

ECOLOGICAL ASSESSMENT REPORT FOREST WIND PROJECT

*Report: FWH-03
Client: Forest Wind Holdings
March 2020*



FOX & CO
ENVIRONMENTAL

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P.F			A.F. M.P. J.P.		P. Fox 

Executive Summary

Forest Wind Holdings Pty Limited (FWH) proposes to develop and construct a wind farm called Forest Wind (the Project) located within exotic pine plantations in Queensland Government owned Toolara, Tuan and Neerdie State Forests, situated between Gympie and Maryborough in the Wide Bay Region of Queensland.

Specifically, the Project comprises a wind farm with up to 226 wind turbines and ancillary infrastructure (herein referred to as the Project Area, Plantation Licence Area (PLA). The Project Area (PLA) will be located within the Gympie Regional Council (GRC) and Fraser Coast Regional Council (FCRC) Local Government Areas (LGAs).

The Project Area (PLA) is located almost entirely within existing operational and actively managed exotic pine plantations. A small portion of the Project Area (PLA) is Native State Forest (NSF). No confirmed infrastructure is proposed within the NSF at this stage. It is within the pine plantation licence area and is therefore included in the Project Area (PLA). The Project Area (PLA) (including ancillary infrastructure) is referred to as the Project Area (PLA).

An ecological assessment has been undertaken to describe the existing environment and to assess the potential impacts that the Project may have on flora and fauna, particularly Matters of State Environmental Significance (MSES) and Matters of National Environmental Significance (MNES). This information will inform the application for a Development Approval (DA) for a Material Change of Use (MCU) for a wind farm and referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Under State Code 23: Wind Farm Development, within the State Development Assessment Provisions (SDAP), wind farm development is required to ensure that risks to flora, fauna and associated ecological processes are mitigated or managed through effective siting, design and operation of the wind farm. This is addressed in this assessment and informs the development assessment process.

Preliminary ecological assessments were undertaken by O2 Ecology (2016) and Premise Environment (Premise) (2017-2019). The initial assessments informed further survey design and assessments undertaken by Premise between 2017 and 2019. As the Project has undergone design changes, additional surveys and targeted assessments have been undertaken by Fox & Co Environmental Pty Ltd (Fox & Co). This report consolidates the flora and fauna assessments undertaken, with particular reference to the occurrence of threatened and /or migratory species (EPBC Act and/or Queensland's *Nature Conservation Act 1994* (NC Act)), although native species such as Least Concern (NC Act) species have also been assessed. It identifies the potential significance of impacts from the Project on terrestrial and aquatic flora and fauna and provides management measures proposed to mitigate potential impacts on flora and fauna during construction and operation of the wind farm.

There are no world heritage properties, national heritage places, wetlands of international importance or commonwealth marine areas within the Project Area (PLA). The Project Area (PLA) is not within the Great Barrier Reef Marine Park.

Key findings of the investigations to date include:

- the Project is ideally situated as the exotic pine plantations are considered of low ecological value and remnant vegetation, which provides the highest value for flora and fauna, within the plantation area will be avoided wherever possible (except some marginal works areas).
- The mosaic of remnant vegetation within the Project Area (PLA) provides the most valuable habitat for native species within the Project Area (PLA) and these areas, including waterways, will be avoided with all infrastructure within the Project Area (PLA) sited within existing exotic pine plantations and not remnant vegetation.

- One (1) flora species of EPBC conservation significance was identified
 - Pineapple Zamia (*Macrozamia pauli-guilielmi*) - Endangered (EPBC Act and NC Act).
- Nine (9) fauna species of conservation significance were identified:
 - White-throated needletail (*Hirundapus caudacutus*) – Vulnerable (V), Migratory Terrestrial (MT) and Listed Marine (LM) (EPBC Act)
 - Fork-tailed swift (*Apus pacificus*) – MT (EPBC Act)
 - Spectacled monarch (*Monarcha trivirgatus* syn. *Symposiarchus trivirgatus*) – MT, LM (EPBC Act)
 - Rainbow bee-eater (*Merops ornatus*) – LM (EPBC Act)
 - Cicadabird (*Coracina tenuirostris*) – LM (EPBC Act)
 - Koala (*Phascolarctos cinereus*) - V (EPBC Act and NC Act)
 - Grey-headed Flying-fox (*Pteropus poliocephalus*) – V (EPBC Act)
 - Swamp crayfish (*Tenuibranchiurus glypticus*) - Endangered (NC Act). It is not listed under the EPBC Act
 - Wallum froglet (*Crinia tinnula*) – V (NC Act). It is not listed under the EPBC Act
- Additional conservation significant flora and fauna species are considered to have at least a moderate potential to occur based on previous records in the region and potential habitat on or adjacent to the Project Area.

Potential impacts to the above identified conservation significant species, conservation significant species with at least a moderate likelihood of potentially occurring and common Least Concern species known to fly at rotor height were considered.

