CONTINUOUS LENGTH OF MESH. EXTEND THE MESH INTO THE EXCAVATED TRENCH.

5. IF THE FILTER FENCE IS THE BE SUPPORTED BY STRAW BALES, THEN AFTER SUITABLE ANCHORING THE BOTTOM 300mm OF FABRIC, PLACE A CONTINUOUS ROW OF STRAW BALES IMMEDIATELY DOWN-SLOPE OF THE FABRIC AND WRAP THE FABRIC OVER THE TOP OF THE STRAW BALES. SECURELY ANCHOR THE FILTER FENCE WITH A SINGLE STAKE DRIVEN THROUGH THE FABRIC AND CENTRE OF EACH BALE.

6. USING A CONTINUOUS LENGTH OF NON-WOVEN GEOTEXTILE, SECURELY ATTACH THE FABRIC TO THE UP-SLOPE SIDE OF THE SUPPORT POSTS OR BACKING MESH, WITH THE FABRIC EXTENDED AT LEAST 200mm INTO THE TRENCH.

7. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC TO PREVENT DISPLACEMENT OF THE FABRIC AND TO PREVENT THE FREE MOVEMENT OF WATER UNDER THE FABRIC.

8. IN ALL CASES, INSTALL THE FILTER FENCE IN A MANNER THAT WILL MINIMISE THE RISK OF SEDIMENT-LADEN WATER FLOWING AROUND THE FENCE.

MAINTENANCE

1. INSPECT THE FILTER FENCE REGULARLY AND AT LEAST DAILY DURING DE-WATERING OPERATIONS. MAKE REPAIRS AS NEEDED TO THE FABRIC AND SUPPORT FRAME.

2. INSPECT THE FABRIC FOR OBVIOUS LEAKS RESULTING FROM HOLES, TEARS OR JOINT FAILURE IN THE FABRIC.

3. CHECK THAT WATER HAS NOT OVERTOPPED THE FENCE AT LOW POINTS.

4. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC PLACED INSIDE THE OLD FABRIC, EXTENDING AT LEAST FROM SUPPORT POST TO SUPPORT POST.

5. CHECK FOR MATERIALS LEANING UP AGAINST THE FILTER FENCE. MAKE REPAIRS AS NEEDED TO THE FABRIC AND SUPPORT FRAME.

REMOVAL

1. REMOVE ALL ACCUMULATED SEDIMENT AND DISPOSE OF IT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

2. REMOVE ALL MATERIALS AND REPAIR DAMAGE TO THE GROUND SURFACE AS NECESSARY.

3. APPROPRIATELY REHABILITATE (E.G. REVEGETATE) THE GROUND AS NECESSARY TO MINIMISE THE RISK OF AN ONGOING EROSION HAZARD.

