



Mt Fox Energy Park

Ecological Assessment





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 - Appendix K MFEP Preliminary Koala Management Plan
 - Appendix L MFEP Preliminary Fauna Management Plan
 - Appendix M MFEP Bird and Bat Adaptive Management Plan

Executive Summary

The following report provides the results of an ecological assessment of the proposed location for construction and operation of the proposed Mt Fox Energy Park. The proposed works assessed for this report were for the construction of up to 57 wind turbines located on private property immediately south east of Mt Fox, Queensland.

4 Elements Consulting carried out extensive desktop reviews across the project site, followed by on-ground assessments to assess the characteristics and health of the project site flora and fauna, and to determine the presence of conservation significant species. Data collected were used to develop recommendations to best mitigate the impact of works on the environmental values of the proposed Mt Fox Energy Park (MFEP) project site.

Based on a 10 km radius of the project site, data from the *Nature Conservation Act* (1992) Wildlife Online database identified six (6) species of conservation significance, comprising three (3) mammal and three (3) plant species. The *Environment Protection and Biodiversity Conservation Act* Protected Matters Search Tool identified 41 threatened species. These comprised nine (9) birds, four (4) amphibians, two (2) reptile, 14 mammals and 12 plants.

Results of the on-ground field assessment recorded four (4) conservation significant fauna species within the project site. These included Northern Greater Glider (vulnerable *EPBCA*, *NCA*), Bare-rumped Sheathtail Bat (vulnerable *EPBCA*, *NCA*), Greater Large-eared Horseshoe Bat (vulnerable *EPBCA*, Endangered *NCA*) and White-throated Needletail (vulnerable *EPBCA*). Impact mitigation measures have been developed for these species which include Species Management Plans and crucial further on-ground assessment of distribution and critical resources for these species. Further survey will maximise the efficacy of Species Management Plans and mitigation measures, such as optimising micro-siting around key habitat features and the establishment of artificial dens. Additionally, the implementation of Bird and Bat Adaptive Management planning, and Pest, Fire, Weed and Fauna Habitat Management Plans are necessary to ensure the integrity of habitat is maintained across the project life. An additional seven (7) threatened flora species and nine (9) threatened fauna species including the Koala (vulnerable *EPBCA*, vulnerable *NCA*) are considered to have at least a moderate likelihood of occurrence within the project site. Pre-clearance surveys within the final detailed clearing alignment will be undertaken to confirm whether these species are present and inform targeted species management and micro-siting where appropriate. Extensive resource mapping and Spot Assessment Techniques (SATs) using detection dogs will be undertaken for the Koala to understand their distribution (if any) across the wider landscape.

A total of five (5) *EPBCA* listed migratory species were recorded within the project site and an additional eight (8) were considered at least a moderate likelihood of occurrence.. No species recorded or considered a potential

occurrence are likely to be present in large enough numbers within the project site that the project is at risk of a significant impact to these species.

On ground regional ecosystem classification identified areas on the project site are listed on the *Vegetation Management Act 1999* as Matters of State Environmental Significance (MSES). Under a presumed clearing alignment of a 15 m road width and 0.4 ha/turbine pad area the proposed clearing alignment includes the removal of 94.3 ha of remnant vegetation. This includes 39.5 ha of listed 'Of Concern' and 0.00 ha 'Endangered' vegetation within the current proposed clearing extent. Under the current clearing alignment, a single vegetation community, RE 7.5.1b, requires the removal of 8.2 ha or 1.30% of the 2017 total extent. However, it should be noted that this RE was not mapped in the project site in the v 11.1 REDD mapping (on which the 2017 remnant area statistic is based). The entire 244.9 ha of this RE mapped within the project site was mapped as a result of this survey. Therefore, it is 'additional' to the 600-ha figure. Calculating the total clearance area as a proportion of 844.9 ha current total extent the percentage proposed to be cleared is less than 1%. It is expected that once a detailed access road alignment is designed by utilising all existing internal tracks for access tracks to turbine pads, with more detailed micro-siting the clearing area can be minimalised significantly from this current figure. Given that this RE is situated within relatively flat topography, the clearing width for access roads is likely to be less than the presumed 15 m as wide road battering will not be a requirement. It is expected a detailed alignment will avoid excessive clearing of RE 7.5.1b and other "of concern" REs by utilising existing cleared access tracks and reducing road width to 10 m where avoidance is not possible. Post mitigation clearing is considered unlikely to result in a change in the *VM Act* status for any RE within the clearing alignment as a result of the proposal.

