Preliminary Fauna Management Plan

Chalumbin Wind Farm

Prepared for:
Chalumbin Wind Farm Pty Ltd

October 2022

Document Information

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1.0 Introduction

1.1 Background

Chalumbin Wind Farm Pty Ltd (CWF) proposes to develop the Chalumbin Wind Farm Project (the Project) at a location approximately 15 km south-west of Ravenshoe in Far North Queensland within the Tablelands Regional Council Local Government Area (LGA). The Project consists of up to 86 wind turbine generators (WTGs) and associated infrastructure. A Project description is presented in **Section 1.4** and the Project layout is shown in **Figure 1-1**.

The Project area (which encompasses the land parcels within which infrastructure is proposed, including parts of the Wooroora Road reserve) is a total of 31,225 ha, as described in **Section 1.3**. The Project footprint (i.e. maximum area of disturbance) is a much smaller area within these land parcels, and is a total of 1,071.1 ha (3.4 % of the Project area. The Project footprint is sufficiently wide to allow the micro-siting of infrastructure to respond to site-specific constraints.

1.2 Purpose and Scope

The purpose of this Fauna Management Plan (FMP) is to establish a framework for managing impacts on native fauna during the construction and operation of the Project. Acting as a preliminary document, this FMP is also prepared to demonstrate partial compliance with Performance Outcome (PO) 5 of *State Code 23: Wind farm development* within the State Development Assessment Provisions (SDAP).

To achieve these outcomes, the scope of this FMP aims to:

- Review potential Project impacts to native fauna, threatened fauna species and associated habitats identified in the Ecological Assessment Report (EAR); and
- Provide recommendations for avoidance, mitigation and management of potential fauna impacts in order to maintain these ecological values in the Project area.

Impacts and management measures specific to bird and bats arising from potential collision with wind turbines are assessed in the Preliminary Bird and Bat Management Plan for the Project (Attexo 2021a).

1.3 Project Location

The Project area is located 15 km southwest of Ravenshoe along the boundary between the Wet Tropics bioregion (to the east) and the Einasleigh Uplands bioregion (to the west). The eastern and southern parts of the Project area are within the Kirrima-Hinchinbrook sub-bioregion (7.6) and the north-western part is within the Herberton-Wairuna sub-bioregion (9.6). The Project footprint spans parts of the Wooroora Road reserve in addition to two properties: Glen Gordon Station (31SP288862) is a freehold property and Wooroora Station (1CWL3298) is a leasehold property. Both properties are primarily used for grazing and there are several easements intersecting them associated with roads and electrical infrastructure.

Surrounding properties are used for grazing and conservation purposes, with National Parks and Timber Reserve abutting the northern and eastern boundaries of Wooroora Station. The Kennedy Highway is within 8 km north-northwest of the Project area whilst Tully Falls Road is within 5 km of the Wooroora Station eastern boundary.

ARK ENERGY

Attexo

Chalumbin Wind Farm

Project Layout

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Figure 1.1

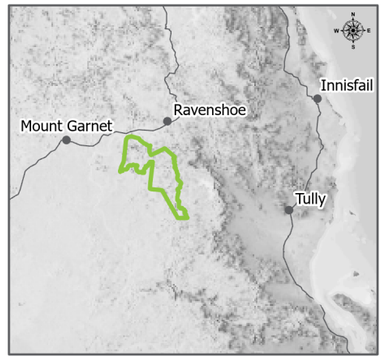
- Project Area Boundary
- Turbine
- Met-mast
- Access Road
- Facilities

Clearance Envelope

- Stage 1
- Stage 2
- Existing HV Transmission Line
- Watercourse
- WTQ Boundary
- WHA Buffer - 500m
- Lot Boundary
- Easement

Date: 13/10/2022 Author: TOD

Project: EPU-004 Reviewed: NOD



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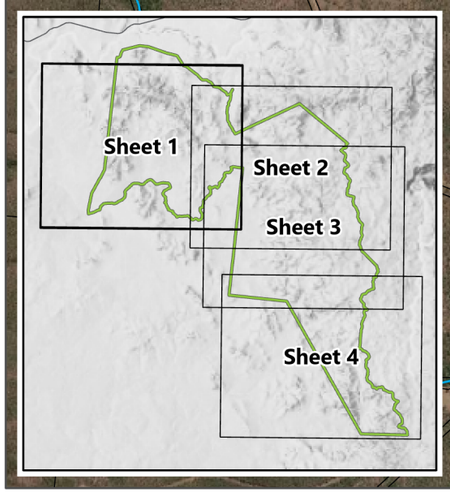

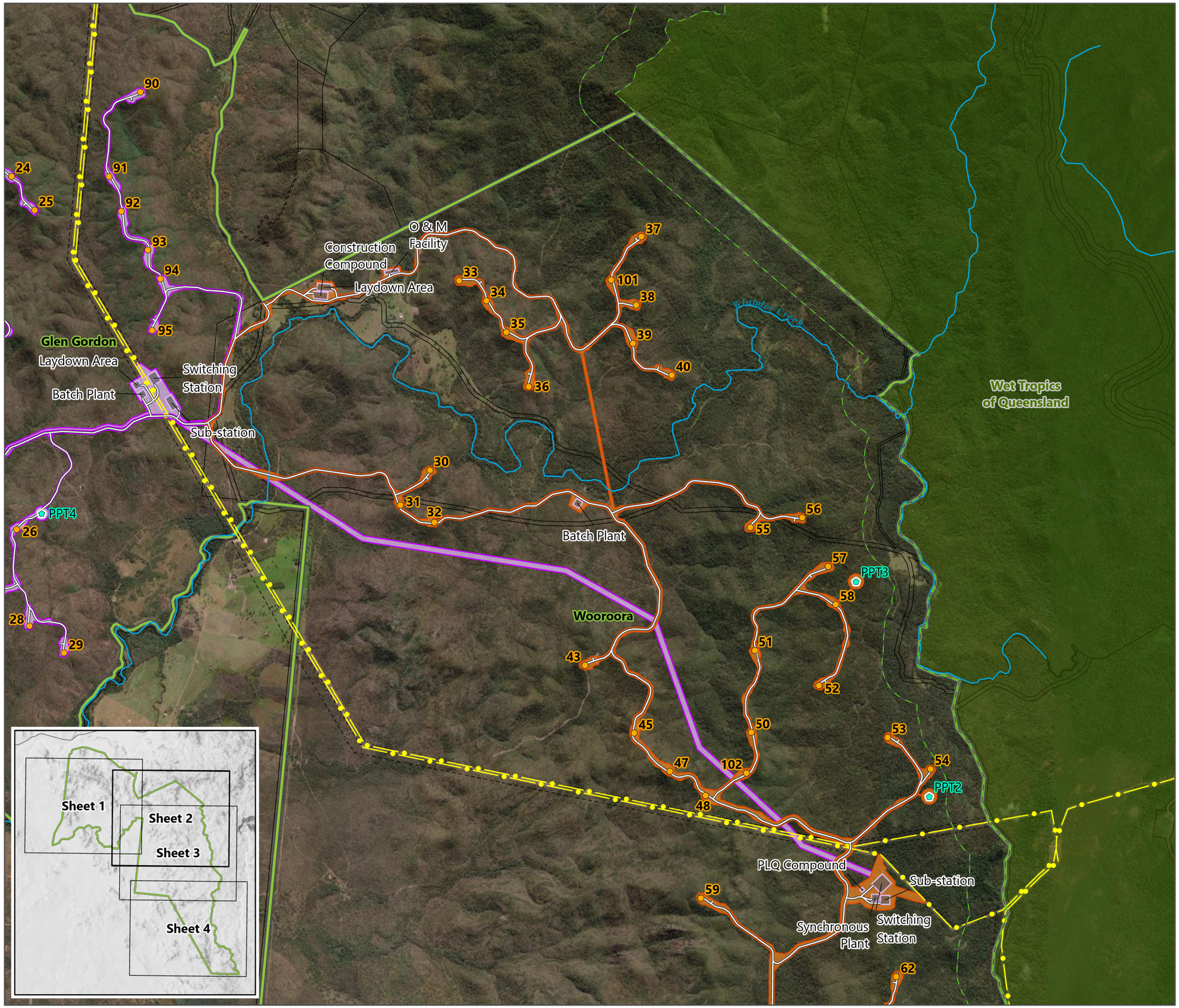

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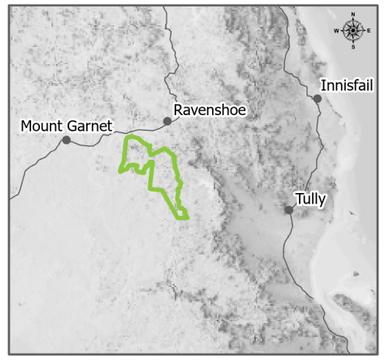