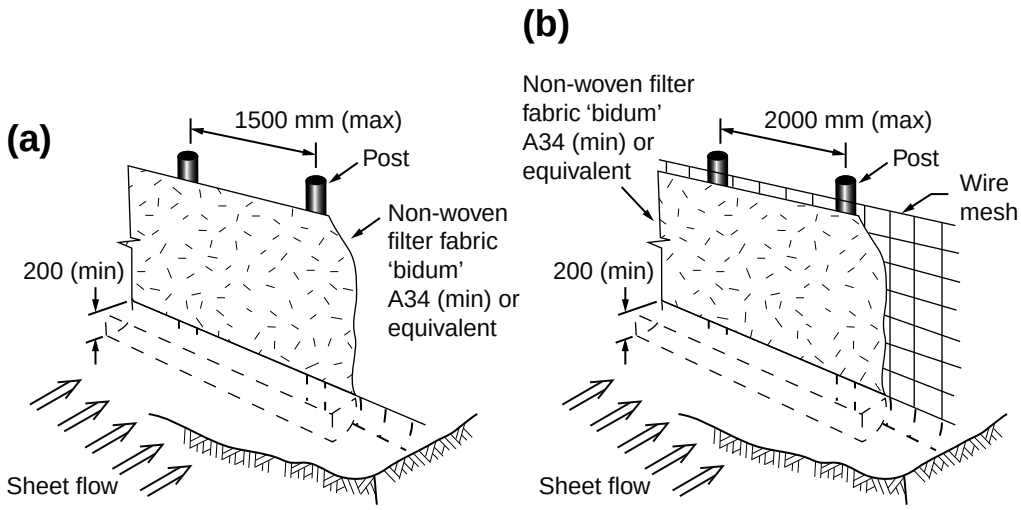


Figure 1 - Various installation methods

Drawn:	Date:		
GMW	Apr-10	Filter Fence	FF-01

Appendix 6: Typical stormwater Quality Management Plan

Example site-based Stormwater Quality Management Plan

Issue	Stormwater Quality Management – Construction Phase
Purpose:	To provide a set of Best Practice site management procedures to control the severity and extent of soil erosion and pollutant transport during the earthworks and construction phase.
Performance Criteria:	Water discharged from the site is to comply with [*insert relevant State Act, and date*] to ensure that no detrimental impacts on water quality and the environment occur during the construction phase. The quality of discharge from the site to satisfy the following Water Quality Objectives (WQOs): ***Release Criteria:*** • An increase in suspended solids within surface waters contained in [*insert name*] – upstream of site to downstream of site – of less than 10%. • Water pH released from a controlled sediment basin outflow must be within the range 6.5 to 8.5. • Suspended Solids released from controlled sediment basin outflows must be no greater than 50mg/L. • Oils and Grease – no visible films or odour. • Litter – no visible litter washed or blown from the site.
Responsibility:	The owner of the property will be responsible for the implementation of the Water Quality Monitoring Program (WQMP) during the course of all construction activities. The Construction Contractor will be responsible for the implementation of the Stormwater Management Plan (SWMP) during the course of all construction activities.
Implementation Strategy:	Permanent and long-term drains and bund walls to be topsoiled and vegetated with suitable vegetation as soon as possible. Clean-up of general site litter on a weekly basis, prior to anticipated heavy rainfall and after significant rainfall events (>25mm/24hours). Landscaping activities and revegetation to occur as soon as practical after completion of earthworks and construction activities within the immediate area and must achieve a minimum 70% coverage of all erodible surfaces. Only appropriate herbicides and fertilisers to be used. The storage and handling of flammable and combustible liquids is managed in accordance with AS1940–1993. A detailed Erosion and Sediment Control Plan (ESCP) must be submitted to, and approved by, [*insert name of regulatory authority*] prior to site establishment and commencement of vegetation clearing or soil disturbance within each subdivision stage. Where appropriate, ESCPs must incorporate guidelines on the treatment, protection and stabilisation of exposed dispersive soils.
Monitoring:	Erosion and sediment control (ESC) measures to be inspected daily by the site manager (or nominated representative) during periods of runoff-producing rainfall, and de-silted, repaired and amended as appropriate to maintain the WQOs. (a) **Daily site inspections**, during periods of runoff-producing rainfall must include: • all drainage, erosion and sediment control measures; • occurrences of excessive sediment deposition (whether on-site or off-site);

	• all site discharge points. (b) **Weekly site inspections** must include: • all drainage, erosion and sediment control measures; • occurrences of excessive sediment deposition (whether on-site or off-site); • occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements; • litter and waste receptors; • oil, fuel and chemical storage facilities. (c) Site inspections immediately **prior to anticipated runoff-producing rainfall** must include: • all drainage, erosion and sediment control measures; • all temporary (e.g. over-night) flow diversion and drainage works. (d) Site inspections immediately **following runoff-producing rainfall** must include: • treatment and de-watering requirements of sediment basins; • sediment deposition within sediment basins and the need for its removal; • all drainage, erosion and sediment control measures; • occurrences of excessive sediment deposition (whether on-site or off-site); • occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements; • occurrences of excessive erosion, sedimentation, or mud generation around the site office, car park and material storage areas. (e) In addition to the above, **monthly site inspections** must include: • surface coverage of finished surfaces (both area and percentage cover); • health of recently established vegetation; • proposed staging of future site clearing, earthworks and site/soil stabilisation. Water quality monitoring must be carried out on any controlled discharge of water from a sediment basin, including water pH and suspended solids. • Water quality monitoring at the nominated monitoring stations must be carried out monthly and following significant rainfall (>25mm in 72hrs). The parameters to be tested for waters collected at monitoring stations must include: temperature, dissolved oxygen, pH, specific conductance, salinity, turbidity, suspended solids, and litter. Note that additional water quality monitoring maybe required if the WQOs are not being met.
Auditing:	ESCP reviews are to be carried out on a monthly basis to assess the implementation strategy. A checklist is to be completed which assesses the strategies listed above.
Identification of Incident or Failure:	Non-compliance with agreed performance criteria will be identified by: 1. Visual inspections identifying: • build-up of sediment off the site; • excessive sediment build-up on the site; • excessive erosion on the site; • release of construction material from the site; • poor vegetation establishment;