Mitigation measures to minimise potential impacts to all species, particularly conservation significant species are provided. Avoidance is the guiding principle to avoiding impacts on MNES and MSES as well as least concern species. Avoidance measures utilised in the Project include:

- The Project is set back a minimum of 4km from the Great Sandy Strait which is a known significant non-breeding area for EPBC listed migratory shorebirds.
- The Project Area (PLA) is located within an existing exotic pine plantation and avoids remnant vegetation and waterways. Remnant vegetation will not be cleared for the construction of the wind turbines.
- Only marginal clearing of remnant vegetation may occur for upgrades to existing waterway crossings to enable access to the site.
- Electrical cabling will mostly be underground along existing access tracks, or in track drains, which will further reduce the likelihood of collision and/ or electrocution of birds and bats. Some track drains may potentially provide suitable habitat for some acid frog species such as *Crinia tinnula*. Pre-clearance surveys will be undertaken prior to works in low-lying drain areas and, subject to the pre-clearance surveys, further mitigation measures may be implemented.
- Other infrastructure such as construction compounds avoid remnant vegetation and waterways and therefore avoid damage to remnant areas of natural habitat.
- Existing forestry tracks will be used to provide access within the Project Area (PLA) and therefore avoids disturbance to remnant vegetation and habitat associated with remnant vegetation.
- Pre-clearance/pre-construction surveys to determine if site -specific micro-siting of turbines is required to further minimise impacts.
- Clearly and accurately designate no-go areas prior to works in roadside drains and access tracks.
- Avoid hollow bearing trees, if present along tracks which may require widening.. Pre-clearance surveys to determine density and number of hollows lost during construction, if any. Replace any loss of hollows at a previously agreed replacement ratio.
- Comply with existing site-specific management plans currently implemented for the operating forestry practices
- Erosion and Sediment Control Plans (ESCP) developed by a Certified Professional in Erosion and Sediment Control (CPESC).

- Storage of fuels, chemicals, wastes and other potentially contaminating substances in appropriately banded areas and away from waterways.

Additional mitigation measures to reduce collision based impacts during operation are associated with adaptive management and reducing the risk of attracting birds and bats into the rotor swept area (RSA) of the wind farm. This includes:

- An adaptive management bird and bat monitoring program has been prepared and already commenced implementation. Should the monitoring program's results demonstrate that further mitigation is required, further assessment will be undertaken to determine appropriate mitigation or management measures. Additional measures may include deploying a radar detection and deterrent technology system.
- Spatially and temporarily replicated carcass monitoring undertaken by suitably qualified ecologists, trained detector dogs or other approved method. This will be used to identify particular turbines that may be causing excessive number of deaths. Monthly surveys to be undertaken at a stratified random representative selection of turbines. Surveys will also be timed to occur at times of flowering of eucalypt and melaleuca where possible. Should mortality be shown to exceed an acceptable mortality rate, comprehensive evaluation of risk factors will be undertaken and mitigation plans adopted until the risk of impact has been abated. Mitigation plans may include changes in operational regimes of the turbine causing impact, for example, different systems, limiting rotational speed or suspension of operation of high risk turbines in high impact periods which may be identified through detection systems (eg. departure and return flight times in evening for bats, identified with a radar).
- Trial acoustic and/or sonar to deter bats/birds. Slow rotor speeds or temporary shutdown of subject turbines during Summer period of known migratory aerial insectivores when birds may be on site.
- A Project specific Bird and Bat Management Plan has been prepared which outlines the objectives and monitoring program.

List of Abbreviations

Abbreviation	Definition
ALA	Atlas of living Australia
APS	Australian painted snipe
AVH	Australia's virtual herbarium
BFF	Black flying-fox
Biodiversity Status: E OC NC	Endangered Of Concern No Concern at Present
BBMP	Bird and Bat Management Plan
Conservation Class (VM Act): E OC LC	Endangered Of Concern Least Concern
CPESC	Certified professional in erosion and sediment control
DoEE	Commonwealth Department of the Environment and Energy
DES	Queensland Department of Environment and Science
DSEWPC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
DSITI	Queensland department of Science, Information Technology and Innovation
EH	Essential habitat
EMP	Environmental management plan
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
ESCP	Erosion, sediment, control plan
ESA	Environmentally sensitive areas
EVNT	Endangered, Vulnerable or Near Threatened (conservation status listing of species under the EPBC Act or NC Act)
FCRC	Fraser Coast Regional Council
FTS	Fork-tailed swift
FWH	Forest Wind Holdings
GBF	Giant barred frog
GBR	Great Barrier Reef
GES	wetland of general ecological significance
GHFF	Grey-headed flying-fox
GPS	Global positioning system
GRC	Gympie Regional Council
ha	Hectare
HBT	Hollow bearing tree
HES	wetland of high ecological significance
km	Kilometre
LGA	Local Government Areas
LM	Listed marine species
LNP	Long-nosed potoroo
LPS	Local priority species
LRFF	Little red flying-fox

Abbreviation	Definition
MNES	Matter of National Environmental Significance
MRC	Mary River cod
MRT	Mary River turtle
MSES	Matters of State Environmental Significance
MT	Migratory terrestrial species
MW	Migratory wetland species
NC Act	Queensland's Nature Conservation Act 1992
NCWR	Nature Conservation (Wildlife) Regulation 2006
NFFMP	National flying-fox monitoring program
NSF	Native state forest
NSW	New South Wales
OPP	Oxleyan pygmy perch
OZCAM	Online zoological collections of Australian museums
PLA	Plantation licence area
PMAV	Property map of assessable vegetation
PMST	Commonwealth EPBC Act protected matters search tool
RE	Regional ecosystem
REDD	Regional ecosystem description database
RSA	Rotor swept area
SDAP	State development assessment provision
SFF	Spectacled flying-fox
SIA	Significant impact assessment
SLC	Special least concern
SMP	Species management plan
SPP	State Planning Policy
SWTST	Southern white-throated snapping turtle
TEC	Threatened ecological community
USC	University of the Sunshine Coast
VM Act	Queensland's Vegetation Management Act 1999
WBSE	White-bellied sea eagle
WTN	White-throated needletail
WPA	Wetland protection area
WSF	Wallum sedge frog

1 INTRODUCTION

Forest Wind Holdings Pty Limited (FWH) proposes to develop and construct a wind farm called Forest Wind (the Project) located within exotic pine plantations in Queensland Government owned Toolara, Tuan and Neerdie State Forests, situated between Gympie and Maryborough in the Wide Bay Region of Queensland.