On-ground botanical assessment identified one species of conservation significance: *Corymbia leptoloma*. To satisfy the requirement of "no net loss" under the *Nature Conservation Act 1992*, mitigative measures for this species will include more intensive sampling within the proposed clearing alignment, to ascertain more accurate distributions for micro-siting, as well as seed collection and nursery propagation for potential inclusion within rehabilitation areas post construction. In addition, important populations within the project site outside of the proposed clearing alignment will be identified to assist with conservation management on the project site.

1.0 Introduction

4 Elements was commissioned by Mt Fox Energy Park Pty Ltd to undertake detailed ecological investigations associated with the construction and operation of the proposed Mt Fox Energy Park (henceforth referred to as the "project site") situated south west of Ingham in the Hinchinbrook region.

The purpose of preliminary assessments was to compile a basis of environmental information to support a Development Application for the construction and operation of the windfarm. The proposed project will consist of up to fifty-seven (57) wind turbines, a substation, battery storage, an underground cable network and associated access tracks.

Information contained in this report is intended to provide a description of the potential influences of a wind farm on the receiving environment. Consideration is given to a range of mitigation measures necessary to offset or preclude adverse environmental impacts. Other mitigation measures will be developed at later stages after regulatory approval, including a Construction Environmental Management Plan, Rehabilitation Plan, Weed Management and Pest Management Plan with additional plans being included as required. Key management and mitigation recommendations are, however, provided and discussed within relevant sections of this reporting document.

This report documents the findings of flora and fauna field surveys of the site between February and October 2020. These surveys include generic and some, more targeted, flora and fauna surveys across the project site. The results of the surveys provide a baseline of environmental information, with a representative account of the flora and vegetation, associated habitats and resident fauna of the site and immediate surrounding areas.

The aim of these investigations was to obtain a flora and fauna inventory of species present on the site and to conduct an assessment that would adequately target Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES).

1.1 Site Description

The subject site is located within the Hinchinbrook Shire Council (HSC) Local Government Area approximately 35 km south west of Ingham and near the community of Mt Fox (**Figure 1**). The project footprint encompasses approximately 3285 ha of land, comprising five (5) individually titled allotments of freehold land (**Figure 2**).

Part of the project site is zoned within the Solar Energy Development Precinct as defined by the Hinchinbrook Shire Council Planning Scheme. These include three lots located in the west of the study site directly adjoining or dissected by the state 275 kV transmission line.

The project site is zoned as "unknown" under the Agricultural Land Classification in the Hinchinbrook Shire Council Planning Scheme and consists of "high value" vegetation within the HSC Environmental Significance

Overlay. The region is locally characterised by broad-scale agricultural grazing, state forests reserves and conservation areas.

The study site is characterised by steep to gently undulating hills throughout. A small proportion of the property contains cleared non-remnant pasture used for grazing purposes. Most sections of the study site are well vegetated, ranging from small, sheltered gullies containing wet complex notophyll vine forests situated in the central north to drier open forests and woodlands over much of the remaining property. The entire project site has historically been used for cattle grazing and timber extraction purposes and continues to be utilised as a cattle grazing property by the current landowner.

Soil drainage and nutrient levels related to land zone type determine the vegetation community distribution broadly across the project site. Tall large open forest and woodlands, with large diameter hollow bearing trees, are common within the laterite soils and cluster to the west of the property. Lower open forest and closed shrubland communities dominate the granite-based soils that broadly increase towards the east of the study site.

Fifty-seven (57) turbine sites are proposed on a preliminary basis and individually they will occupy small footprints of land. All turbines are located throughout the study site within a broad mosaic of remnant vegetation communities.

1.2 Project Description

Mount Fox Energy Park is a proposed 350 Megawatt (MW) renewable energy development at Mount Fox in North Queensland. Fifty-seven (57) utility scale wind turbines (**Figure 3**) will inject clean, renewable electricity into the National Electricity Market (NEM) or 'grid' through a 275 kV Powerlink-owned transmission line that intersects the project site.