	• poorly maintained, damaged or failed ESC devices. 2. Deteriorated water quality identified by the Environmental Consultant as being attributable to the construction activities.
Corrective Action:	After any identification of incident or failure, the source/cause is to be immediately located and the following measures implemented: • Build-up of sediment off the site – the material must be collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm; then on-site ESC measures amended, where appropriate, to reduce the risk of further sedimentation. • Excessive sediment build-up on the site – collect and dispose of material, then amend up-slope drainage and/or erosion control measures as appropriate to reduce further occurrence. • Severe or excessive rill erosion – investigate cause, control up-slope water movement, re-profile surface, cover dispersive soils with a minimum 100mm layer of non-dispersive soil, and stabilise with erosion control blankets and vegetation as necessary. • Off-stream erosion – fill rills, vegetate and install velocity control measures. • In-stream erosion – consult appropriate hydraulic/waterway consultant for advice. • Release of construction material from the site – collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm; then inspect litter and waste receptors. • Poor vegetation growth or soil coverage – plant new vegetation and/or mulch as required. Newly planted and previously planted areas may require supplementary watering and replanting. • Sediment fence failure – replace and monitor more frequently. Regular failures may mean that the sediment fence location, alignment or installation may need to be amended. If the release of excessive sediment and/or other materials off the site occurs, or water quality monitoring indicates levels are not within the WQOs, clean up deposition, and inspect all control measures. If the release of excessive sediment and/or other materials off the site is identified during two consecutive site inspections, or water quality monitoring indicates levels not within the WQOs on two consecutive monthly tests, then review and revise the ESCP, or otherwise reduce the rate, extent and/or duration of soil exposure. If monitored levels within any sediment basin does not conform to the release criteria for: • suspended solids – flocculate and retest; • pH – add acid if pH is too high, or add hydrated lime if pH is too low, and retest.
Reporting:	Reports will be submitted monthly during the construction at each stage. The reporting will include: • Construction Contractor site manager's report; and • Environmental Consultant's water quality monitoring report. Reporting will conform to [*insert document*] and identify performance of the implementation strategy, monitoring, identification of incidents and failure, and necessary/adopted corrective action. Reports will be submitted to the owner (or their appointed representative) monthly for submission to [*insert name of regulatory authority*].

Appendix 7: Typical Sediment Control Measures / Erosion Control

PREPARATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND DIMENSIONAL DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR EXTENT, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. TAKE ALL NECESSARY STEPS TO ENSURE DISTURBANCE TO THE BUFFER ZONE IS MINIMISED THROUGHOUT THE TIME IT IS USED AS A SEDIMENT TRAP.

3. TO THE MAXIMUM DEGREE PRACTICABLE, ENSURE FLOW PASSING THROUGH THE BUFFER ZONE IS NOT ALLOWED TO CONCENTRATE WITHIN DRAINAGE DEPRESSIONS, SWALES, RILLS OR WHEEL TRACKS.

4. WHERE NECESSARY, INSTALL APPROPRIATE DRAINAGE CONTROLS UP-SLOPE OF THE BUFFER ZONE TO DISTRIBUTE THE INFLOW ALONG THE FULLY LENGTH OF THE BUFFER ZONE AS 'SHEET FLOW'.

5. WHERE NECESSARY, INSTALL A COARSE SEDIMENT TRAP, SUCH AS A SEDIMENT FENCE, UP-SLOPE OF THE BUFFER ZONE TO REDUCE THE QUANTITY OF SEDIMENT PASSING ONTO THE GRASS. GENERALLY THIS IS REQUIRED IF LARGE QUANTITIES OF COARSE SEDIMENT ARE EXPECTED.

6. IF REQUIRED, INSTALL A LIGHT BARRIER FENCE TO CLEARLY IDENTIFY THE BUFFER ZONE AND HELP EXCLUDE CONSTRUCTION TRAFFIC.

MAINTENANCE

1. INSPECT THE BUFFER ZONE ON A REGULAR BASIS AND AFTER RUNOFF-PRODUCING RAINFALL.

2. ENSURE THAT THERE IS NO SOIL EROSION AND THAT SEDIMENT DEPOSITION IS NOT CAUSING THE CONCENTRATION OF FLOW THROUGH THE BUFFER ZONE, OR FLOW BYPASSING.

3. IF THE BUFFER ZONE HAS BEEN DISTURBED, TAKE NECESSARY STEPS TO RE-ESTABLISH SUITABLE SHEET FLOW CONDITIONS.

4. REMOVE EXCESSIVE ACCUMULATIONS OF SEDIMENT THAT MAY CAUSE THE CONCENTRATION OF FLOW. EXCESSIVE SEDIMENT SHOULD BE REMOVED AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT, OR WHERE APPROPRIATE, EVENLY RAKED INTO THE SOIL. SEDIMENT SHOULD BE REMOVED IN A MANNER THAT AVOIDS DAMAGE TO THE BUFFER ZONE OR THE CREATION OF WHEEL TRACKS DOWN THE SLOPE.

5. EXCESSIVE SEDIMENT MAY BE DEFINED AS:

(i) ANY SEDIMENT THAT COVERS A PORTION OF THE GRASSED SURFACE; OR

(ii) SEDIMENT DEPOSITION SUCH THAT THE GRASS STRAND HEIGHT ABOVE THE SEDIMENT IS LESS THAN 50mm; OR

(iii) A DEPOSITION OF SEDIMENT IN EXCESS OF 750g/m^2 (APPROXIMATELY THE EQUIVALENT OF THREE 70mm DIAMETER BALLS OF DRY SOIL).