Specifically, the Project comprises a wind farm with up to 226 wind turbines and ancillary infrastructure (herein referred to as Project Area – Plantation Licence Area (Project Area (PLA))) The Project Area (PLA) will be located within the Gympie Regional Council (GRC) and Fraser Coast Regional Council (FCRC) Local Government Areas (LGAs).

An ecological assessment has been undertaken to describe the existing environment and to assess the potential impacts that the project may have on flora and fauna, particularly Matters of State Environmental Significance (MSES) and Matters of National Environmental Significance (MNES). This information will inform the application for a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Preliminary ecological assessments were undertaken by O2 Ecology (2016) and Premise Environment (Premise) (2017-2019) (Appendix F). The initial assessments informed further survey design and assessments undertaken by Premise between 2017 and 2019. As the Project has undergone design changes, additional surveys and targeted assessments have been undertaken by Fox & Co Environmental Pty Ltd (Fox & Co). This report consolidates the flora and fauna assessments undertaken, with particular reference to the occurrence of threatened and /or migratory species. It identifies the potential significance of impacts from the Project on terrestrial and aquatic flora and fauna and provides management measures proposed to mitigate potential impacts on flora and fauna during construction and operation of the wind farm.

The Project will involve the following components:

- Up to 226 wind turbines
- Access tracks using existing forestry tracks in the Project Area (PLA)
- Underground electrical cables
- Operations compounds
- Substations
- Battery storage and distribution lines
- Temporary construction compounds and facilities

1.1 Location and Project Area (PLA)

The Project Area (PLA) is located within an existing operational and actively managed exotic pine plantation within the Toolara, Tuan and Neerdie State Forests located in the Wide Bay Area (**Figure 1**). A small portion of the Project Area (PLA) is Native State Forest (NSF). No confirmed infrastructure is proposed within the NSF at this stage. It is within the pine plantation licence area and is therefore included in the Project Area (PLA). The Project Area (PLA) comprises land titles on which turbines are proposed, as follows:

- Lot 915 of Crown Plan FTY1775
- Lot 1004 of Crown Plan FTY1659
- Lot 1419 of Crown Plan FTY1697

1.2 Plantation Management

The Project will be located within an existing actively managed and operational exotic pine plantation in the Toolara, Tuan and Neerdie State Forests which is used for the primary purpose of growing and extracting exotic pine from a major forestry plantation, with two major timber processing facilities within the plantation. The plantation is Australia's largest single plantation forestry operation consisting of a commercial crop, with maintained access for silviculture and harvesting purposes. The exotic pine trees grown are a hybrid species of slash pine (*Pinus elliottii*) and Caribbean pine (*Pinus caribaea*).

This exotic modified landscape will continue into the foreseeable future under various forestry stewardship and certification programs and Queensland *Biosecurity Act 2014*, on the terms of a licence until 2109. The plantation activities include:

- ploughing and planting;
- harvesting and haulage of timber from blocks to road verge;
- extensive haulage on forestry roads for;
 - transportation of logs timber processors;
 - transportation of timber waste and products to other timber processes;
- invasive weed management, including mechanical and chemical weed control;
- fire management (including comprehensive controlled prescribed burning regime);
- quarrying activities; and
- ongoing forestry road maintenance and with earthmoving machinery.

The Plantation Licensee undertakes the following management schedule of works on plantation compartments. Table 1 provides a summary of the Plantation Management Schedule.

Table 1 Plantation Management Schedule

Task	Typical Crop Age
Preplant overall weed control for grass and woody vegetation	Year 0
Tree row cultivation on selected blocks	Year 0
Tree row herbicide treatment by band tending method #1	Year 0
Tree row herbicide treatment by band tending method #2	Year 0
Machine inter-row mechanical weed control	Year 2-3
Prescribed burn#1	Year 8-10 (10m high)
Prescribed burn#2 (+3yrs)	Year 11-13
Prescribed burn#3 (+3yrs or as required)	Year 14+
Thinning mechanical on compartments with higher stocking	Year 17-20
Clearfell	Year 27

Over 27 years there are 9-10 intervention events to make the plantation safe and optimise productivity. On average non-plantation woody species are treated every 3-4 years.

Approximately 3,000 ha of crop is cleared per year under the current harvesting program by the licensee. The proposed area of pine plantation clearing for the Project is a one off event, consisting

of only one sixth of the annual cleared crop area, or less than 1% of the pine plantation. There is only marginal increase in the pine plantation clearing rate as a consequence of the Project.