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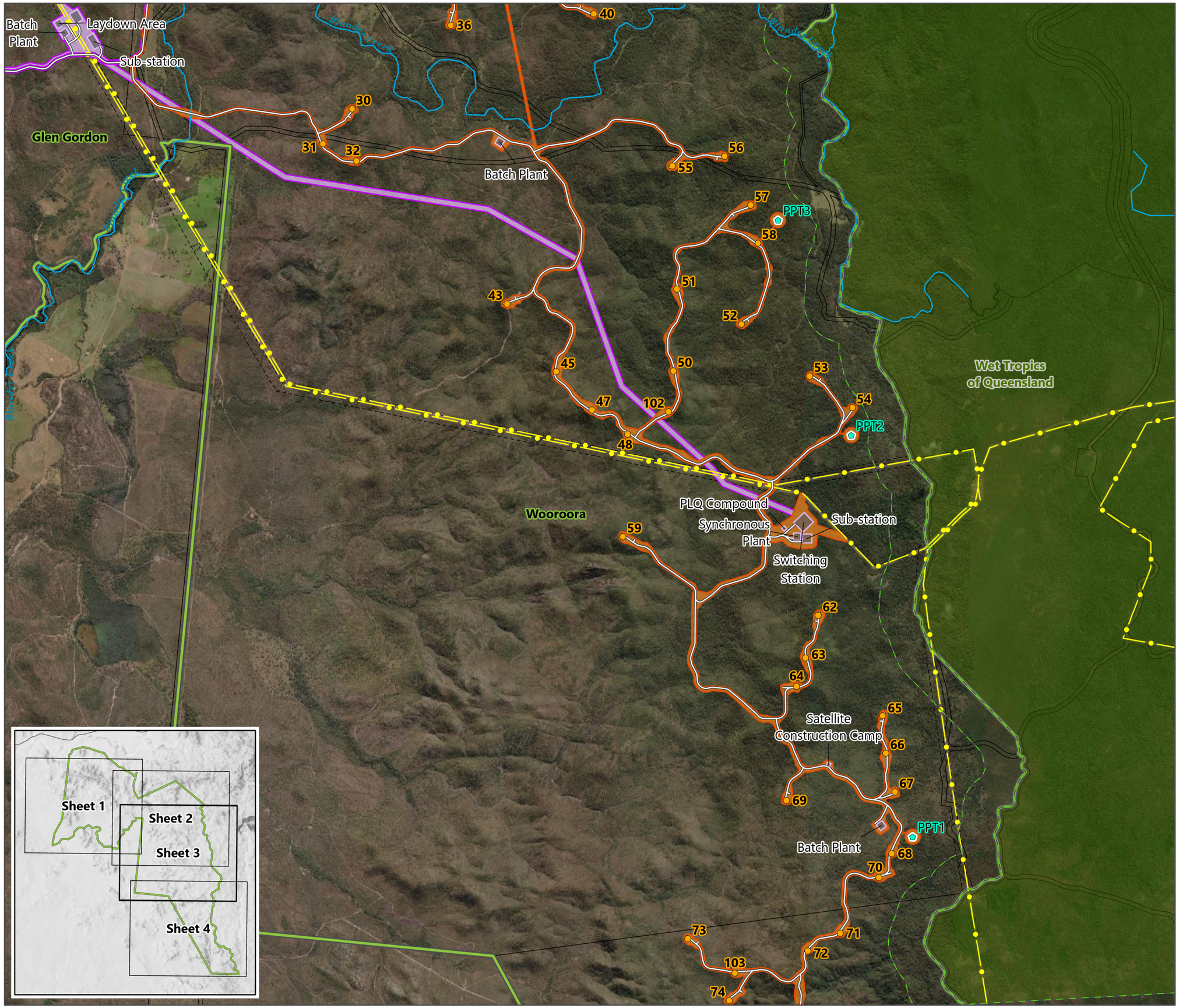

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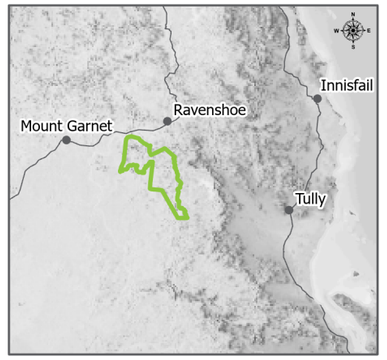

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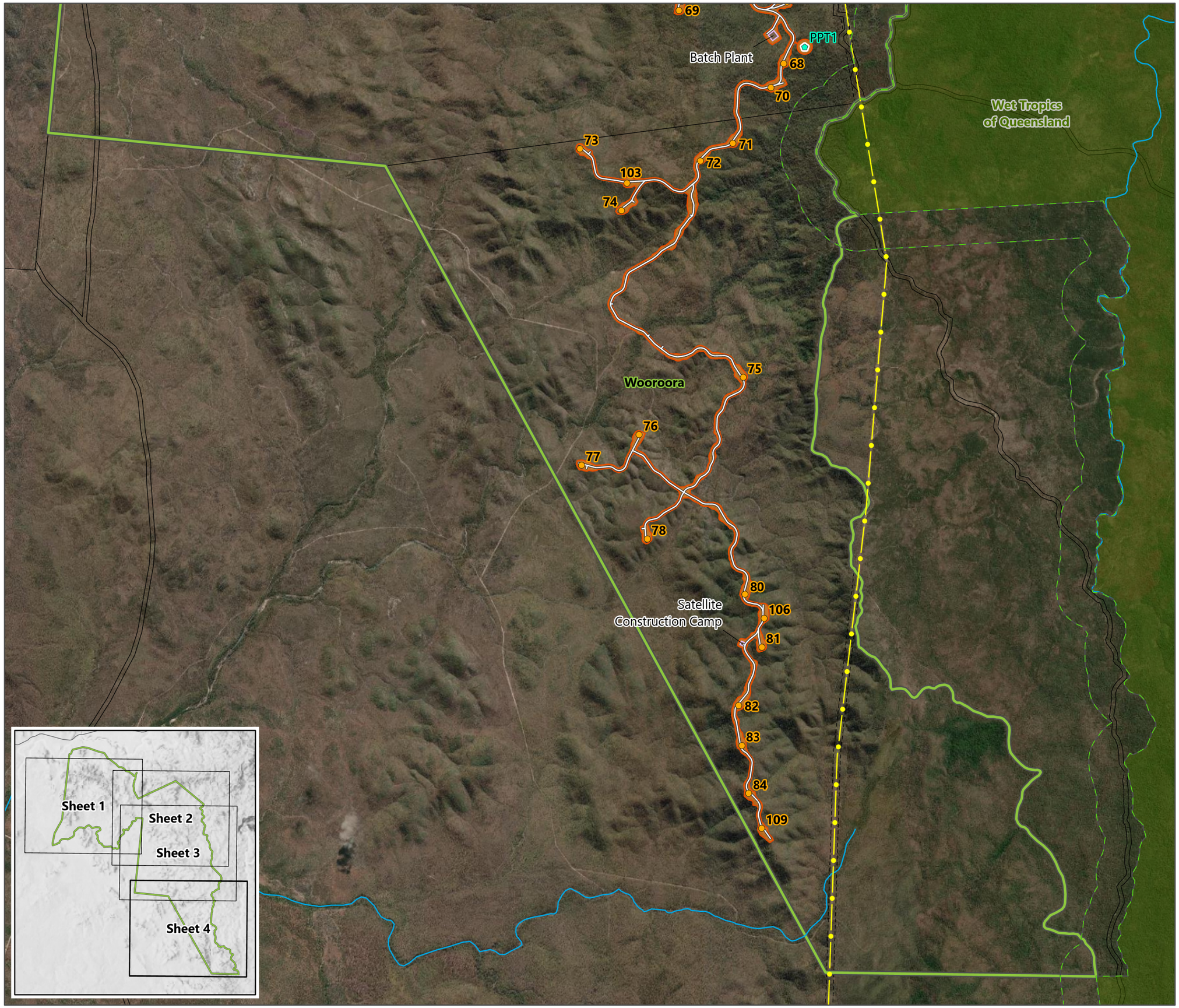

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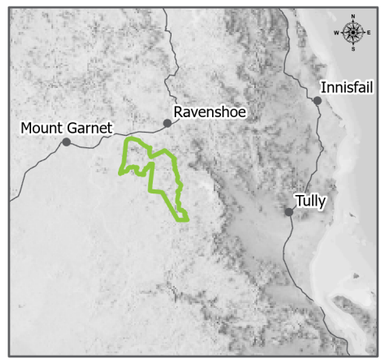

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1.4 Project Description

A detailed Project description is provided within the Public Environment Report (PER). The Project is proposed to have 86 WTGs and will generate approximately 602 MW or 1,985 GWh/annum. Turbine towers will be up to 160 m tall and turbine blades may be as long as 90 m. Other infrastructure will include linking access tracks and associated infrastructure including substations and battery energy storage system, medium voltage overhead and underground powerlines, permanent wind monitoring masts, temporary construction compound, laydown areas and stockpile areas, temporary site offices and an operation and maintenance facility (refer **Figure 1-1**). A full description of the Project is provided in the Planning Report as part of the Development Application for the Project.

1.5 Project Development Stages

The activities associated with each key Project development stage are summarised in the following sections.

1.5.1 Construction

Construction is expected to commence in mid-2023, subject to approvals and commercial considerations. The construction phase is expected to last for a period of approximately 24-30 months, with approximately 250 to 350 staff employed during the peak construction period. The workforce will likely reside in Ravenshoe and other surrounding townships.

Activities during the early stages of construction consist primarily of site establishment, contractor engagement, vegetation clearing, commencement of building compounds and laydown areas, and construction of internal site roads. During this time, detailed design of foundations and any remaining geotechnical work will be undertaken. Wind turbine components will typically arrive on site around six to nine months into construction. The main focus up until this time is the construction of access tracks, reticulation and building the substation. Depending on specific geotechnical conditions, some rock blasting may be necessary to support construction activities.

Wind turbine installation begins with construction of the foundation (typically a reinforced gravity foundation of approximately 800 m^3 of concrete). Once the concrete has cured, the tower is installed in sections which are lifted on top of one another. The nacelle (which weighs up to 400 t, including the drive train, generator and gearbox) is then lifted into position.

After this point, the blades are mounted on the hub (alternatively they are arranged at ground level and lifted as a single unit). Once the wind farm has been fully constructed and tested and registered as a generator on the National Electricity Market, it can be connected to the transmission network. Powerlink will be coordinated with for the establishment of a connection switchyard, cutting into the existing 275 kV transmission line and creating a configuration to allow the wind farm to connect through.

The wind farm contractor will then connect the final reticulation into the switchyard. At energisation, the wind farm is subject to testing. Once its performance is confirmed by the Australian Energy Market Operator (AEMO) and Powerlink, a number of hold point tests are undertaken at increasing output. The wind farm must prove its ability to meet the agreed performance standards under its connection agreement before it can move to the next hold point and increase its output.

1.5.2 Operations

The operational life of the wind farm is expected to be 30 years. Approximately 15 to 30 full-time jobs will be generated during operation, typically 10 to 20 technicians along with a Project Manager, administration, and other support roles. This will include environmental roles on an as-needed basis to assist in operational monitoring.