6. THE SOURCE OF ANY EXCESSIVE SEDIMENT SHOULD BE INVESTIGATED AND CONTROLLED WHERE PRACTICAL.

7. TAKE APPROPRIATE STEPS TO MAINTAIN AT LEAST 75% GRASS COVER OVER THE BUFFER ZONE.

8. WHERE PRACTICAL, MAINTAIN ANY GROUNDCOVER VEGETATION AT A HEIGHT GREATER THAN THE EXPECTED DEPTH OF WATER FLOW AND AT LEAST 50mm.

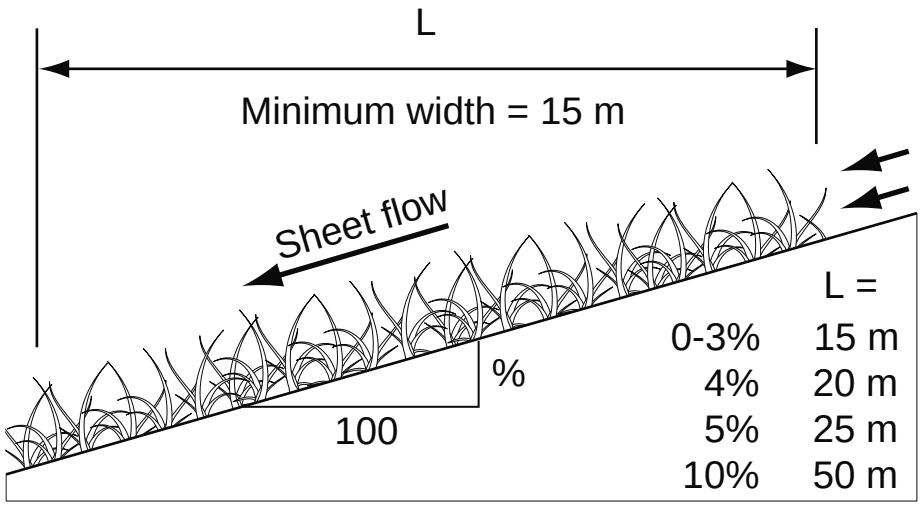


Figure 1 - Minimum dimensional requirements of a grassed buffer zone

Drawn:	Date:		
GMW	Apr-10	Buffer Zones (grassed)	BZ-01

MATERIALS

COMPOSTS MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(i) WELL-DECOMPOSED 100% ORGANIC MATTER PRODUCED BY CONTROLLED AEROBIC (BIOLOGICAL) DECOMPOSITION.

(ii) MAXIMUM OF 1% OF INERT MATERIAL.

(iii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m, AND pH RANGE OF 5.0 TO 8.5.

(iv) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN SELECTING THE LOCATION OF A COMPOST FILTER BERM, TO THE MAXIMUM DEGREE PRACTICABLE, ENSURE THE BERM IS LOCATED:

(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;

(ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);

(iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;

(iv) AWAY FROM AREAS OF CONCENTRATED FLOW.

3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE ENDS OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED ALONG THE CONTOUR SUCH THAT WATER WILL POND EVENLY ALONG THE LENGTH OF THE BERM.

5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.

6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT THE BERM AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.

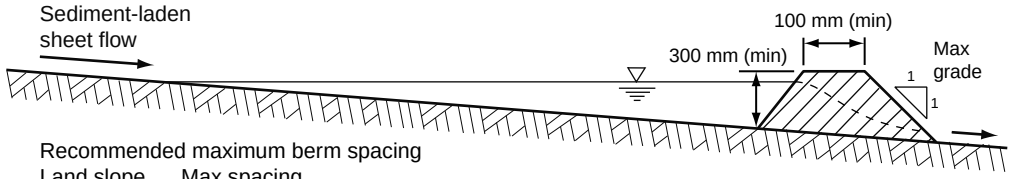
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.

2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.



Recommended maximum berm spacing

Land slope	Max spacing
< 2%	35 m
5%	25 m
10%	20 m
20%	12.5 m
25%	10 m

Figure 1 - Typical profile of a compost filter berm

Drawn:	Date:		
GMW	Apr-10	Compost Filter Berm	CFB-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED, PRIOR TO PLANTING.

3. REMOVE ALL OBJECTIONABLE MATERIAL FROM THE AREA TO BE TURFED.

4. ALL TURF SHOULD BE USED WITHIN 12-HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS.

5. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY.

6. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF.

7. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES.

8. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.

9. IF THE FILTER STRIPS ARE REQUIRED TO BE PLACED ALONG THE CONTOUR, THEN ENSURE EACH ROW OF TURF IS PLACED ALONG A LINE OF CONSTANT LAND ELEVATION.