The proposed development also involves associated infrastructure including internal reticulation systems, internal access roads/laydowns areas, new substation, switch yard, battery storage and site office. The project site was chosen for its year-round strong and reliable wind conditions along the ridges of the hills located within the site. The proposed location is also particularly suitable as the project site is of sufficient size that the turbines can be easily located further than the required 1,500 m buffer from sensitive receptors.

The Mt Fox wind farm will be constructed over two stages on the project site as follows:

Stage 1 – installation of two (2) meteorological (met) masts to measure wind, temperature and pressure at the project site. Each mast is approximately 120 m to 140 m in height. The meteorological masts will be located entirely within Lot 3 on WG274.

Stage 2 – involves the installation and operation of 57 utility-scale wind turbines and associated infrastructure. The turbines are to be located on the higher ridgelines within the project site and comprise towers with a hub

height of up to 137.5 m (+/- 10m) above ground level, with a maximum rotor diameter of 185 m. The wind turbines will be located on Lot 3 on WG274, Lots 57 and 59 on SP237064 and Lot 18 on WU6.

No development is proposed on Lot 21 on WU4 as part this application; however, it has been included as balance land for possible future development associated with the wind farm. It is acknowledged that any future development on Lot 21 will require a development application to be submitted to Council or SARA depending on the proposed use.

Stage 2 as detailed above will involve the construction of the Mt Fox Energy Park over an approximate 24-month period with up to 180+ personnel involved in construction.

Worker's accommodation is to be located entirely within the pre-cleared footprint of the Fernlea Homestead. Fifty percent of the workforce is expected to stay at existing accommodation (i.e. split between existing onsite homesteads and Hidden Valley to the south), the below arrangement has been selected based on standardised units:

- ▶ 16 x 4 Bed units (64 resident workers, ensuites, 12 m x 3 m ea.)
- ▶ 2 x Kitchen blocks (60 workers/unit) to accommodate workers staying offsite (12 m x 9 m ea.)
- ▶ 1 x Recreation/laundry block (12 m x 9 m)
- ▶ 1 x Toilet block (to accommodate non-resident workers, 12 m x 9 m)

It is the intention of Mount Fox Energy Park Pty Ltd that no waste remain onsite. Works are underway to ensure that all possible waste is to be removed by a licenced local contractor, or treated onsite where immediate removal is not possible (i.e. an on-site aerobic treatment system or similar).

A detailed waste management plan is to be determined closer to contractor selection as this will be directly impacted by the final format of the accommodation, particularly the layout of pre-installed equipment and facilities. Mt Fox will operate all year round seven days per week, 52 weeks per year.

Water for construction of the wind farm will be sourced from existing groundwater supplies via a bore or similar. Two existing bores are located on the project site which may be suitable for construction purposes, with an additional two bores also required. A separate application will be made for these bores. The use of existing groundwater supplies for construction purposes will be investigated during the detailed design phase. Construction materials for the wind farm will be sourced from existing or new quarries in the area. A development application for a concrete batching plant and extractive industry (including an Environmentally Relevant Activity) will be required later when quarry investigations have been completed.