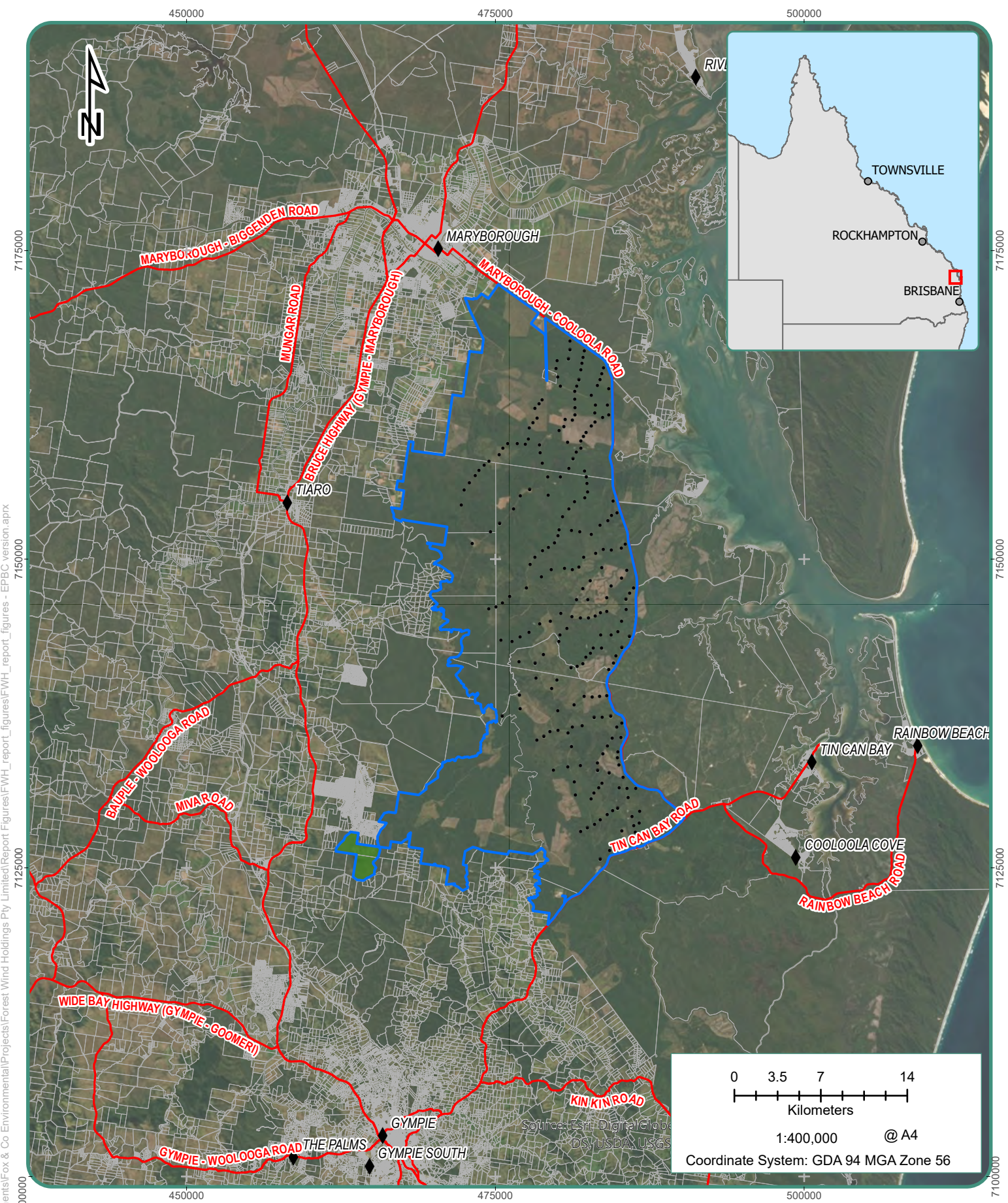
Tuan, Toolara and Neerdie State Forest roads and internal service tracks occupy approximately 4.5% of the aggregate plantation/road area. Roads and tracks provide access for forest management and fire protection. Primary haul roads within the Project Area (PLA) are predominately dirt/gravel dual lane surfaces that incur continuous daily traffic from heavy log-haul and light vehicle. Maintenance is ongoing with regular road pavement resurfacing, watering and compacting to accommodate the high vehicle frequency. Secondary haul roads in the Project Area (PLA) are generally single lane formed and gravelled surfaces used intermittently for silviculture and harvesting. Maintenance includes periodic surface inspections for pavement integrity and positive drainage with repairs effected as required to ensure the pavement is safe for general forest management traffic. Prior to a harvesting event (the year prior) upgrades to the pavement surface and drainage will be completed to ensure the secondary road is consolidated and serviceable for the planned harvest event. There are also internal compartment tracks and breaks which are generally single lane bare earth surfaces with table drains that discharge into adjoining compartments and native vegetation filter strips. Internal tracks are often parallel riparian native vegetation separating the plantation trees from creek lines and waterways.

Several invasive species which are a threat to least concern species, Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES) have been recorded on site during surveys including feral cats, wild dogs, pigs and wild horses. Wild horses are likely responsible for trampling riparian and low-lying areas within the Project Area (PLA) as they were often observed in waterways and low-lying areas within the Project Area (PLA).

Table 2 provides the area of exotic pine plantation and existing remnant vegetation within the Project Area (PLA).

Table 2 Area of Exotic Pine and Remnant Vegetation within the Project Area (PLA)

Aspect	Area	Area cleared for Project Infrastructure
Project Area (PLA)	67,131 ha	500 ha (total)
Project footprint (excludes existing access tracks)	Up to 500 ha or less than 1% of the Project Area (PLA)	-
Area of remnant vegetation in the Project Area (PLA)	17.4% of the Project Area (PLA) 11,691 ha	0 ha
Exotic pine plantation and cleared tracks in the Project Area (PLA)	82.6% of the Project Area (PLA) 55,440 ha	Up to 500 ha



TITLE: <h1>Project Area and Regional Context</h1>	
MAP NO: Figure 1	LEGEND
PROJECT: Forest Wind Holdings Pty Ltd	<ul style="list-style-type: none"> ◆ Populated places • Nominal turbine locations — State controlled roads ▭ Project Area (PLA) ▭ Property boundaries ▭ Native state forest

Date: 10/02/2020

Data Source:
 © State of Queensland (Department of Natural Resources, Mines and Energy) 2019.