10. IF THE FILTER STRIPS ARE PLACED AT AN ANGLE TO THE LAND SLOPE (i.e. SUCH THAT UP-SLOPE RUNOFF WILL BE DEFLECTED ALONG THE UPPER EDGE OF THE TURF), THEN LATERAL STRIPS OF TURF MUST BE PLACED AT MAXIMUM 5m INTERVALS AND EXTENDING AT LEAST 400mm UP-SLOPE OF THE FILTER STRIP.

11. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH.

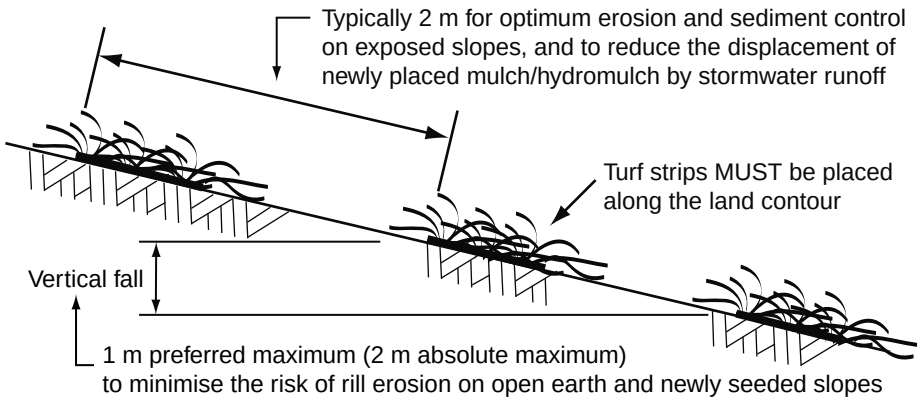
MAINTENANCE

1. INSPECT THE GRASS FILTER STRIPS AFTER EACH RUNOFF EVENT. CHECK FOR EVIDENCE OF CONCENTRATED RILL-FORMING FLOW ALONG THE UPPER EDGE OF THE TURF.

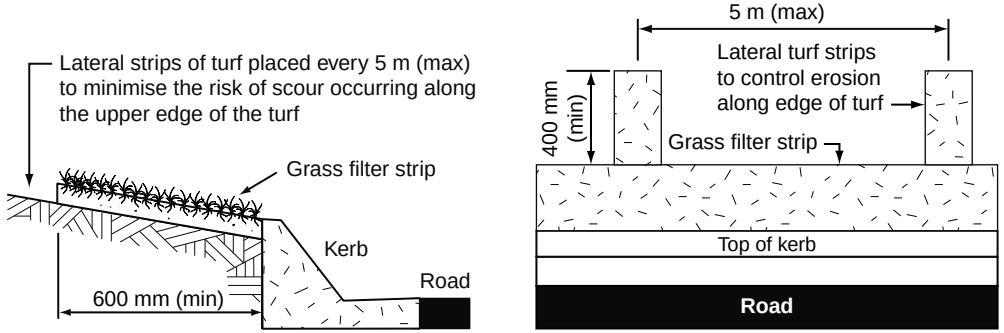
2. IF EXCESSIVE EROSION IS OCCURRING ALONG THE UP-SLOPE EDGE OF THE TURF, THEN PLACE ADDITIONAL DIAGONAL TURF STRIPS. ALTERNATIVELY, USE SANDBAGS TO APPROPRIATELY DIVERT RUNOFF THROUGH THE GRASS.

3. MAINTAIN A HEALTHY AND VIGOROUS GRASS CONDITION WHENEVER AND WHEREVER POSSIBLE, INCLUDING WATERING AND FERTILISING AS NEEDED.

4. WHERE PRACTICABLE, MAINTAIN A MINIMUM LEAF LENGTH OF 50mm. MOWING SHOULD NOT BE ATTEMPTED UNTIL THE TURF IS FIRMLY ROOTED, USUALLY 2 TO 3 WEEKS AFTER LAYING.