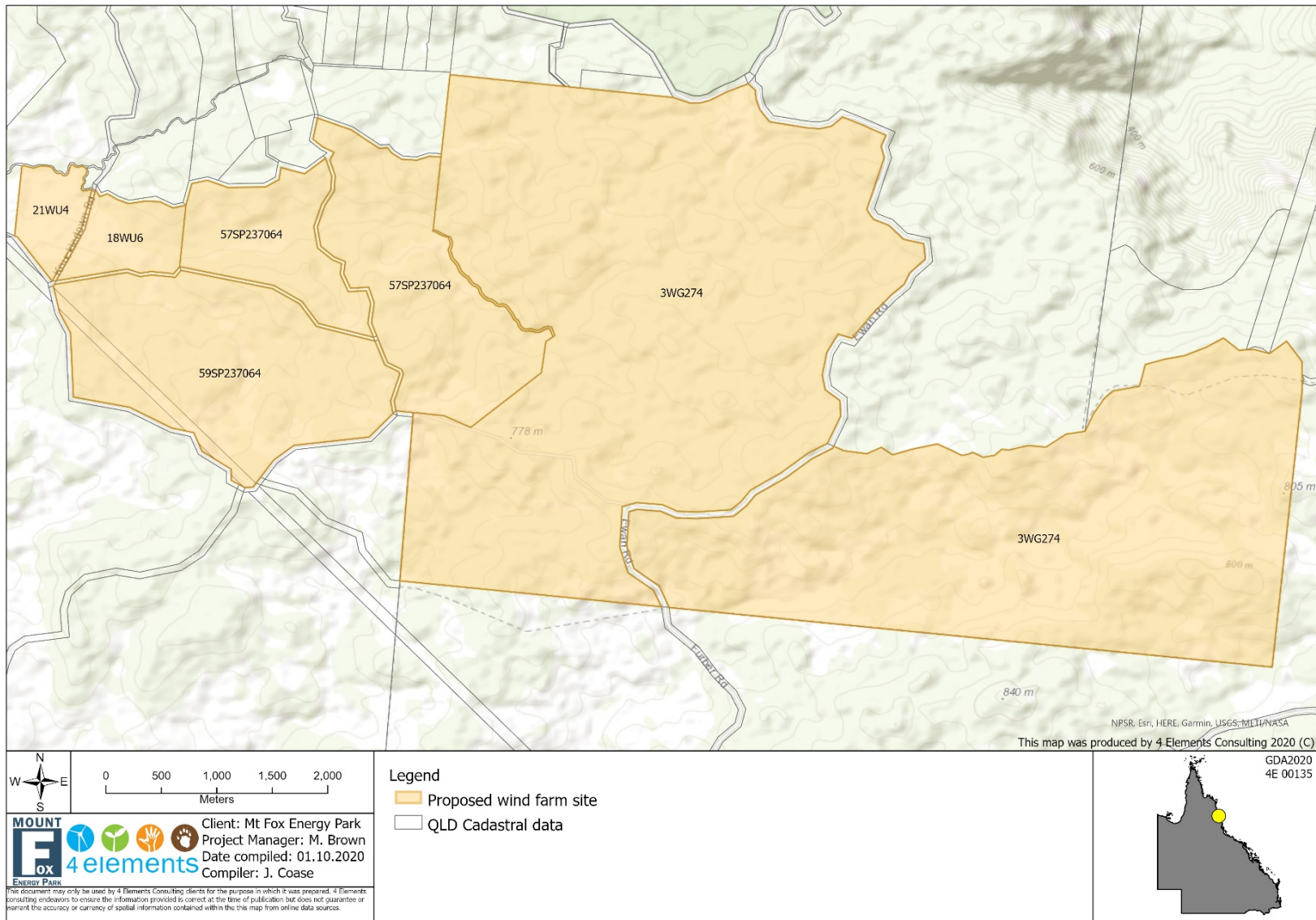


Figure 2 Individual Lots Within Project Site

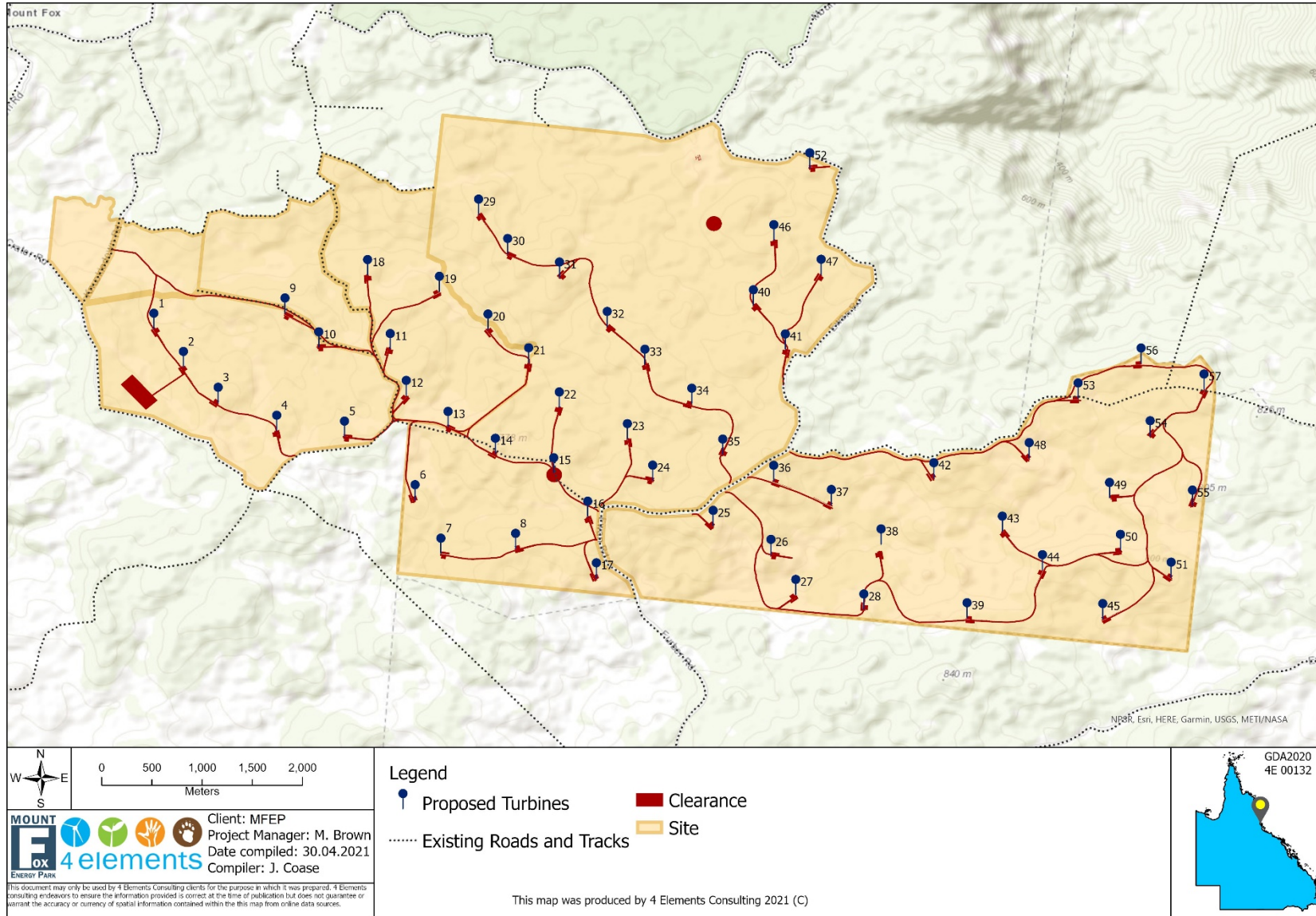


Figure 3 Proposed Wind Turbine Alignment

1.3 Scope of Works

To accurately characterise ecological features of the project site, determine presence/absence of threatened species and their key habitat requirements, wet season flora and fauna ecological surveys and bird utilisation surveys were undertaken. This report includes the assessment outcomes from February to October 2020.

The objectives of these surveys and detailed site investigations included the following:

- ▶ A review and identification of species of flora and fauna occurring or considered likely to occur on/or within the windfarm footprint;
- ▶ An assessment of the likelihood of the proposed project to have a significant impact on any threatened community, or flora and fauna species or populations listed under Queensland's *Nature Conservation Act 1992 (NCA 1992)* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)*;
- ▶ The identification of a range of recommendations to reduce potential impacts of the proposed wind farm project on local environmental values, sensitive environments, and species or populations of flora and fauna;
- ▶ Provide a robust baseline of environmental information and data to inform a range of management plans for the project including the development of specific environmental management plans, such as Threatened Species Management Plans and Weed Management Plan; and
- ▶ Assessment of severity of residual impacts following implementation of mitigation programs and plans and the need for any compensating offsets.
- ▶ Bird and Bat Utilisation Surveys as completed by Nature Advisory (2020). Refer to **Appendix A and Appendix B**.

1.4 Permits and Licensing

4 Elements undertook all ecological assessments under the following Queensland permits:

- ▶ *Scientific Purposes Permit* issued by the Department of Environment and Science (DES) for conducting research on wildlife, including plants (WISP18193117);
- ▶ *Scientific User Permit* issued by Department of Agriculture and Fisheries (DAF) for using animals for a scientific purpose (SUR000622); and
- ▶ *Animal Ethics Committee Approvals* issued by the Department of Agriculture and Fisheries (DAF) to undertake baseline ecological studies (CA2018/08/1220).