1.5.3 Decommissioning

Infrastructure may be repowered with new equipment for a further 30-year operating life, or decommissioned, with the site rehabilitated to facilitate continuation of the current land use (agriculture) or alternative land use. If decommissioned, most above-ground infrastructure apart from roads (which are left to benefit the landholders) will be removed (e.g., all turbines, transmission lines, etc). The land will then be rehabilitated in line with development permit conditions and specific landowner agreements. Some infrastructure may remain in-situ depending on landowner preferences.

2.0 Regulatory Framework

2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage Matters of National Environmental Significance (MNES), many of which are also internationally important. If a proposed development or other action is likely to have a significant impact on a protected matter, then it must be referred for assessment under the EPBC Act. Protected matters under the EPBC Act are:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (as listed under the Ramsar Convention)
- Listed threatened ecological communicates (TECs) and listed threatened species;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- The environment, where nuclear actions are involved;
- A water resource, in relation to coal seam gas and large coal mining developments;
- The environment, where actions are proposed on or will affect Commonwealth land;
- The environment, where Commonwealth agencies are proposing to undertake the action.

There are known matters of national environmental significance (MNES) within the Project area, including threatened flora, fauna, and migratory species. A referral to the Commonwealth Department of Agriculture, Water, and the Environment (DAWE) (reference: EPBC 2021/8983) was made for the Project in June 2021. On 10 August 2021 DAWE determined that the Project is a controlled action and will be assessed by Public Environment Report.

2.2 Queensland State Framework

2.2.1 Planning Act 2016

In Queensland, wind farms require a development permit under the *Planning Act 2016* for a Material Change of Use (MCU) for a windfarm and for Operational Works for clearing regulated vegetation (OPW). The MCU requires assessment under *State Code 23 – Wind Farm Development* and the OPW requires assessment under *State Code 16 – Native Vegetation Clearing*. The material for the development permit is provided in one comprehensive package and is submitted to the State Assessment and Referral Agency (SARA), as assessment manager.

An Ecological Assessment Report (EAR) addressing prescribed matters of state environmental significance (MSES) has been prepared as part of the development application. This Preliminary FMP, a Preliminary Vegetation Management Plan (VMP), and a Preliminary Bird and Bat Management Plan (BBMP) were prepared to support the EAR. The Project (in an earlier 94 WTG arrangement) received a Development Permit under the *Planning Act 2016* (Qld) from the

Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) on 30 June 2022. This included conditions in relation to offset requirements under the Queensland *Environmental Offsets Act 2014*.

2.2.2 Vegetation Management Act 1999

The Project's development permit authorises the clearing of vegetation that is regulated under the *Vegetation Management Act 1999* (VM Act), subject to conditions regarding environmental offsets.

2.2.3 Nature Conservation Act 1992

The objective of the *Nature Conservation Act 1992* (NC Act) is the conservation of nature; the Act provides for the gazettal of protected areas including nature refuges, prescribes classes of wildlife and sets out restrictions on the taking or harm to native wildlife without a valid permit. As part of the EAR impact assessment, threatened flora and fauna species have been reviewed based on their potential to occur in the Project area, and including consideration of their habitat within the Project area.

2.2.3.1 Fauna Breeding Places

For the purposes of this FMP, an animal breeding place is defined as: a bower; burrow; cave; hollow; nest; or other thing that is commonly used by the animal to incubate or rear offspring. For a proposed activity that will have an unavoidable impact on a defined breeding place of protected animals (which include all classes of native wildlife including those classified as least concern) a Species Management Program (SMP) is required to be prepared under the NC Act and approved by DES.

The purpose of a SMP is to:

- assess the threats to native animal breeding places resulting from a planned activity;
- incorporate management actions that will avoid or minimise both the immediate and the long-term impact of removing or altering an animal breeding place; and
- set monitoring and reporting requirements that demonstrate the management actions in the SMP are effectively implemented and produce the intended results.

For species listed as least concern, a Low Risk SMP is required for tampering with animal breeding places. For species listed as colonial breeders, special least concern (SLC) and Endangered, Vulnerable and Near Threatened (EVNT) species, a High Risk SMP will authorise tampering for fauna breeding places. Both classifications of SMP require a duration to be defined and must be relevant to the activity being undertaken and allow for a periodic review of the program. The standard term for an SMP is three years.

The seasonal terrestrial ecology surveys undertaken between 18 January and 1 February 2020 (wet season) and between 18 June and 29 June 2021 (dry season) included habitat assessments and identification of animal breeding places. This information has been used to inform the likely occurrence of species within the Project area, habitat mapping and also to inform an assessment of potential impacts to threatened fauna species. The field survey results will inform the preparation of a High Risk SMP for the Project. The High Risk SMP must be approved by DES prior to vegetation clearing commencing.

2.2.3.2 Protected Plants

The Project may require the clearing of plant species protected under the NC Act. For any EVNT plant species with the potential to be impacted by the Project, a Protected Plant Clearing Permit may be required from DES. This is further described within the Project's Preliminary Vegetation Management Plan (Attexo 2021b).

2.2.4 Environmental Offsets Act 2014

In Queensland there is an offsets framework governed by a range of legislation, policies and guidelines to support a determination as to when environmental offsets are required, and how they are to be delivered. A summary of the framework and guiding principles that apply is summarised below.

The Queensland Offsets Framework includes:

- *Environmental Offsets Act 2014* (EO Act);
- *Environmental Offsets Regulation 2014* (EO Regulation);
- Queensland Environmental Offsets Policy (QEOP) (version 1.10);
- Significant Residual Impact Guideline – for prescribed activities under Planning Act (EHP 2014).

Impacts to Matters of State Environmental Significance (MSES) are assessed in the EAR (Attexo 2021c). An assessment of significant residual impacts to MSES has been completed for those prescribed matters relevant to the Project under State Code 16 and applying criteria from the SRI Guideline (DSDIP 2014). Environmental offsets will only be required if it is determined that there are significant residual impacts to the following listed matters:

- Endangered or Of Concern REs;
- REs within a defined distance of a watercourse;
- REs that intersect with a wetland;
- Connectivity; and
- Essential Habitat.

2.2.5 Biosecurity Act 2014

The *Biosecurity Act 2014* provides a legislative framework to manage pest flora and fauna, diseases and environmental contaminants, to address the impacts they have on the economy, environment, agriculture, tourism and society. The Act prohibits or restricts the introduction and spread of declared plant and animal pests within Queensland.

Field ecology surveys identified the presence of pest plants and animals, including classifications under the Act. Weeds listed as weeds of national environmental significance (WoNS) are also noted. The presence of weeds and pest fauna species in the Project area and their proposed control are addressed in this Preliminary FMP.

2.3 Local Framework

Minor permit and approvals processes are likely to be required under the Tablelands Regional Council's Planning Scheme for earthworks, access works, interfaces with road reserves, etc. The requirements of the respective local

governments are unlikely to have a significant bearing on the fauna management measures associated with the Project; these are governed at Commonwealth and State level for wind farm development.

3.0 Ecological Values

Wet season fauna surveys were undertaken by three teams of two people between 18 January and 1 February 2021, in accordance with the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al 2018) which identifies the optimal times of year for the Wet Tropics and Einasleigh Uplands bioregions as early wet season (November to January) and early dry season (May to July). Vertebrate activity is typically high during the early wet season as animals start to move around in response to the building humidity.

Supplementary spotlighting for amphibians was undertaken by a team of two people between 26 and 31 March 2021, immediately after a significant rainfall event. As per the Survey guidelines for Australia's threatened frogs (DEWHA, 2010), the optimum timing for surveying for a number of the target threatened frog species (such as *Litoria serrata* and *Pseudophryne covacevichae*) is during periods of peak activity from September to March, after but not during heavy rainfall. The camera traps that had been deployed in January were also collected at this time.

Dry season fauna surveys were undertaken by three teams of two people between 18 and 29 June 2021.

The PER further describes additional surveys undertaken for targeted fauna values within the Project area.

Key findings for all surveys are detailed below.

3.1 Fauna Habitat Descriptions

Fauna habitat within the Project area is generally remnant vegetation associated with woodlands or open forests. Some vegetation within the Project area has historically been cleared for grazing, generally within close proximity to the homesteads. The most common vegetation community within the Project area is Regional Ecosystem (RE) 9.12.2; a woodland community dominated by a mix of *Corymbia citriodora, C. intermedia* and *Eucalyptus portuensis* that occurs on the slopes and ridges of hills across both Wooroora and Glen Gordon Stations. Within the Einasleigh Uplands bioregion portion of the Project area, the equivalent vegetation community (RE 7.12.34) is the second most dominant. At the tops of many of these hills, scattered rocky scarps and rocky granite pavements contain shrubland and closed forest habitat including *Acacia spp*. and *Lophostemon suaveolens* associated with RE 7.12.65k. Other communities that occur across these hills include the *Eucalyptus reducta* dominated RE 7.12.21, *Eucalyptus resinifera* and *Corymbia intermedia* woodland associated with RE 7.12.52, and occasional patches of vine thicket.

The most common communities within the low-lying areas of the Project Area are RE 9.5.5a, a mixed woodland of *Eucalyptus crebra*, *Corymbia clarksoniana* and *C. citriodora*, and RE 9.3.16, a *Eucalyptus tereticornis* and *E. platyphylla* woodland occurring on alluvial flats. Blunder Creek is the largest waterway to traverse the Project area with a catchment of 142 km^2 (Heiner & Grundy 1994). Blunder Creek flows east to west across both Wooroora and Glen Gordon Stations before joining the Herbert River approximately 9 km to the west. Blunder Creek is identified as a stream order four where it traverses the Wooroora property and becomes a stream order five waterway within Glen Gordon Station. There are a series of stream orders one, two and three across the site consisting of soft substrate bottom, and rocky gullies with distinct water holes and dense riparian vegetation. A number of farm dams also occur on the site.

Five broad fauna habitat types were identified in the Project area and are summarised in **Table 3.1**. A short summary and representative photos of each are provided in the following sections.