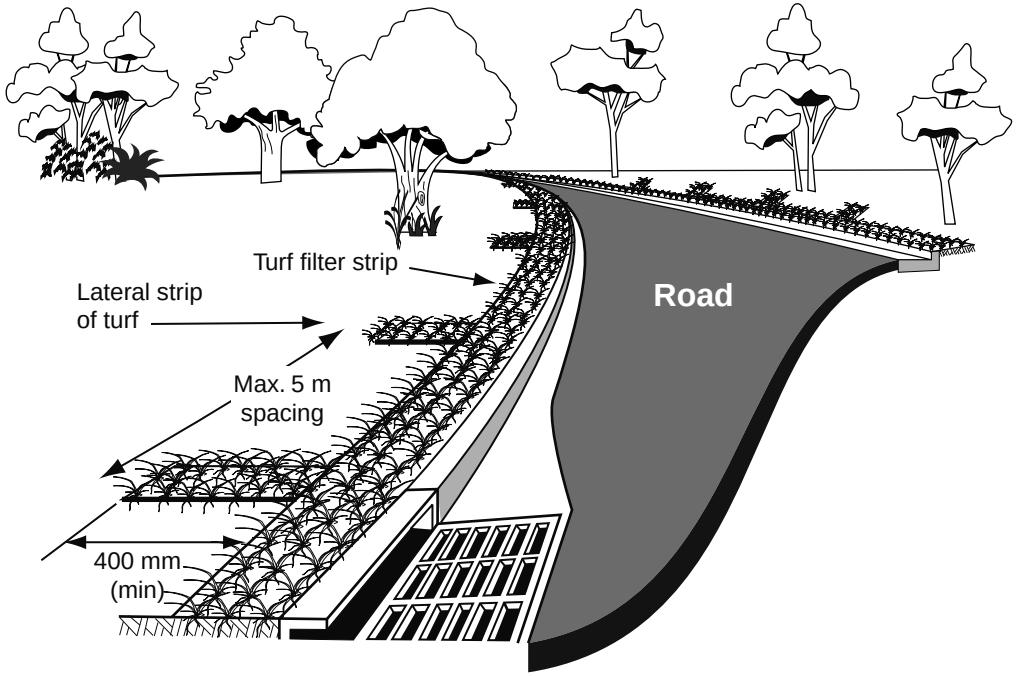


(a) Placement of grass filter strips along the contour of a slope

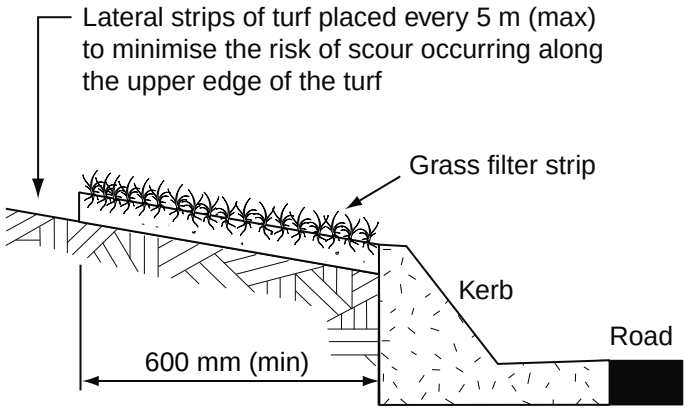


(b) Placement of grass filter strips along edge of impervious surface

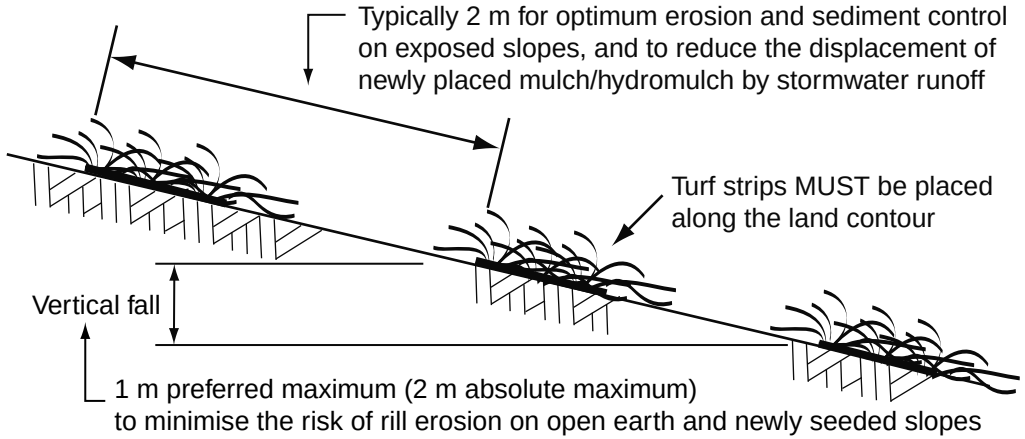
Drawn:	Date:		
GMW	Apr-10	Grass Filter Strips	GFS-02



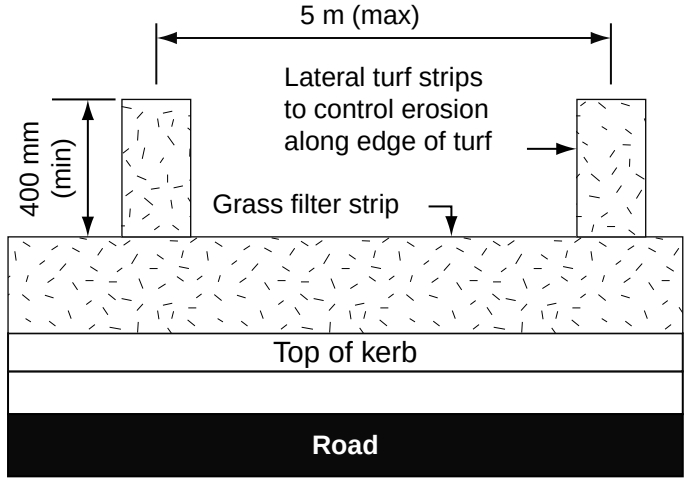
(a) Placement of grass filter strips along road kerb