1.5 Personnel

This ecological investigation was undertaken by a team from 4 Elements Consulting: Mellissa Brown (Principal Ecologist and Project Manager), Ryan Hughes (Senior Botanist), Carly Starr (Zoologist), Matthew Hemmings (Ecologist) and Jade Coase (Ecologist). A team from Nature Advisory Pty Ltd and Greentape Solutions Pty Ltd

completed Bird and Bat Utilisation Surveys comprising of Janelle Vanderbeek (Zoologist), Rhys Sharry (Zoologist), Tom Cotter (Zoologist), Peter Lansley (Senior Zoologist) and Brett Lane (Senior Consultant and Project Manager).

1.6 Statutory Considerations

The following legislation, provided in **Table 1**, are relevant to identifying ecological values and to provide guidance for the assessment of potential project impacts and identify environmental constraints to project activities. These legislation and guidance documents have been considered in this report and the reports provided in the Appendices to this report.

Table 1 Statutory Legislation Applied to the Project and Corridors

Legislative Act	Brief Description
Commonwealth Legislation	
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	<p>The <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) provides a mechanism for assessing the environmental impact of activities and development where "Matters of National Environmental Significance" (NES) may be significantly affected.</p> <p>The Act identifies nine matters of NES, which require consideration and analysis, namely:</p> <ul style="list-style-type: none"> ▶ Ramsar wetland of international importance; ▶ World Heritage properties; ▶ National Heritage places; ▶ Commonwealth Marine areas; ▶ Great Barrier Reef Marine Park; <p>Nationally listed threatened species and ecological communities;</p> <ul style="list-style-type: none"> ▶ Nationally listed migratory species; ▶ Nuclear actions (including uranium mining); and ▶ Water resources in relation to coal seam gas and large coal mining development. <p>Where a project or action is believed to potentially cause a significant impact on a matter of NES, it is to be referred to the Australian Government Department of Agriculture, Water and the Environment (DAWE) for assessment as to whether the action is a 'controlled action' requiring Commonwealth approval for the proposed action. The EPBC Act processes also allow voluntary referral of a project to seek confirmation that a Project will not have significant impacts on matters of NES. Where an action requires Commonwealth approval, a formal assessment process is undertaken in accordance with provisions of relevant legislation.</p>
State Legislation	
<i>Vegetation Management Act 1999</i>	<p>The <i>Vegetation Management Act 1999</i> (VMA) is the planning initiative underlying regional management of vegetation in Queensland, including clearing of vegetation types, termed Regional Ecosystems (REs).</p> <p>The RE classification is a hierarchical system formed by a three-part code with the primary subdivision being bioregion, followed by land zone, and then vegetation. The biogeographic region</p>

Legislative Act	Brief Description
	<p>or bioregion is the primary level of classification for biodiversity values in Queensland describing where the RE is found on a state-wide basis. Land Zones are geological and geomorphic categories that describe the major geologies and landforms of Queensland.</p> <p>The system is based primarily on geology, with geologic age considered an important determinant. The status of REs is based on their pre-clearing and remnant extent and is gazetted under the act and listed in the RE Description Database (REDD) maintained by the Queensland Department of Resources (DR).</p> <p>The VMA aims to conserve remnant endangered and of concern REs, prevent land degradation and further loss of biodiversity, manage the environmental impacts of clearing vegetation and reduce of greenhouse emissions. The VMA status of a RE is described in line with the following:</p> <ul style="list-style-type: none"> ▶ Endangered. A RE that is prescribed under the regulation and has either of the following attributes: <ul style="list-style-type: none"> ❖ Less than 10% of its pre-clearing extent remaining; or ❖ From 10% to 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha. ▶ Of concern. A RE that is prescribed under the regulation and has either of the following attributes: <ul style="list-style-type: none"> ❖ From 10% to 30% of its pre-clearing extent remaining; or ❖ More than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha; or ▶ Least concern. A RE that is prescribed under the regulation and has more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is more than 10,000 ha; or ▶ The biodiversity status of a RE is classified by DES based on the condition of remnant vegetation. A RE will have a vegetation management status and/or a biodiversity status of endangered, of concern or least concern; or ▶ Essential Habitat. The VMA also has provision for the regulation of essential habitat for species of state significance. Essential habitat (mapped by DES) is vegetation in which a listed species has been known to occur. Clearing or disturbance to areas of essential habitat will require compensatory habitat measures to be developed. For the project development area, core habitat has been used to describe the combination of critical or essential habitat for both national or state listed significant species.
<i>Planning Act 2016</i>	<p>The Planning Act (2016) (Qld) establishes the framework for Queensland planning system. The purpose of the legislation is to establish an efficient and accountable system of land-use planning and development assessment that will lead to ecological sustainability. The Planning Act defines ecological sustainability as a balance between:</p> <ul style="list-style-type: none"> ▶ The protection of ecological processes and natural systems at local, regional, state and national levels; ▶ Economic development; and ▶ The cultural, economic, physical and social wellbeing of Queenslanders.