Table 3.1 Fauna habitat types within the Project area

Habitat Type	Habitat Description	Associated REs[1]	Habitat Features	Area within the Project Area (ha)	Area within the Project Footprint (ha)
1	Open eucalypt woodland	9.8.4, 9.11.10, 9.12.2, 9.12.4, 9.12.17, 9.5.5a, 9.5.17, 7.3.8, 7.3.19, 7.3.19a, 7.3.42b, 7.3.43, 7.8.7, 7.8.7a, 7.8.15, 7.12.21, 7.12.27ac, 7.12.29a, 7.12.30a, 7.12.34, 7.12.52, 7.12.57, 7.12.57a, 7.12.61, 7.8.19 and 7.8.10	• Rare to regular tree hollows. • Occasional rocky outcrops. • Occasional caves and rock crevices. • Rare to regular fallen logs. • Leaf litter in varying densities. • Regular suitable burrowing substrate.	27,186.1	958.56
2	Riparian areas along natural creeks or drainage lines with temporary or permanent water	9.3.15, 9.3.16, 7.3.16, 7.3.26 and 7.3.43	• Occasional permanent water. • Regular tree hollows. • Occasional rocky outcrops. • Occasional fallen logs. • Regular leaf litter. • Regular suitable burrowing substrate.	1,437.6	17.54
3	Low *Lophostemon* and *Acacia* shrubland on exposed rocky pavements	7.12.65k, 7.12.66 and 7.12.65.	• Regular rocky outcrops. • Occasional caves and rock crevices. • Occasional to regular leaf litter. • Rare suitable burrowing substrate.	1,778.1	50.29

[1] These are ground-truthed REs rather than those mapped by the Department of Resources

Habitat Type	Habitat Description	Associated REs[1]	Habitat Features	Area within the Project Area (ha)	Area within the Project Footprint (ha)
4	Notophyll vine forest	7.8.4, 7.8.4a, 7.12.7a and 7.12.16a.	• Occasional tree hollows. • Regular fallen logs. • Regular leaf litter. • Regular suitable burrowing substrate.	144.5	0
5	Non-remnant	N/A	• Occasional permanent water • Rare tree hollows. • Occasional fallen logs. • Rare leaf litter. • Regular suitable burrowing substrate.	1,133.4	44.76

3.1.1 Open Eucalypt Woodland

Over a third of the Project area supports moist to dry open forests to woodlands dominated by white mahogany (*Eucalyptus portuensis*), Queensland stringybark (*E. reducta*), red mahogany (*E. resinifera*) and/or pink bloodwood (*Corymbia citriodora*) on igneous hills and/or granite or rhyolite uplands (corresponding to REs 9.12.2, 7.12.34 and 7.12.27) (**Plate 3-1**). The understorey is typically comprised of shrubs and grasses including *Xanthorrhoea johnsonii*, *Grevillea spp., Acacia spp.* and kangaroo grass (*Themeda triandra*) whilst trees range in heights from 2-30 metres and canopy cover of 20-50%. In most instances these communities support large, hollow-bearing trees which are recognised to provide habitat for glider species (where trees are >20 m tall with suitable hollows) and hollow nesting birds whilst microhabitat such as cracks and crevices of exposed rocks, fallen timber and dense leaf litter provide habitat for reptiles and small ground-dwelling mammals. Rocky outcrops may also provide habitat for the northern quoll *(Dasyurus hallucatus)* although the presence of this species has not been confirmed within the Project area, with any stream order 1 watercourses providing potential habitat for the magnificent brood-frog (*Pseudophryne covacevichae*); the latter species has been recorded in a number of locations within the Project area.

Plate 3-1 Open Eucalypt woodland on ridges and undulating hills

3.1.2 *Low Lophostemon* and *Acacia* shrubland on exposed rocky pavements

Rocky pavements are characteristic of granite and rhyolite rock outcrops and correspond with RE 7.12.65k. Rocky pavement within the Project area is associated with the drier western areas, often shrublands to closed forests with vegetation communities dominated by *Acacia* spp. and/or *Lophostemon* spp. and/or *Allocasuarina* spp. and/or *Eucalyptus* spp. (**Plate 3-2**). Complex rocky pavements associated with increasing altitude and the formation of caves, fissures and crevices provide critical microhabitat for roosting, nesting and breeding of obligate cave-dwelling bat species such as the eastern horseshoe bat, (*Rhinolophus megaphyllus*). Rocky outcrops also support threatened flora species with restricted range such as *Prostanthera clotteniana, Triplarina nitchaga* and *Homoranthus porteri*.

Plate 3-2 Low *Lophostemon* and *Acacia* shrubland on exposed rocky pavements

3.1.3 Riparian Zones

Riparian habitats corresponding to REs 9.3.16, 9.3.15, 7.3.26 and 7.3.43 are represented as narrow communities primarily consisting of eucalypt woodlands on alluvium with occasional small sections of dry rainforest type communities fringing ephemeral drainage and creek lines. These communities typically consist of large forest red gums (*Eucalyptus tereticornis*) with sub-dominance of river she-oak (*Casuarina cunninghamiana*) and/or poplar gum (*E. platyphylla*) (**Plate 3-3**). The canopy and mid-storey are relatively low with trees <20 m tall and shrubs 1-4 m. The understorey is characterised by tussock species including black speargrass (*Heteropogon contortus*) and *Imperata cylindrica*, and provides rich habitat for small invertebrates. These areas also represent preferred habitats for folivores such as greater glider (*Petauroides volans minor*) as associated moisture expression provides both favoured foraging tree species as well as large hollows for denning. They also provide potential nesting habitat for the masked owl, northern subspecies (*Tyto novaehollandiae Kimberli*). Waterways within the Project area are known to contain special least concern species such as platypus (*Ornithorhynchus anatinus*).

Plate 3-3 Riparian Vegetation Along Blunder Creek

3.1.4 Notophyll Vine Forests

Several small patches of simple notophyll vine forest (SNVF) are present in the Project area, corresponding with REs 7.12.7 and 7.12.16. Larger SNVF communities generally occupy valleys or slopes with southerly aspects on richer soils, whilst smaller patches of SNVF occur as a result of lower soil moisture availability, impeded drainage, drier climate, increased elevation and exposure, and less fertile soils. This community is characterised by leaf size (medium sized leaves, 7.5-12.5 cm long) and described by the uniformity of tree basal diameter and the regularity of spacing between canopy trees which, as a result, provides even canopy height and crown cover. The provision of dense canopy cover offers potential sheltering opportunities for multiple faunal classes including threatened species such as the southern cassowary (*Casuarius casuarius johnsonii*) and the spectacled flying-fox (*Pteropus conspicillatus*); neither of these species has been recorded within the Project area to date. The ground layer of these communities also provides terrestrial microhabitat such as rocks and crevices with abundant leaf litter.

3.1.5 Non-remnant areas

Non-remnant areas are primarily represented within proximity to the homesteads or fixed agricultural infrastructure such as cattle yards and mostly consists of active grazing land (**Plate 3-4**). Large areas have been completely cleared with only pastural grasses remaining, with other areas only partially cleared - particularly adjacent to vehicle tracks and artificial water sources. Completely cleared sites are heavily grazed and likely offer little habitat for specialised faunal groups. However, partially cleared areas offer habitat for species that typically prefer open grassy woodlands such as squatter pigeon, northern subspecies (*Geophaps scripta peninsulae*). This species also benefits from the permanent water storages in the Project area such as farm dams.

Plate 3-4 Non-remnant areas

3.2 Threatened Fauna Presence

Based on the findings of the Project EAR (Attexo 2021c), 19 threatened fauna species (listed as Endangered, Vulnerable, Migratory and/or Special Least Concern) were identified as known or likely to occur within the Project area, as listed in **Table 3.2**. Potentially suitable habitat for each of these species is shown in **Figure 3-1**, based on the broad habitat types described above. In most cases, the species will have niche habitat requirements that are more specialised than these broad habitat types; for example, northern greater gliders are broadly associated with open eucalypt woodland but have additional specific requirements relating to hollow-bearing trees. Habitat mapping within the PER is more refined.

The locations of recorded EVNT fauna species within the Project area are also shown.

Table 3.2 Species habitat associations

Species	NC Act	EPBC Act	Likelihood of Occurrence	Associated habitat[2]	Potential habitat within Project footprint (Ha)
Amphibians					
Magnificent brood-frog (*Pseudophryne covacevichae*)	V	V	Known to occur	1, 2	976.1
Tapping green-eyed tree frog (*Litoria serrata*)	V	-	Known to occur	2	17.54
Birds					

[2] Habitat types are described in **Table 3.1.**

Species	NC Act	EPBC Act	Likelihood of Occurrence	Associated habitat[2]	Potential habitat within Project footprint (Ha)
Black-faced monarch (*Monarcha melanopsis*)	SLC	M	Known to occur	4	0
Fork-tailed swift (*Apus pacificus*)	SLC	M	Known to occur	1, 2, 3, 4, 5	1,071.15
Masked owl, northern subspecies (*Tyto novaehollandiae Kimberli*)	V	V	Known to occur	1, 2, 3	1,026.39
Red goshawk (*Erythrotriorchis radiatus*)	E	V	Likely to occur	1, 2, 3	1,026.39
Rufous fantail *(Rhipidura rufifrons)*	SLC	M	Known to occur	1, 2, 4	976.1
Satin flycatcher *(Myiagra cyanoleuca)*	SLC	M	Known to occur	1, 2	976.1
Southern cassowary – southern population (*Casuarius casuarius johnsonii*)	E	E	Likely to occur	4	0
Spectacled monarch *(Symposiachrus trivirgatus)*	SLC	M	Known to occur	1, 4	958.56
White-throated Needletail (*Hirundapus caudacutus*)	V	V & M	Known to occur	1, 2, 3, 4, 5	1,071.15
Mammals					
Lumholtz tree kangaroo (*Dendrolagus lumholtzi*)	NT & SLC	-	Known to occur	4	0
Northern greater glider (*Petauroides volans minor*)	V	E	Known to occur	1, 2	976.1
Northern quoll *(Dasyurus hallucatus)*	LC	E	Likely to occur	1	958.56
Platypus (*Ornithorhynchus anatinus*)	SLC	-	Known to occur	2	17.54
Short-beaked echidna (*Tachyglossus aculeatus*)	SLC	-	Known to occur	1, 2, 3, 4, 5,	1,071.15
Spectacled flying-fox *(Pteropus conspicillatus)*	E	E	Likely to occur	1, 2, 4	976.1
Spotted-tailed quoll – northern subspecies	E	E	Likely to occur	4	0