1.3 Aims and Objectives

The aim of the assessments was to document the flora, fauna and vegetation within and adjacent to the Project Area (PLA), with particular reference to the EPBC Act and/or *Nature Conservation Act 1994* (Qld) (NC Act) protected species. Desktop assessments and targeted flora and fauna surveys aimed to:

- determine existing environmental values of the Project Area (PLA);
- undertake likelihood of occurrence assessments of EPBC Act and/or NC Act protected species and communities which may occupy or use the Project Area (PLA);
- identify species 'at risk' to impacts which may require additional management measures to mitigate impacts during the construction and operation phase.

1.3.1 Previous Reports

During the pre-approval and pre-construction phases of the project, investigations were undertaken by O2 Ecology (2016), Premise Environment Pty Ltd (formerly O2 Ecology) (2017-2019) and Fox & Co Environmental Pty Ltd (2019). The methods and results of these investigations are included in the following reports:

- Premise Environment (October 2017). *Forest Wind, Ecological Assessment, Report No. 1701513b* (refer Appendix F).
- Fox & Co Environmental (March 2020). *Forest Wind Bird and Bat Utilisation Survey, Report FWH-01b* (refer Appendix G).
- Fox & Co Environmental (March 2020). *Forest Wind Bird and Bat Management Plan, FWH-02* (refer Appendix H).
- Fox & Co Environmental (February 2020). *Threatened Ecological Community and Ecological Assessment Report Raintree Bridge, Tinana Creek*. Forest Wind Project. FWH-04.
- University of the Sunshine Coast (September 2019). *Forest Winds – Phase 1 Koala Survey Report*.
- Fox & Co Environmental (March 2020). *Forest Wind Significant Impact Assessment, Matters of National Environmental Significance (20022020)*.

2 REGULATORY FRAMEWORK

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a MNES require approval from the Australian Government Minister for the Environment. The nine matters of national environmental significance protected under the EPBC Act are:

- world heritage properties;
- national heritage places;
- wetlands of international importance (listed under the Ramsar Convention);
- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mines); and
- a water resource, in relation to coal seam gas development and large coal mining development.

Other matters protected by the EPBC Act include:

- the environment, where actions proposed are on, or will affect Commonwealth land and the environment; and

- the environment, where Commonwealth agencies are proposing to take an action.

A self-assessment using the Commonwealth Department of Environment and Energy (DoEE) *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* is required to determine whether the Project will, or is likely to, have a significant impact on MNES. Anyone wanting to undertake an action that may have a significant impact on a MNES is required to submit a referral to the federal DoEE. DoEE then makes a decision as to whether the project is deemed a 'controlled' or 'non-controlled' action.

A pre-lodgement meeting for the Project was held with the DoEE on 26 July 2019. The Project will be referred under the EPBC Act to determine whether the Project is considered a 'controlled action'.

2.2 Queensland

Matters of State Environmental Significance (MSES) are referenced in the biodiversity State interest under the State Planning Policy (SPP) and are mapped by the Queensland Government. The *Environmental Offsets Regulation 2014* also prescribes MSES for the purposes of the environmental offsets legislation in Queensland.

Many of the MSES in the *Environmental Offsets Regulation 2014* coincide with the MSES listed under the SPP, however, there are additional items listed under the *Environmental Offsets Regulation 2014* that are not listed in the SPP. The MSES mapping includes certain environmental values that are protected under Queensland legislation such as State conservation areas, marine parks, waterways and wetlands, protected habitat, fish habitat, regulated vegetation, connectivity areas and offset areas.

MSES defined under the SPP and *Environmental Offset Regulation 2014* include the following:

- protected areas (including all classes of protected area except coordinated conservation areas) under the NC Act
- marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004*
- marine plants
- areas within declared fish habitat areas that are management A areas or management B areas under the *Fisheries Regulation 2008*
- waterways providing fish passage
- threatened wildlife under the NC Act and special least concern animal under the *Nature Conservation (Wildlife) Regulation 2006*
- regulated vegetation under the *Vegetation Management Act 1999* (VM Act) that is:
 - o Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems
 - o Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems
 - o Category R areas on the regulated vegetation management map
 - o areas of essential habitat on the essential habitat map for wildlife prescribed as 'endangered wildlife' or 'vulnerable wildlife' under the NC Act
 - o regional ecosystems that intersect with watercourses identified on the vegetation management watercourse map
 - o regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map
- high preservation areas of wild river areas under the *Wild Rivers Act 2005*
- connectivity areas containing remnant vegetation Category B as depicted in the Environmental Offset Landscape Connectivity Assessment Tool
- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Referable Wetlands under the *Environmental Protection Regulation 2008*
- Wetlands and watercourses in high ecological value waters defined in the *Environmental Protection (Water) Policy 2009*, schedule 2
- Legally secured offset areas

2.2.1 State Development Assessment Provisions

Under State Code 16: Native Vegetation Clearing of the State Development Assessment Provisions (SDAP), operational work for clearing native vegetation should demonstrate that the development avoids impacts on vegetation that is a MSES, and where avoidance is not reasonably possible, minimises and mitigates impacts and provides an offset for any acceptable significant residual impacts where appropriate.

The *Vegetation Management Act 1999* (VM Act) regulates clearing of native vegetation. The State Forest is exempt as per Clause 7 (1c) of the VM Act, which states:

The Act applies to all clearing of vegetation other than vegetation on –
1 (c) an area declared as a State Forest or timber reserve under the *Forestry Act 1959*.

Operational works in relation to the clearing of native vegetation within a State Forest for the Project are exempt from the provisions of the VM Act and any approvals that would be otherwise triggered by this Act are not required.