(b) Placement of grass filter strips along edge of impervious surface



(c) Placement of grass filter strips along the contour of a slope



(d) Placement of grass filter strips along edge of impervious surface

Drawn:	Date:		
GMW	Dec-09	Grass Filter Strips	GFS-01

MATERIALS

SOCKS: MINIMUM 200mm DIAMETER SYNTHETIC OR BIODEGRADABLE TUBES MANUFACTURED FROM NON-WOVEN OR COMPOSITE FABRIC SUITABLE FOR THE 'FILTRATION' OF COARSE SEDIMENTS.

FILL MATERIAL: STRAW, CANE MULCH, COMPOSTED MATERIAL (AS4454), COARSE SAND, OR CLEAN AGGREGATE.

STAKES: MINIMUM 25 x 25mm TIMBER.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN PLACED ACROSS NON-VEGETATED OR NEWLY SEEDED SLOPES, THE FILTER SOCKS MUST BE PLACED ALONG THE CONTOUR.

3. IF PLACED ON OPEN OR LOOSE SOIL, ENSURE THE FILTER SOCKS ARE TRENCHED 50 TO 100mm INTO THE GROUND.

4. ENSURE THE OUTER MOST ENDS OF EACH FILTER SOCK OR CONTINUOUS ROW OF FILTER SOCKS ARE TURNED UP THE SLOPE TO ALLOW WATER TO ADEQUATELY POND UP-SLOPE OF THE SOCKS, AND TO MINIMISE FLOW BYPASSING.

5. ENSURE THE ANCHORING STAKES ARE DRIVEN INTO THE END OF EACH SOCK AND ALONG THE LENGTH OF EACH SOCK AT A SPACING NOT EXCEEDING 1.2m OR SIX TIMES THE SOCK DIAMETER (WHICHEVER IS THE LESSER).

7. ADJOINING SOCKS MUST BE OVERLAPPED AT LEAST 450mm, NOT ABUTTED.

MAINTENANCE

1. INSPECT ALL FILTER SOCKS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT WEEKLY INTERVALS.

2. REPAIR OR REPLACE DAMAGED FILTER SOCKS.

3. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. ALL EXCESSIVE SEDIMENT TRAPPED BY THE FILTER SOCKS MUST BE REMOVED FROM THE DRAIN OR SLOPE IF SUCH SEDIMENT IS LIKELY TO BE WASHED AWAY BY EXPECTED FLOWS.

2. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. ALL SYNTHETIC (PLASTIC) MESH OR OTHER NON READILY BIODEGRADABLE MATERIAL MUST BE REMOVED FROM THE SITE ONCE THE SLOPE OR DRAIN IS STABILISED, OR THE SOCKS HAVE DETERIORATED TO A POINT WHERE THEY ARE NO LONGER PROVIDING THEIR INTENDED DRAINAGE OR SEDIMENT CONTROL FUNCTION.

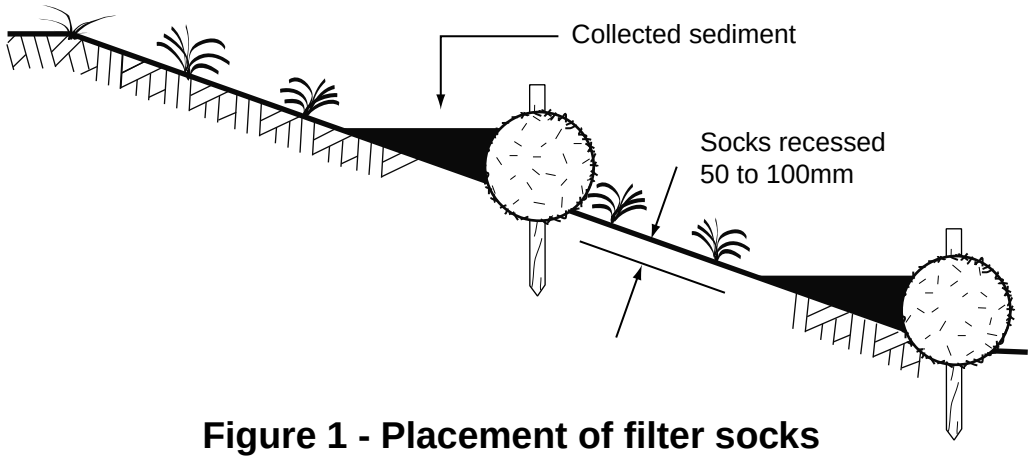


Figure 1 - Placement of filter socks

Drawn:	Date:		
GMW	Dec-09	Filter Socks - Sheet Flow	FS-02

MATERIALS

FIBRE ROLLS: TYPICALLY 200 TO 250mm JUTE, COIR OR STRAW ROLL TIED WITH SYNTHETIC OR BIODEGRADABLE MESH.