Species	NC Act	EPBC Act	Likelihood of Occurrence	Associated habitat[2]	Potential habitat within Project footprint (Ha)
(Dasyurus maculatus gracilis)					
Yellow-bellied glider (*Petaurus australis*)	E	E	Known to occur	4	0 ha

NT: Near Threatened, V: Vulnerable, E: Endangered, CE: Critically Endangered, M: Migratory, SLC: Special Least Concern

ARK ENERGY

Attexo

Chalumbin Wind Farm

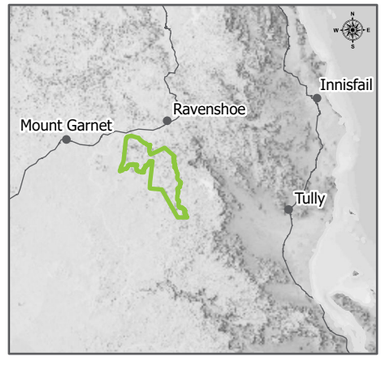
Broad Fauna Habitat Associations

Figure 3.1

- Turbine
- Met-mast
- Existing HV Transmission Line
- OSM_AU_Waterways
- Project Area Boundary
- Project Area Boundary
- Facilities
- Lot Boundary
- Easement
- Habitat 1 - Open eucalypt woodland
- Habitat 2 - Riparian habitat
- Habitat 3 - Low Lophostemon and Acacia shrusbland on exposed rocky substrates
- Habitat 4 - Notophyll vine forest
- Habitat 5 - Non-remnant

Date: 14/10/2022 Author: TOD

Project: EPU-004 Reviewed: NOD



0 5 Km

Scale: 1:125,000@A3

Data Source(s):
Digital Cadastral Database - Department of Resources (2022); Regional Ecosystem Mapping, WildNet - Department of Environment and Science (2022); Atlas of Living Australia (2020) Earthstar Geographics, © State of Queensland (Department of Resources) 2022

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3.3 Least Concern Fauna Presence

Throughout the fauna survey program incidental sightings of 241 native fauna listed as Least Concern under the NC Act were recorded. These species included 32 mammals, 155 birds, 38 reptiles and 16 amphibians. These species are listed in Appendix D of the Project EAR (Attexo 2021c). Least concern species were widespread across the Project area, with most observed in Habitat Type 1 (open eucalypt woodland) and Habitat Type 3 (Riparian zones).

3.4 Introduced Fauna Presence

Seven pest fauna species were recorded during field surveys, including one amphibian, one bird and five mammals as follows:

- Domestic dog (*Canis lupus familiaris*);
- Domestic cat (*Felis catus*);
- Domestic cattle (*Bos taurus*);
- Feral pig (*Sus scrofa*);
- House mouse (*Mus musculus*);
- Common myna (*Acridotheres tristis*); and
- Cane toad (*Rhinella marina*).

4.0 Impacts and risks

4.1 Construction

Throughout the construction phase the Project has the potential to impact MSES values via the following:

- Vegetation clearing resulting in loss of habitat;
- Habitat fragmentation and reduced connectivity;
- Fauna injury or mortality during vegetation clearing and potential entrapment in trenches when installing underground powerlines;
- Injury or mortality due to vehicle strike;
- Wildlife disturbance due to dust, noise, light and vibration emissions;
- Reduced water quality due to erosion and sedimentation;
- Potential spills of hazardous materials;
- Introduction or increased prevalence of pests and weeds due to increased vehicle movements and vegetation clearing; and
- Increased risk of bushfire due to potential ignition sources on site associated with increased activity.

These are discussed in more detail in the following sections.

4.1.1 Habitat Loss

The Project area supports large areas of remnant vegetation dominated by open eucalypt woodland with small pockets of scattered rainforest communities close to the eastern boundary (i.e. closer to the Wet Tropics WHA). The Project has been designed to avoid any clearing of rainforest vegetation therefore threatened species specifically associated with these communities are not expected to be impacted.

Clearing of eucalypt woodland will reduce breeding, foraging and sheltering habitat for flora and fauna species, and the process of vegetation clearance has the potential to result in injury to or mortality of native fauna species. Some species are more sedentary and hence more susceptible to impacts than others. Conversely, more mobile species such as migratory birds are unlikely to be disturbed by vegetation clearing as they are able to disperse more easily.

The total estimated area of vegetation clearing is 1,071.15 ha of regulated vegetation. **Table 3.2** presents a summary of clearing of habitat associated with threatened species, based on broad habitat associations.

4.1.2 Habitat Fragmentation

Terrestrial habitat connectivity may be reduced as a result of the Project due to linear clearing, which may reduce fauna movements between areas of retained remnant vegetation. This habitat fragmentation will be more prominent where clearing widths are larger and intersect intact areas of vegetation. Clearing linear widths through habitats also has the potential to isolate plant populations by causing barriers to the dispersal of seeds and fruit, and to increase edge effects (additional light entering the forest, weed encroachment, increased feral animal abundance and increased risk of bushfire), thereby reducing the ecological functioning of those areas.

Some species are more prone to the impacts on fragmentation, such as greater gliders which are not able to traverse larger cleared areas. The maximum known gliding distance for a greater glider is 100 m (Smith et. al 2007) so clearings greater than 100 m wide are likely to act as a barrier to this species' movement at that location. Other species (such as masked owl) are less likely to be affected by clearings of this size and will disperse quite readily across access tracks and powerline easements.

Fragmentation impacts will be somewhat temporary as a substantial proportion of the clearing for the access roads will be rehabilitated on completion of construction (refer to the Project's Preliminary Rehabilitation Plan).

4.1.3 Injury or Mortality

Direct fauna injury or mortality may occur as a result of the Project during vegetation clearing (e.g. through removal of mature trees containing hollows), vehicle collision or through entrapment in trenches.

Mortality from tree clearing is a greater risk for nocturnal arboreal mammals such as the greater glider, whereby mortality may occur from removal of hollow-bearing trees which provide daytime denning habitat for the species.

Excavations will be required to create trenches in which underground cables will be carried, and to allow construction of turbine pads and access roads. This will involve removal of ground vegetation, soil and rock which provide fauna habitat (e.g. denning sites in rocky areas). During trenching activities there is potential for fauna to fall into and become trapped in open trenches, where they may perish or become subject to increased predation risk. Particularly susceptible species groups include reptiles, frogs and small mammals.

Increased traffic around the Project area has the potential to kill or injure fauna on impact. Some ground-dwelling or slow-moving species may be particularly susceptible to these impacts.

4.1.4 Noise and Vibration

Noise may adversely affect fauna by interfering with communication (e.g. territorial bird song), masking the sound of predators and prey, causing avoidance reactions and displacement from habitat. Construction noise will be generated by the Project through the use of machinery, plant and vehicles, and will vary from short intermittent noise from plant and equipment to more persistent noise from generators. The generation of construction noise may be in areas which have the potential to support threatened fauna species. Individuals that occur within the Project area may leave the area of impact. Project construction works and therefore potential noise impacts will be temporary.

Vibration from vehicles and equipment may cause temporary disturbance to fauna, and displacement or structural damage to boulder piles, rock fissures and caves which form habitat for fauna. Blasting may be required for construction of some pads and access roads depending on geological constraints, and obligate cave-dwelling bats would be particularly susceptible to vibration impacts from blasting.

4.1.5 Light Emissions

Artificial lighting from infrastructure and machinery may impact fauna within the Project area during construction. Artificial lighting can have a range of impacts which vary between species. Artificial light can disrupt patterns of both nocturnal and diurnal species by eliciting responses. Some species may avoid brightly lit areas, potentially due to the perception of being increased risk of predation. Conversely, some species such as nocturnal reptiles, frogs and bats may congregate at artificial light sources to feed on insects attracted to light.

Other potential adverse impacts include disruption of breeding and migratory patterns, disorientation and potential collision with structures.

4.1.6 Hazardous Materials

Project activities have the potential to result in accidental releases of hazardous materials, such as fuels and oils from vehicles and machinery. These hazardous materials can lead to localised soil contamination and contamination of water resources, which in turn can cause injury, reduced vigour or mortality to flora and fauna. The severity of the impact is dependent on the location and magnitude of the release.

4.1.7 Erosion and Sedimentation

The main construction activities that could impact on water quality are excavations and earthmoving for construction of turbine pads and access roads. This may lead to erosion and sedimentation, reduction in water quality and changes to water flows.

During construction activities, sediment may be mobilised and transported by surface water during rainfall events, ultimately discharging into watercourses and drainage lines and potentially reducing water quality in downstream aquatic habitats. Increased suspended sediments can reduce light penetration into the water column, reducing photosynthesis of aquatic macrophytes and decreasing dissolved oxygen levels. However, many creek lines in the Project area are ephemeral, which may reduce the magnitude of these impacts.

Changes in the hydrology of the Project area may occur through alteration of surface flows and stormwater runoff, including obstruction of flow. This can result in scouring or waterlogging occurring in some areas.

The accidental release of pollutants (including leaks and other uncontrolled releases) into the surrounding environment and waterways has the potential to degrade aquatic habitat quality in the Project area and impact vegetation communities and fauna utilising these areas. This includes direct toxic impacts on fauna from ingestion or inhalation. Without mitigation, contaminants may enter waterways including oily wastewater (from heavy equipment cleaning), contaminated runoff from chemical or fuel storage areas and general washdown water.

4.1.8 Dust

Increased dust from vegetation clearing, earthworks and vehicle movements during construction has the potential to temporarily and locally impact flora and fauna values in the vicinity of the Project footprint. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity, resulting in reduced habitat quality for fauna. Increased dust can also impact on respiratory systems of fauna, alter soil properties impacting on plan species assemblages and reduce water quality in aquatic habitats.

Dust is expected to only be a potential issue during vegetation clearing and construction.

4.1.9 Bushfire Risk

Fire is a natural part of the Australian landscape, and most vegetation communities are adapted to periodic fires. However, changes in the natural fire regime may result in changes in the species composition and / or structure of the vegetation. The increased presence of construction vehicles and personnel in the Project area may increase fire risk through use of machinery that may generate sparks, use of flammable liquids and idling vehicles being present in areas of ground vegetation.