Under Code 23 of the SDAP, wind farm developments should be appropriately located, sited, designed and operated to ensure that the development avoids, or minimises and mitigates adverse impacts on the natural environment (fauna and flora) and associated ecological processes.

3 METHOD

A combination of desktop and site assessments (including flora, terrestrial and aquatic fauna) were conducted between 2016 - 2019. The desktop assessments included a review of relevant literature, mapping and database searches. The site assessments were conducted to obtain specific ecological information relevant to the Project Area (PLA). This section also outlines the terminology and nomenclature used in this report and describes the procedures and guidelines used in undertaking the assessment.

3.1 Desktop Assessment

A desktop assessment of available State and Commonwealth databases was undertaken to identify records or potential occurrences of least concern and conservation significant flora and fauna species within and adjacent to the Project Area (PLA). The desktop assessment used the below databases and documents.

The Commonwealth DoEE Protected Matters search tool (PMST) was used to identify species and vegetation communities listed under the EPBC Act that may occur within the search area. The PMST is a predictive database that identifies EPBC Act listed flora and fauna species with a Moderate Potential to Occur in each search area based on bioclimatic modelling.

Regional Ecosystems (REs) are vegetation communities that are consistently associated with a combination of geology, land form and soil within a bioregion. The Queensland Herbarium (DES) has mapped the remnant and pre-clearing extent of REs for the State using a combination of satellite imagery, aerial photography interpretation and on-ground studies. The latest version of the Regional Ecosystem Biodiversity Status Map (Version 11) illustrates the extent of REs as of 2017. REs can be used to predict the occurrence of suitable habitat.

The Department of Natural Resources, Mines and Energy (DNRME) Regulated Vegetation Management Map dataset was used to determine areas that are assessable and non-assessable under the provisions of the VM Act. The current *Vegetation Management Act 1999* (VM Act) Regional Ecosystem and Remnant Map, Essential Habitat point and polygon data and Property Maps of Assessable Vegetation (PMAVs) were used to determine the extent and type of remnant or regrowth vegetation within the Project Area (PLA).

The Queensland Department of Environment and Science (DES) Biomaps Online search tool was used to identify all species that have previously been recorded within the search area and reported to DES.

The Atlas of Living Australia (ALA) database contains records of Australia's Virtual Herbarium (AVH) (Council of Heads of Australasian Herbaria, 2014) and the Online Zoological Collections of Australian Museums (OZCAM) (Council of Heads of Australian Faunal Collections, 2014) and provides information on all the known species in Australia aggregated from a wide range of data providers: museums, herbaria, community groups, government departments, individuals and universities. Database records for the Gympie Regional Council (GRC) and Fraser Coast Regional Council (FCRC) LGAs were reviewed, validated where required, and used to provide locations of any threatened species records within the area. GRC provided a list of Local Priority Species.

Refer Appendix E for search results.

The DoEE National Flying-fox Monitoring Viewer (informed by the DoEE, National Flying-fox Monitoring Program (NFFMP) – flying-fox census) was reviewed to assess the status of the flying-fox camps in the region, given that camps fluctuate over time (abundance and species present).

Figures showing MSES have been prepared since previous reporting (Premise, 2017) due to changes in design layout and potential updates in mapping layers. These are provided in Appendix A and include:

- Regional Ecosystems (Figure 8)
- Essential Habitat (Figure 9)
- Flora Survey Trigger Map (Figure 10)
- Conservation Areas (Figure 11)
- Ramsar wetlands (Figure 12)
- MSES Wetlands (Figure 13)
- Vegetation Management Wetlands (Figure 14)
- MSES Regulated Vegetation (intersecting a watercourse) and High Ecological Value Waters (Figure 15)
- Waterway Identification (Figure 16)

3.2 Likelihood of Occurrence

An assessment was undertaken of the likelihood of occurrence for threatened fauna and flora species identified through the desktop review. The field surveys further informed and verified this likelihood of occurrence assessment.

The DoEE and DES do not have prescriptive likelihood of occurrence guidelines within their policies but rather clarify the scale of assessment required to determine the level of impact (e.g. level of assessment, previous record searches, and distribution maps). The below criteria have been developed with the aim of considering this scale of assessment to identify the likelihood of occurrence for threatened species:

- Low potential to occur – the species has not been recorded in the region (no records from desktop searches) and/or current known distribution does not encompass Project Area (PLA) and/or suitable habitat is generally lacking from the Project Area (PLA).
- Moderate potential to occur – the species has been recorded in the region (desktop searches) however suitable habitat is generally lacking from the Project Area (PLA) or species has not been recorded in the region (no records from desktop searches within past 10 years) however potentially suitable habitat occurs at the Project Area (PLA).
- High potential to occur – the species has been recorded in the region (desktop searches) and suitable habitat is present at the Project Area (PLA) or immediately adjacent to it.
- Known to occur – the species has been within the Project Area (PLA) in the recent past (i.e. last 5-10 years) and the site provides suitable habitat for it.

3.3 Collision Risk Assessment

To assess the collision risk of birds/bats with wind turbines, bird/bat utilisation studies were undertaken between 2016-2019. Birds/bats, including Least Concern (NC Act) species with a moderate – high likelihood of occurrence, or birds/bats known to occur were assessed. Refer Section 5 and Appendix D for the collision risk assessment and likelihood of occurrence.