STAKES: MINIMUM 25 x 25mm TIMBER STAKES.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN PLACED ACROSS NON-VEGETATED OR NEWLY SEEDED SLOPES, THE ROLLS MUST BE PLACED ALONG THE CONTOUR.

3. IF PLACED ON OPEN OR LOOSE SOIL, ENSURE THE FIBRE ROLLS ARE TRENCHED 75 TO 125mm IN SANDY SOILS AND 50 TO 75mm IN CLAYEY SOILS.

4. ENSURE THE OUTER MOST ENDS OF THE FIBRE ROLL ARE TURNED UP THE SLOPE TO ALLOW WATER TO ADEQUATELY POND UP-SLOPE OF THE ROLL, AND TO MINIMISE FLOW BYPASSING.

5. WHEN PLACED ACROSS THE INVERT OF MINOR DRAINS, ENSURE THE SOCKS ARE PLACED SUCH THAT:

(i) THE CREST OF THE DOWNSTREAM ROLL IS LEVEL WITH THE CHANNEL INVERT AT THE IMMEDIATE UPSTREAM SOCK (IF ANY);

(ii) EACH ROLL EXTENDS UP THE CHANNEL BANKS SUCH THAT THE CREST OF THE FIBRE ROLL AT ITS LOWEST POINT IS LOWER THAN THE GROUND LEVEL AT EITHER END OF THE ROLL.

6. ENSURE THE ANCHORING STAKES ARE DRIVEN INTO THE END OF EACH ROLL AND ALONG THE LENGTH OF EACH ROLL AT A SPACING NOT EXCEEDING 1.2m OR SIX TIMES THE ROLL DIAMETER, WHICHEVER IS THE LESSER. A MAXIMUM STAKE SPACING OF 0.3m APPLIES WHEN USED TO FORM CHECK DAMS.

7. ADJOINING ROLL MUST BE OVERLAP AT LEAST 450mm, NOT ABUTTED.

MAINTENANCE

1. INSPECT ALL FIBRE ROLLS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT WEEKLY INTERVALS.

2. REPAIR OR REPLACE DAMAGED FIBRE ROLLS.

3. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. ALL EXCESSIVE SEDIMENT TRAPPED BY THE ROLLS MUST BE REMOVED FROM THE DRAIN OR SLOPE IF SUCH SEDIMENT IS LIKELY TO BE WASHED AWAY BY EXPECTED FLOWS.

2. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. THE BIODEGRADABLE CONTENT OF THE STRAW ROLLS MAY NOT NECESSARILY NEED TO BE REMOVED FROM THE SITE.

4. ALL SYNTHETIC (PLASTIC) MESH OR OTHER NON READILY BIODEGRADABLE MATERIAL MUST BE REMOVED FROM THE SITE ONCE THE SLOPE OR DRAIN IS STABILISED, OR THE ROLLS HAVE DETERIORATED TO A POINT WHERE THEY ARE NO LONGER PROVIDING THEIR INTENDED DRAINAGE OR SEDIMENT CONTROL FUNCTION.

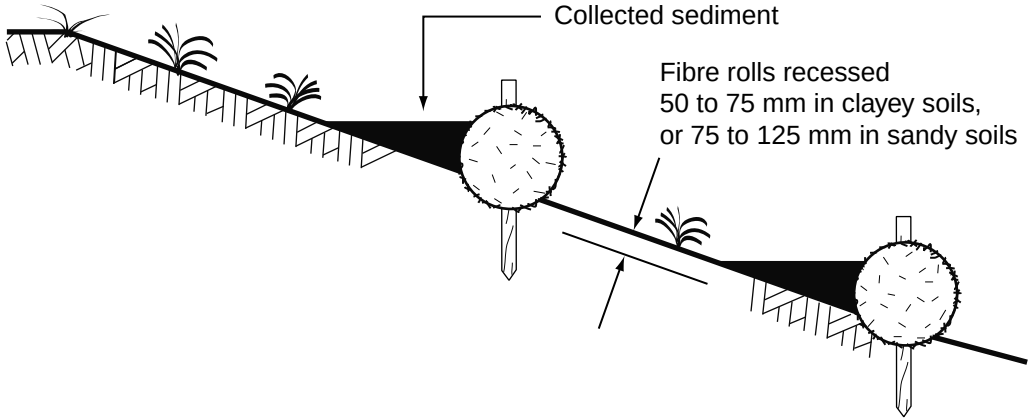


Figure 1 - Typical installation of fibre rolls

Drawn:	Date:		
GMW	Apr-10	Fibre Rolls	FR-01