4.1.10 Pests and Weeds

Project activities have the potential to increase the abundance of pest flora in the Project area and facilitate dispersal of species to previously unaffected areas. Movement of vehicles, equipment and personnel throughout the Project area is the key vector of transmission, in particular vehicles and equipment sourced from regions beyond the Project area which may introduce new species. Many weed species thrive on disturbed ground and will rapidly colonise disturbed areas in advance of native species recolonisation.

Increased pest flora abundance has adverse impacts on native vegetation and biodiversity, as well as potential negative economic effects on local land uses such as grazing activities.

Project-related activities may also increase pest fauna abundance in the Project area. This can lead to increased competition with, and predation of native fauna. In addition, habitat degradation may occur through vegetation trampling (e.g. feral pig wallowing). Creation of new access points into areas of intact vegetation may create pathways for feral fauna species to disperse. Uncontained waste sources may also attract feral fauna such as wild dogs.

4.2 Potential Operational Impacts

Throughout the operational phase, the Project has the potential to impact on fauna via the following:

- Fauna injury or mortality due to vehicle strike;
- Collision with turbines towers, blades and powerlines;
- Barotrauma;
- Wildlife disturbance due to light emissions;
- Potential spills of hazardous materials;
- Increased pests and weeds due to increased vehicle movements; and
- Increased risk of bushfire due to potential ignition sources on site associated with increased activity.

These are discussed in more detail in the following sections.

4.2.1 Vehicle Strike

Increased traffic around the Project area has the potential to kill or injure fauna on impact although traffic levels will be greatly reduced from the construction phase and more geared towards light vehicles. Ground dwelling or slow-moving species may be particularly susceptible to traffic impacts.

4.2.2 Collision Risk

Potential impacts to threatened and migratory species, and other species groups of concern (e.g. microbats, raptors and waterfowl) may occur through direct collision with turbine towers and blades and associated powerlines, but also through flying through the "wake" behind the turbine. Many species will rarely, if ever, fly at rotor height while others will do so routinely. Different types of flight (e.g. soaring, direct flight, hovering) and different speeds of flight also will pose a different risk of collision. These impacts to birds and bats and the Projects mitigation measures are discussed in further detail in the Project Bat and Bird Management Plan (Attexo 2021a).

Turbine siting will influence collision risk, with turbines located near wetlands likely to lead to greater risk of collision with birds and bats which congregate near wetland habitats. Turbines located on ridgelines and in valleys or other topographical features which may "funnel" birds and bats through a narrow pathway, are pose a greater risk of collision.

Other factors that attract birds and bats to the proximity of turbines include an increase in perching habitat (from powerlines or the turbine structure itself), increased lighting that increases insect abundance around turbines, and the presence of carcasses around the base of turbines (attracting raptors and corvids in particular).

Generally, species at higher risk of collision are likely to comprise:

- Raptors – this group take advantage of updrafts associated with ridgelines to move around. Raptor species were reasonably well represented in the diurnal bird surveys, with observations of collared sparrowhawk, brown goshawk, grey goshawk, wedge-tailed eagle, Pacific baza, whistling kite, brown falcon and peregrine falcon.
- Migratory swifts – both white-throated needletail and fork-tailed swift were recorded during the field surveys and will routinely fly at RSA height.
- Waterfowl (ducks, cormorants, terns, herons, etc.) – these species are generally prone to collision due to their often-direct nature of flight, flight height and lower manoeuvrability than other species. No significant wetlands are present within the Project area and this group was not well represented in the diurnal bird surveys, with a few observations of Australian wood duck, Pacific black duck, white-necked heron and white-faced heron.
- Migrating passerines and other species – migratory passerines routinely fly at rotor swept area (RSA) height. Passerine species represent the majority of bird species recorded during the field surveys, albeit the Project area is not known to be located in a significant corridor for passerine migration.
- High-flying or migratory/nomadic microbats – many species forage at or below canopy height, but some species forage well above canopy height (e.g. some of the freetail and sheathtail species).

4.2.3 Barotrauma

Mortality from near-contact collision in the form of barotrauma is known to primarily affect microbat species. Barotrauma is associated with low air pressure produced in the wake of moving blade-tips in the form of vertices. These vertices increase in size and decompression gradients with increasing blade velocity. The sudden change in air pressure associated with the vertices is known to damage the internal air-containing tissues of microbats such as lungs when entering a fast-moving turbine wake, typically causing internal haemorrhaging resulting in death. This form of mortality may account for up to 50 % of all microbat deaths associated with wind farms in locations where microbats are common. Rapid air pressure changes are largely an undetectable hazard and it is thought that microbats are more susceptible to fatal barotrauma than other groups due to particular anatomical features such as large lungs to body ratios and specialised vascular system to power high-energy flight (*Baerwald et al. 2008*).

4.2.4 Light Emissions

Artificial lighting from infrastructure may impact fauna within the Project area during operation of the Project. In particular, artificial light can disrupt patterns of both nocturnal and diurnal species by eliciting responses. Some species may avoid brightly lit areas, potentially due to the perception of an increased risk of predation. Increased lighting of turbines may increase the presence of insects and in turn lead to an increased risk of collision with turbines for bats and birds. The Project is not expected to have any operational WTG lighting requirements.

4.2.5 Erosion and Sedimentation

During operational activities, sediment may be mobilised and transported by surface water during rainfall events across established tracks, laydown areas and other infrastructure. Any deposited dust or chemicals on these surfaces such as diesel residue may be collected by these flows and discharging into watercourses and drainage lines and potentially reducing water quality in downstream aquatic habitats. Increased suspended sediments can reduce light penetration into the water column, reducing photosynthesis of aquatic macrophytes and decreasing dissolved oxygen levels. However, many creek lines in the Project area are ephemeral, which may reduce the magnitude of these impacts.

Changes in the hydrology of the Project area may occur through alteration of surface flows and stormwater runoff, including obstruction of flow. This can result in scouring or waterlogging occurring in some areas.

4.2.6 Hazardous Materials

Operational activities have the potential to cause harm to fauna species through accidental releases of hazardous materials. The volume of such substances being used and stored on site during operation will be significantly less than during construction, with a corresponding reduction in risk.

4.2.7 Weeds and Pests

As described in **Section 4.1.10** for construction activities, operational activities have the potential to increase the abundance of pest flora and fauna in the Project area and facilitate dispersal of species to previously unimpacted areas.

4.2.8 Bushfire Risk

During operational activities, there is potential for heightened fire risk due to the increased presence of maintenance and monitoring vehicles and personnel in the Project area. This is through the use of machinery that may generate sparks, use of flammable liquids and idling vehicles being present in areas of ground vegetation.

4.3 Potential Decommissioning Impacts

At the end of the Project's operational life, infrastructure will be decommissioned at the site rehabilitated to facilitate continuation of the current land use (i.e. agriculture). Decommissioning involves the removal of all above-ground infrastructure such as turbines, overhead transmission lines, switching stations, etc. Removal of buried infrastructure is not normally undertaken as this typically causes additional disturbance and environmental impacts. Once above-ground infrastructure is removed, the land is rehabilitated in line with specific approval conditions and landholder agreements.

Impacts during decommissioning are likely to relate primarily to vehicle movements around the Project area, potential for spread of weeds and elevated risk of bushfire as described in the sections above. No additional vegetation clearing would be anticipated during decommissioning activities; however, this it would be subject to a separate assessment if required.

5.0 Impact Avoidance, Minimisation and Mitigation

5.1 Avoidance

Ecological surveys of the Project area commenced at an early stage during Project design, and as such the results of the surveys have been able to significantly inform the Project layout. Central to this process was ensuring that areas of higher ecological significance were avoided to the greatest practical extent, taking into consideration the challenging terrain and wind resource requirements. These avoidance measures are described in the Project EAR (Attexo 2021c) and the PER.

5.2 Minimisation and Mitigation

Where impacts cannot be avoided, mitigation and management measures will be implemented to reduce residual impacts to the lowest extent practicable. **Section 5.1** (Construction) and **Section 5.2** (Operation) detail stage-specific measures proposed for the Project to minimise impacts to native fauna. **Section 5.3** identifies species-specific measures proposed for impact minimisation and mitigation.