3.4 Field Assessments

3.4.1 Survey Timing and Climatic Conditions

The field surveys of the Project Area (PLA) were conducted between 2016 – 2019. Initial surveys were undertaken in December 2016 and March 2017 to provide additional information during the initial feasibility stage. Subsequent field surveys were undertaken monthly between October 2018 and April 2019 (inclusive) and weekly from February 2019 through to the end of April 2019. Monthly bird utilization surveys (BUS) surveys (refer Table 3) were specifically designed to capture the migratory period of EPBC Act migratory birds arriving or leaving the Ramsar Great Sandy Strait, in

addition to other known migratory terrestrial birds identified in the initial feasibility assessments in 2016.

Table 3 summarises the climatic conditions on each bird survey.

Table 3 Weather Conditions During BUS Surveys¹

Date	Temp °C		Rain	Evap	Radiation	Vapour Pressure	Relative humidity		Mean sea level pressure
	max	min	mm	mm	MJ/m ²	hPa	min%	max%	hPa
8/12/2016	32.5	22.5	0	7.2	19	24	49.1	88.1	1012.5
15/03/2017	29.5	20	32.2	1.2	20	26	63.1	100	1013.5
23/10/2018	29	17.5	0	4.8	26	21	52.4	100	1017
24/10/2018	31	17.5	0	6	24	21	46.7	100	1017.5
29/11/2018	32.5	18	8.9	8.6	27	14	28.6	67.9	1006.5
18/12/2018	29	22.5	6.9	4	14	27	67.4	99.1	1010.5
16/01/2019	32.5	19	0	6.8	28	21	42.9	95.6	1014.5
14/02/2019	33	23.5	0.5	7.8	16	28	55.7	96.7	1010.5
20/02/2019	33.5	20.5	0	7	27	25	48.3	100	1008
27/02/2019	30	17.5	0.2	5.8	25	17	40.1	85.1	1019
4/03/2019	29	21	5.1	8.2	18	24	59.9	96.5	1019
14/03/2019	33	22.5	0.4	5.4	23	27	53.7	99.1	1014
20/03/2019	33	21	2.4	4.6	22	27	53.7	100	1012.5
25/03/2019	32	21	0	5	17	26	54.7	100	1016
10/04/2019	28.5	16.5	0.4	5.6	18	21	54	100	1017.5
17/04/2019	26.5	17	0.8	4.2	18	20	57.8	100	1020.5

¹ – BoM Weather Station: Tuan Creek Forest Station (40207), latitude -25.6778, longitude: 152.7928, extracted 20 August 2019.

3.4.2 Flora Surveys

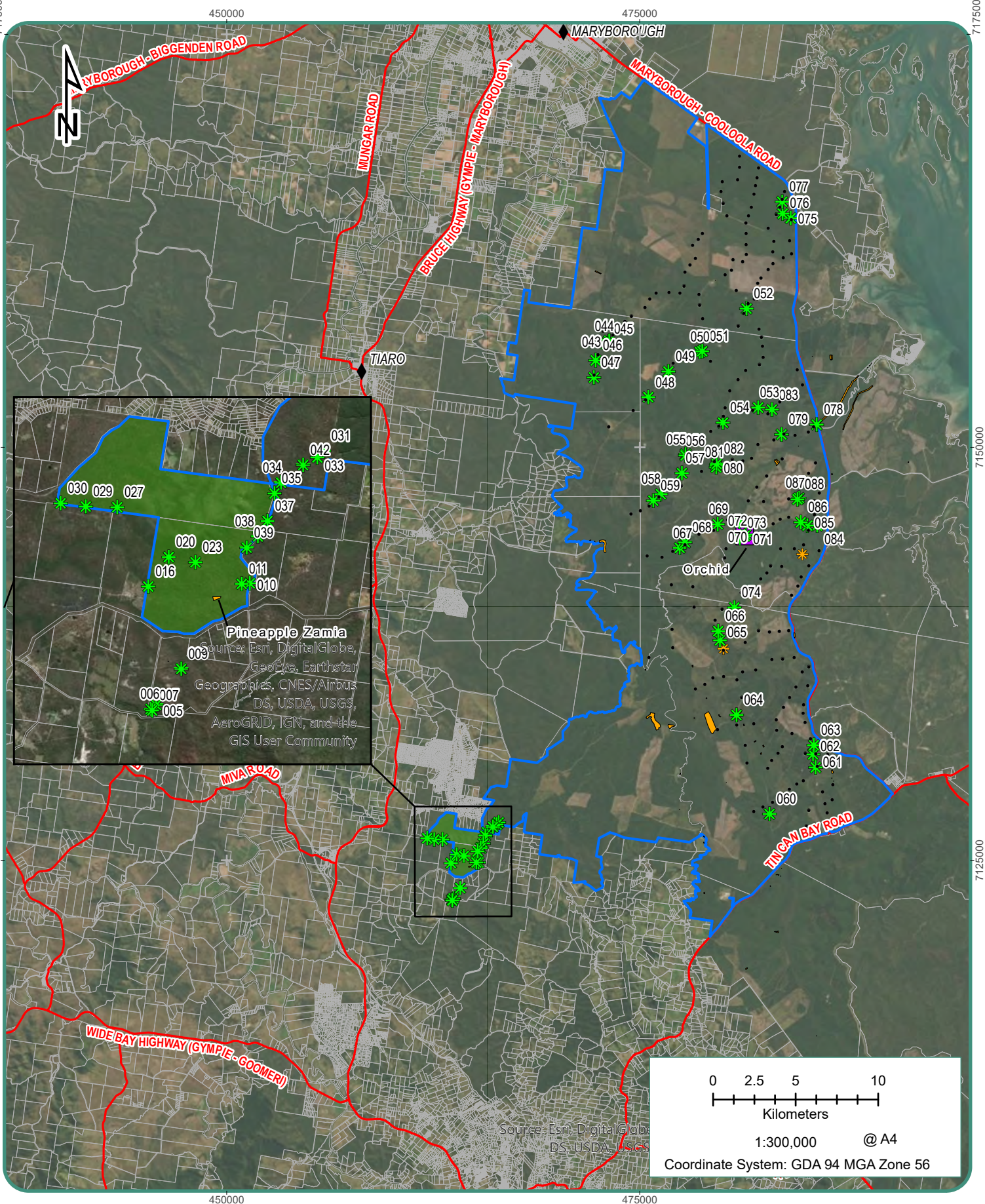
Flora and vegetation surveys were undertaken on:

- 2-3 April 2019 (NSF property described as 1419FTY1697);
- 17-19 June 2019 (inclusive) across the Project Area (PLA); and
- 9 January 2020 (Raintree Bridge on Tinana Creek).

The surveys were undertaken to ground-truth mapped RE, identify flora species, including threatened flora.

Surveys undertaken in the NSF involved meander surveys and 20 quaternary vegetation assessments. This involves collecting information on structure, canopy height, dominant and co-dominant canopy species, subdominant, associated species and additional notes such as presence of hollow bearing trees (HBT).

Forty-four (44) quaternary sites were undertaken across the Project Area (PLA) in remnant RE patches. Flora surveys were not undertaken within the Pine Plantations due to the commercial forestry operations and the regular management practices undertaken within the pine plantations (slashing of regrowth and herbicide treatments). Nonetheless, prior to development, pre-clearance surveys (including protected plant surveys in flora survey trigger areas) will be undertaken. Refer to Figure 2 for flora survey locations within the Project Area (PLA).



TITLE: <h1>Flora Survey Locations</h1>		LEGEND		
MAP NO: Figure 2		◆ Populated places	◆ Orchid	
PROJECT: Forest Wind Holdings Pty Ltd		● FWH nominal turbine locations	✱ Flora survey points	
		— State controlled roads	✱ Pineapple Zamia	
		▭ Project Area (PLA)	▭ Pineapple Zamia	
		▭ Property boundaries	▭ Native state forest	

Date: 10/02/2020

Data Source:
© State of Queensland (Department of Natural Resources, Mines and Energy) 2019.

Document Path: C:\Users\greenvale\Documents\Fox & Co Environmental\Projects\Forest Wind Holdings Pty Limited\Report Figures\FWH_report_figures\FWH_report_figures - EPBC version.aprx

3.4.3 Bird Utilisation Survey

139 fixed-point BUS were undertaken between 2016 and 2019. The BUS assessments have been designed with reference to State Code 23: Wind Farm Development, Planning Guidelines (Queensland Government, June 2018). The survey was undertaken with consideration of relevant seasons (migratory period) and also a Before and After Control Impact (BACI) design, which continues during and post-construction to assess impacts. The BACI survey design includes reference sites placed at a sufficient distance from the proposed turbine locations to obtain data outside of the zone of influence of the turbines (State Code 23, June 2018).

The BUS are fixed-time point counts undertaken over a 20 minute period using a method adapted from Reynolds et al. (1980) and Biosis (2016). Point count locations are selected to provide sufficient representation of turbine locations across the entire wind farm. The following was recorded:

- Species
- Number of birds
- Height of bird above the ground
- Horizontal distance from observer to bird
- Weather conditions (cloud cover, wind direction, wind speed)


3.4.3.1 Survey Locations

Twenty-five (25) bird survey locations were established, of which seven (7) are considered reference sites. Locations were selected based on clear vantage points across the entire Project Area (PLA). This was generally in elevated positions or where the pine plantation had been harvested allowing a clear view. Bird survey locations are shown on Figure 3. Birds were also recorded from incidental locations. These are also shown on Figure 3 if the birds recorded were at rotor height. Species observed where flight behaviour would exclude risk of impact (eg. emu) are recorded on the general bird species list, however they are not included on Figure 3. BUS assessment site numbers and dates surveyed are provided in Table 4.

Table 4 Fixed-point BUS Assessments

Site	Date														
	2016	2017	2018			2019									
	8/12	15/3	23-24/10	29/11	18/12	16/1	14/2	20/2	27/2	4/3	14/3	20/3	25/3	10/4	17/4
1	X	X	X	X	X	X	X	X	X	X	X		X	X	X
2			X	X	X	X	X	X	X	X	X		X	X	X
3	X			X	X	X	X	X	X	X	X		X	X	X
4			X	X	X	X	X	X	X	X	X		X	X	X
5			X	X	X	X	X		X		X			X	X
6				X	X	X	X		X	X	X				
7				X	X	X	X	X	X	X	X	X			
8				X	X	X	X		X	X	X	X			
9				X	X	X			X	X			X		
10			X	X					X						
11					X	X			X		X	X			
12						X			X				X		
13					X	X	X		X		X		X		
14					X	X			X		X	X			
15						X	X	X		X				X	X
16							X	X		X	X		X	X	X
17				X											
18												X			
19		X				X									
20							X								
21			X					X							
22													X		
23								X		X		X			
24														X	X
25														X	X
Total	2	2	6	11	12	15	12	9	14	11	12	6	9	9	9

X = 20 minute fixed-point bird utilisation survey undertaken

 = reference site

Site 1 was originally labelled PC1-1 during the initial 2016 / 2017 surveys (shown on Figure 3)

Site 3 originally labelled PC1-2 during the initial 2016 / 2017 surveys (shown on Figure 3)

Site 19 was originally labelled PC2-2 during the initial 2016 / 2017 surveys (shown on Figure 3)