5.2.1 Construction – Impact Mitigation and Management

Table 5.1 Construction – Impact Mitigation and Management

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
Habitat loss	• Construction Manager • Environmental Manager	• Environmental manager will ensure exclusion zones are clearly defined and signage is in place prior to clearing commencing to confine clearing to approved areas and in contravention of disturbance limits. • Clearing boundaries to be identified in maps and GIS that are provided to contractors. • Placement of the substation, office, construction compound and temporary laydowns in existing cleared areas where practicable. • Vegetation clearing will be limited to those areas required for earthworks and construction of the Project. Access roads will be aligned along existing tracks wherever practicable to minimise vegetation removal, loss of hollow-bearing trees and fragmentation. Overhead transmission lines will be limited in width to that required for construction and required firebreaks. Minimising the widths of access roads where practicable, particularly across creeklines.	• Monitoring to ensure vegetation clearing has stayed within approved boundaries and limits. • Monitor to ensure all exclusion fencing and signage remains in serviceable condition.	• Replace any fencing or flagging tape that is in poor condition. • Where clearing extends outside the approved disturbance limits, a record must be taken of the incident and an investigation will occur. • Restoration and revegetation of additional cleared areas will be discussed and where required undertaken.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		• Sequential clearing of native vegetation will occur to retain habitat trees where practicable, and to minimise impacts to native fauna species during clearing process. This includes clearing towards adjacent habitats to encourage movement to these areas and retaining large, canopy trees until second phase. The procedure will be outlined in the Construction Environmental Management Plan (CEMP). • Woody debris, logs and rocks will be retained for use in rehabilitation.		
Habitat fragmentation	• Construction Manager • Environmental Manager	• All fencing on site will give consideration to the movement of fauna. Fencing design will use a best practice approach, allowing fauna to move through or over it and not using barbed wire on the top strand of fences. • Install fauna exclusion fencing around infrastructure that presents a high risk to fauna species such as substations. • Minimise clearing widths and, where feasible, introduce measures to facilitate safe fauna movement between adjacent habitats. This may include reduced vehicle speeds to minimise chance of vehicle	• Monitor that vegetation clearing has stayed within approved boundaries and limits. • Fauna spotter-catcher will monitor vegetation clearing to avoid and minimise impacts on native fauna and ensure sequential clearing is occurring.	• Replace any exclusion fencing, signage or flagging tape that is in poor condition. • Where clearing extends outside the approved disturbance limits, a record must be taken of the incident and an investigation will occur. • Revegetation of additional cleared areas will be discussed and where required undertaken.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		strike, rope crossings at key glider corridors, and fauna furniture in culverts. • Sequential clearing to occur. • Where practicable, access tracks are to follow previously cleared areas to minimise the total width of cleared land and fragmentation of habitats. • Placement of the substation, office, construction compound and temporary laydowns in existing cleared areas where practicable • Priorities the maintenance of connectivity along riparian corridors.		• Any fauna injuries or deaths are required to be reported firstly to the Project Environmental Manager and then DES and/or DAWE if it involves a threatened species. The cause of injury or death will be investigated, and any required changes will be implemented.
Injury or mortality	• Construction Manager • Environmental Manager • Suitably qualified ecologist • Fauna spotter catcher	• Pre-clearance surveys will be undertaken by a suitably qualified ecologist prior to any proposed clearing activities, and will include: – identification and marking all hollow-bearing trees; – identification and marking any other active breeding places such as nests and burrows; – identification if suitable release sites should any fauna species need to be captured and released during clearing phase;	• During trenching activities, open trenches will be monitored daily. • Vehicle speed limits will be monitored and enforced. • Fauna spotter-catcher to monitor vegetation clearing to avoid and minimise impacts on native fauna and ensure sequential clearing is occurring.	• Any fauna injuries or deaths are required to be reported firstly to the Project Environmental Manager and then DES and/or DAWE if it involves a threatened species. The cause of injury or death will be investigated, and any required changes will be implemented. • If native fauna become trapped in a trench they will

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		– identification of presence of weed species and identify if any require treatment prior to clearing. • A suitably qualified fauna spotter-catcher will be present during all clearing activities, working under an approved Species Management Program. The fauna spotter-catcher will be responsible for checking an area immediately prior to any clearing for presence of any native fauna including identification of tree hollows, reptiles under fallen logs, and check breeding places. Any captured species will be relocated to an agreed release site. The fauna spotter-catcher will then advise construction contractors as to best practice approach to avoiding impacts on breeding places and fauna species. • All vehicles associated with construction activities will travel at slow speeds to minimise the chance of any fauna strikes occurring. Speed limit signage will be placed at the entrance to the site and other key access tracks. • Appropriate procedures for managing injured wildlife will be developed and included in the CEMP and SMP.		be released by a fauna spotter-catcher. • If native fauna are identified within the clearing area, the fauna spotter catcher will seek to capture and relocate them to appropriate habitat nearby. • Any fauna injuries or deaths are required to be reported firstly to the Project Environmental Manager and then DES and/or DAWE if it involves a threatened species. The cause of injury or death will be investigated, and any required changes will be implemented.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		• All contractors will be educated on the presence of native fauna, including threatened species, and ways in which impacts to these species can be avoided. This training will form part of mandatory inductions. • Vehicle traffic will be confined to designated roads and access tracks. • The amount of open trench will be minimised and trenches will preferably be backfilled prior to nightfall. • Escape ramps or planks and/or shelter (e.g. sawdust filled bags) for trapped fauna will be installed in open trenches.		
Noise and Vibration	• Construction Manager • Fauna spotter catcher	• No blasting to be undertaken at night. • No blasting will be undertaken within 200 m of known active breeding sites for sensitive species during breeding seasons for those species.	• Monitor noise levels during construction and determine acceptable noise limits. • Fauna spotter catcher to monitor for active breeding places of sensitive species prior to blasting.	• Where noise levels go beyond acceptable limits documented in Project approval, a record must be taken of the incident and an investigation will occur.
Light Emissions	• Construction Manager • Environmental Manager	• Construction activities will be limited to daytime hours where practicable.	• Monitor light levels during construction and	• Where light levels go beyond acceptable limits documented in Project

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		• Minimal lighting will be required around buildings at night.	determine acceptable light limits.	approval, a record must be taken of the incident and an investigation will occur.
Hazardous Materials	• Construction Manager • Environmental Manager	• A detailed Construction Environmental Management Plan (CEMP) will be prepared prior to clearing that identifies water quality risks and controls. • Construction equipment is to be maintained to minimise risk of spill or leakage. • All refuelling facilities, or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and will comply with Australian Standards (e.g. AS 1940: The storage and handling of flammable and combustible liquids). Materials will be stored within bunded areas with a storage capacity of 110% of the storage vessel. Bunding will have floors and walls lined with impermeable material. These areas must be adequately protected from rainfall and stormwater. • Refuelling should not take place within 50 m of a watercourse. • Spill control materials such as booms and absorbent materials will be maintained on site, commensurate with the types and	• Monitor water quality within water courses located downslope from vehicle storage, refuelling or chemical storage facilities. • Monitor stock of spill kits. • Monitor storage facilities for signs of leaks. • Daily weather observation checks to identify high-risk rain events.	• Where water quality levels go beyond acceptable limits documented in Project approval, a record must be taken of the incident and an investigation will occur. • Spills or leaks are to be responded to immediately, as per the Projects CEMP.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		volumes of materials in use, and in place where hazardous materials are stored or used. • No equipment or materials will be stored across water flow paths. • Personnel will receive appropriate spill clean-up training.		
Erosion and sedimentation	• Construction Manager • Environmental Manager	• A detailed CEMP including a certified Erosion and Sediment Control Plan (ESCP) will be prepared prior to clearing that identifies erosion and sediment control measures to be implemented during clearing. • The controls are to include but will not be limited to: – As a minimum standard, access tracks will be constructed in accordance with Erosion control on property roads and tracks—managing runoff (Queensland Government 2013). – Creek crossing locations will seek to take advantage of existing gaps in the riparian corridors as far as practicable. Work in creek crossings will be carried out in periods of no flow where the schedule permits.	• Daily weather observation checks to identify high-risk rain events.	• Cease works until weather passes to minimise sediment runoff.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		– Constructed access tracks (e.g. culverts or splash through crossings) must be provided with a scour apron and cut off wall on the downstream side sufficient to prevent bed erosion. • Design on site infrastructure to ensure water flows are not impounded or concentrated (e.g. culverts, diversion ditches, etc.). • Waterway crossings will be designed in accordance with development requirements for waterway barrier works to ensure fish passage is not impeded. • Watercourse crossings must be designed to maintain flow and minimise the increase in flow volume or velocity. • Avoidance of ground-disturbing activities during the three highest rainfall months of January, February and March.		
Dust	• Construction Manager • Environmental Manager	• Areas which have potential to generate airborne dust will be wetted down regularly. • Low speed limits will be implemented on site to minimise dust generation.	• Daily dust suppression. • Monitor dust levels and effectiveness of mitigation measures.	• In extremely dusty circumstances, cease works until dust suppression can be applied. • Increase frequency of mitigation measures including dust suppression.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		• Areas stripped of topsoil not required for operation will be rehabilitated as soon as practicable. • Machinery and vehicle tyres will be regularly cleaned to reduce wheel entrained dust emissions or consider use of vibration grids. • Water spraying of nearby sensitive vegetation should be considered if visible dust sedimentation is observed.		
Bushfire	• Construction Manager • Environmental Manager	• As part of the construction planning a certified Bushfire Management Plan will be prepared prior to construction and implemented during on-site activities. This is also typically a condition of a wind farm development permit in Queensland. • For "hot-work" activities, a risk assessment will be completed considering forecast weather, fire hazard ratings and site conditions. • Vehicles may not idle or be parked in areas of long grass. • Access tracks, fence lines and cleared overhead powerline easements will be maintained and used as firebreaks within the Project area and regularly maintained	• Monthly assessment of fuel loads. • During construction phase, and in the bushfire season, the fire danger status will be monitored daily through the Rural Fire Service website.	• An Emergency Response Plan will be implemented should an uncontrolled fire take place. • If fuel loads are increasing due to rainfall, review current measures and increase if required. This may be increase stocking rates or undertake cool, mosaic burn.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		during construction and operation of the Project. • Smoking is not permitted on site. • Fuel loads across the Project area will be monitored and managed through activities such as controlled grazing, cool mosaic burns and weed management.		
Weeds and pests	• Construction Manager • Environmental Manager	• A dedicated vehicle and machinery cleaning bay will be installed at the main entrance to the site. This will not be placed near a watercourse. • Hygiene checks will be conducted on all machinery or equipment being moved onto or out of the Project site to minimise distribution of weed species. • Any materials brought into site (such as gravel) will be certified as weed and disease free. • Waste disposal (especially food waste) will be removed from site regularly to discourage presence of pest fauna. When on site, waste will be stored in covered bins/skips to prevent fauna access. • Weeds will be identified during pre-clearing surveys, targeting proposed disturbance areas. Clean and dirty zones	• Record weed species during pre-clearance surveys, and confirm any large infestations required for treatment prior to clearing. • Check wash downs are occurring in an effective manner during regular audits. • Check material being brought into site such as gravel is weed and disease free.	• Increase hygiene protocol requirements if vehicles or equipment are found to introduce new weeds or because of spreading weeds. • Weed control efforts to be increased if needed. • Weed control methods to be adjusted if current techniques are not proving effective.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		should be demarcated on site to facilitate weed management. • Weed management will occur across the Project site to ensure weed cover and abundance does not increase. This will be particularly important along edges of access roads and turbine pads as disturbance and edge effects will increase weed species regeneration. Weed management will be detailed in the CEMP.		

5.2.2 Operation – Impact Mitigation and Management

Table 5.2 Operation – Impact Mitigation and Management

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
Fauna Mortality	• Environment Manager	• All vehicles associated with operations will travel at slow speeds to minimise the chance of any fauna strikes occurring. Speed limit signage will be placed at the entrance to the site and other key access tracks. • All contractors will be educated on the presence of native fauna including threatened species and need to travel slowly and look out for fauna when driving. This training will form part of mandatory inductions.	• Vehicle speed limits will be monitored and enforced.	• Any fauna injuries or deaths are required to be reported firstly to the Project Environmental Manager and then DES and/or DAWE if it involves a threatened species. The cause of injury or death will be investigated, and any required changes will be implemented.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		• Vehicle traffic will be confined to designated roads and access tracks. • Any fauna injuries (e.g. vehicle strike or during clearing activities) will be recorded in a central register by the Project Environment Manager. Injured fauna to be recorded and reported to Environmental Manager. • Appropriate procedures for managing injured wildlife will be developed and included in the EMP.		
Turbine Collision & Barotrauma	• Environment Manager	• Implement management measures detailed in the Preliminary Bird and Bat Management Plan (Attexo 2021a).	• Monitoring of fauna collisions is detailed in the Preliminary Bird and Bat Management Plan (Attexo 2021a).	• Corrective actions and triggers for fauna collisions are detailed in the Preliminary Bird and Bat Management Plan (Attexo 2021a).
Lighting	• Environment Manager	• Night lighting will be limited to aviation lighting on wind turbines (unlikely to be required) and around buildings. Project lighting will be minimised (i.e. low luminance) as far as practicable.	• Monitor light levels during operations and determine acceptable light limits.	• Where light levels go beyond acceptable limits, a record must be taken of the incident and an investigation will occur.
Erosion and Sediment	• Environment Manager	• A detailed Operational Environmental Management Plan (OEMP) will be prepared that identified erosion and sediment control during the operations phase.	• Regular checks of erosion and sediment control measures to ensure they are in working condition and EVNT fauna are not being impacted.	• Implement additional erosion and sediment control measures if existing measures are not effective in protecting EVNT species.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		• Temporary areas will be rehabilitated as soon as practicable post completion of construction to reconnect habitats. Further details to be provided in a rehabilitation plan as part of the OEMP. • Erosion and sediment control measures are to be implemented to avoid runoff impacting watercourses, water quality and fauna habitats. • Implement dust mitigation measures to ensure native vegetation and animal breeding places in areas adjacent to access roads and earthworks are not impacted by dust deposition.		• Establish further exclusion zones if EVNT species are showing signs of impact. • Dust suppression to take place where dust depositing is identified beyond acceptable levels.
Hazardous Materials	• Environmental Manager	• A detailed OEMP will be prepared prior to clearing that identifies water quality risks and controls. • Vehicles coming onto site are to be regularly serviced to minimise risk of spill or leakage. • All storage facilities for chemicals will be in appropriately designed sites and will comply with Australian Standards (e.g. AS 1940: The storage and handling of flammable and combustible liquids). Materials will be stored within bunded areas with a storage capacity of 110% of the storage vessel. Bunding will have floors and walls lined with impermeable material. These areas must be adequately protected from rainfall and stormwater. • Refuelling of vehicles should not be done on site.	• Monitor water quality within water courses located downslope from vehicle parking or chemical storage facilities. • Monitor stock of spill kits. • Monitor storage facilities for signs of leaks. • Daily weather observation checks to identify high-risk rain events.	• Where water quality levels go beyond acceptable limits documented in Project approval, a record must be taken of the incident and an investigation will occur. • Spills or leaks are to be responded to immediately, as per the Projects CEMP.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
		• Spill control materials such as booms and absorbent materials will be maintained on site, commensurate with the types and volumes of materials in use, and in place where hazardous materials are stored or used. • No equipment will be parked or stored across water flow paths. • Personnel will receive appropriate spill clean-up training.		
Weeds and Pests	• Environment Manager	• Vehicle access will be restricted to existing roads and tracks where practicable to minimise spread of weeds and damage to native vegetation. • Any materials brought into site (such as gravel) will be certified as weed and disease free. A record of all materials brought into the site and their origin will be maintained. • Any herbicides used on site must be dispensed by an appropriately trained and qualified weed sprayer. • Weed management will occur across the Project site to ensure weed cover and abundance does not increase. Particularly along edges of access roads and turbine pads as disturbance and edge effects will increase weed species regeneration.	• Record any weed infestation areas. • Wash down for each vehicle entering site from declared weed areas.	• Herbicides to be sprayed in areas of weed infestations in the Project footprint.

Impact	Responsibility	Management/mitigation measures	Monitoring	Corrective actions
Bushfire	• Environment Manager	• Continue implementation of the Bushfire Management Plan. • Vehicles may not idle or be parked in areas of long grass. • Access tracks, fence lines and cleared overhead powerline easements will be maintained and used as firebreaks within the Project area and regularly maintained during construction and operation of the Project. • Fuel loads across the Project area will be monitored and managed through activities such as controlled grazing, cool mosaic burns and weed management.	• Bi-annual assessment of fuel loads.	• An Emergency Response Plan will be implemented should an uncontrolled fire take place. • If fuel loads are increasing due to rainfall, review current measures and increase if required. This may be to increase stocking rates or to undertake cool, mosaic burns.

5.2.3 Species-specific Impact Mitigation and Management

In addition to the general mitigation measures discussed above, species-specific measures are proposed for threatened species with specific habitat requirements or risk profiles. **Table 5.3** provides details on species-specific mitigation measures will be considered for inclusion within a subsequent High Risk SMP for the Project. The specific mitigation and management approach to bird and bat species are discussed in the Project Bird and Bat Management Plan (Attexo 2021a).

Table 5.3 Species-specific Impact Mitigation and Management

Species	Mitigation and Management
Northern greater glider (*Petauroides volans minor*) and Yellow-bellied glider (*Petaurus australis*)	• Pre-clearance surveys to be undertaken in all woodlands proposed to be cleared which are identified as potential habitat for the species (refer species habitat mapping in the EAR (Attexo 2021c)) to identify the presence of suitable hollow-bearing trees which may support the species. These trees will be clearly marked, and GPS locations recorded. Pre-clearance surveys will be completed no more than 48 hours prior to clearing commencing. • Conduct staged and sequential clearing within identified species habitat. Sequential clearing will be detailed in the High Risk SMP. This will include retaining larger, hollow-bearing trees to second phase of clearing to provide opportunity for arboreal fauna to vacate the area. It will also ensure trees are retained to facilitate movement into adjacent habitats. • Trees with large hollows will be cleared using the "slow drop" technique. This technique will be detailed in the High Risk SMP. This is to minimise any likely injury to gliders residing in the hollow. • If any injured gliders are found they will be taken to a local vet/wildlife carer for treatment. • If practical during construction, micro-siting of access tracks and other infrastructure will seek to avoid large hollow-bearing trees. • Avoid the use of barbed wire fencing. • Reduce the frequency and intensity of prescribed burns. Prevent hot bushfires occurring through fuel load management. • Where large, hollow-bearing trees cannot be avoided compensatory hollows will be installed prior to vegetation clearing commencing. This may be through the salvage of natural hollows or use of nest boxes. These hollows will be placed into adjacent suitable habitats for gliders in the Project area. Final numbers to be installed and installation methods and monitoring will be detailed in the High Risk SMP. • Targeted revegetation of areas of the clearance footprint not required for operation will occur using tree species such as Blue Gum, which are likely to form hollows.
Tapping green-eyed Tree Frog (*Litoria serrata*) and	• Potential impacts of the introduction/spread of chytrid fungus on threatened amphibians within the Project area will be mitigated through the requirement for state and federal disease control protocols to be implemented throughout all phases of the project. These include:

Species	Mitigation and Management
Magnificent Brood-frog (*Pseudophryne covacevichae*)	– Hygiene protocols for the control of diseases in Australian frogs (Murray et al., 2011); and – Technical Manual: Interim hygiene protocol for handling amphibians (DEHP, 2016). • Areas with known populations of threatened amphibian species and outside of the Project footprint will be fenced off to avoid trampling. • No facilities will be placed directly up-stream of any known populations of threatened amphibian species to avoid impacts to water quality and sedimentation. • Monitoring of sedimentation and water quality will be conducted within known habitat for threatened amphibian populations as detailed within the High Risk SMP. • To assist in determining potential causes of increased sedimentation within threatened amphibian habitat, impact triggers have been established. These triggers include: – visual evidence of erosion within Project footprint; and – evidence of erosion and sediment control device failure.

6.0 Compliance

6.1 Adaptive Approach to Management

To maintain relevance and effectiveness, this FMP will require review and amendment throughout the life of the Project to ensure that measures within this document remain effective. It is recommended that this document be reviewed and updated as required, for example:

- if there is a modification of the Project schedule, design, or construction methods;
- if performance criteria are not being met and additional measures are required to minimise impact to fauna species; or
- if a legislative change or modification of best practice methods affects the currency of this document.

A compliance register will be developed to track how commitments are being achieved. This compliance register will include document tracking for all reporting required, along with how data and reporting is stored and disseminated.

6.2 Inductions and training

Informing all workers and visitors to the site of their responsibilities in contributing to the protection of the ecological values of the Project area is a key component to the effectiveness of this FMP and all associated and subsequent documents. Managers are responsible for ensuring that they understand and acknowledge the risks associated with their work activities, and the management and mitigation measures that are to be followed to avoid, minimise, and mitigate impacts as a part of their duty of care.

The activities and procedures should be incorporated into a larger package of Health, Safety, Security and Environment (HSSE) training to be administered by managers throughout the life of the Project.

At a minimum, the induction will cover the following aspects:

- Objectives of the FMP and associated environmental controls (including hygiene protocols).
- Briefing on EVNT fauna and associated habitats within the Project area.
- Individual's and organisation's environmental obligations.
- Restricted and 'no-go' areas.
- Procedures for responding to environmental incidents and emergencies.
- Responsibilities for environmental monitoring and reporting.

6.3 Incident management

An overarching incident management and reporting protocol will be defined as a part of the Projects CEMP and OEMP.

7.0 References

Attexo Pty Ltd (Attexo). (2021a), Chalumbin Bat and Bird Management Plan, Prepared for Epuron Pty Ltd.

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Heiner, I. & Grundy, M. (1994) Land resources of the Ravenshoe – Mt Garnet area north Queensland. Vol 1 – Land resource inventory. DPI, Queensland

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