Legislative Act	Brief Description
	<ul style="list-style-type: none"> ▶ The Planning Regulation (2017) and the State Planning Policy (2017) are to guide local and state government in land use planning and development by defining the Queensland Government policies relating to matters of State interest.
<p><i>Nature Conservation Act 1999</i></p>	<p>The Nature Conservation Act 1992 (NCA) aims to conserve nature through strategies such as dedicating and declaring protected areas for those parts of Queensland with outstanding biological diversity, natural features and wilderness values. The NCA provides for the protection of near threatened, vulnerable and endangered animals and plants.</p> <p>Nature Conservation (Wildlife) Regulation 2006</p> <p>In support of the purpose and the provisions of the NCA, the Nature Conservation (Wildlife) Regulation 2006 lists all flora and fauna species which are considered to be 'extinct in the wild', 'endangered', 'Vulnerable', 'Near Threatened' and 'Least Concern' wildlife.</p> <p>With respect to clearing activities:</p> <ul style="list-style-type: none"> ▶ The primary purpose of the NC Act is to conserve biodiversity by creating and managing protected areas, managing and protecting native wildlife, and managing the spread of non-native wildlife. Unless authorised, it is an offence under the NC Act to take, keep, use, or move protected flora and fauna for commercial, recreational or other purposes. Where a proposed development will result in such impacts to flora and/or fauna protected under the NC Act, authorisation from DES will be required. <p>Under section 332 of the Nature Conservation (Wildlife Management) Regulation 2006, mining operations requires an approved Species Management Program (SMP) to undertake any works that will, or potentially will, disturb or interfere with a protected animal breeding place.</p> <p>s332 - Tampering with animal breeding place</p> <p>A person must not, without a reasonable excuse, tamper with an animal breeding place that is being used by a protected animal to incubate or rear the animal's offspring.</p> <p>For subsection (1), an animal breeding place is being used by a protected animal to incubate or rear the animal's offspring if -</p> <ul style="list-style-type: none"> ▶ The animal is preparing, or has prepared, the place for incubating or rearing the animal's offspring; or ▶ The animal is breeding, or is about to breed, and is physically occupying the place; or ▶ The animal and the animal's offspring are physically occupying the place, even if the occupation is only periodical; or ▶ The animal has used the place to incubate or rear the animal's offspring and is of a species generally known to return to the same place to incubate or rear offspring in each breeding season for the animal. <p>Also, subsection (1) does not apply to a person removing or otherwise tampering with the breeding place if -</p> <ul style="list-style-type: none"> ▶ The removal or tampering is part of an approved species management program for animals of the same species; or ▶ The person holds a damage mitigation permit for the animal and the permit authorises the removal or tampering.

Legislative Act	Brief Description
<p><i>Queensland Fisheries Act 1994</i></p>	<p>The <i>Fisheries Act 1994</i> (Fisheries Act) provides for the use, conservation and enhancement of the community's fisheries resources and fish habitat by providing for, amongst other things, the protection of fish habitats.</p> <p>The <i>Fisheries Act</i> has been integrated into the <i>Sustainable Planning Act 2009</i> (SP Act) so that development permits under the SP Act are required for certain operational works that are assessable development under the SP Act.</p> <p>Operation works that are assessable development under the SP Act include waterway barrier works and works in a declared fish habitat.</p>
<p><i>Biosecurity Act (2014)</i></p>	<p>The Queensland Government's <i>Biosecurity Act 2014</i> is administered by the Department of Agriculture and Fisheries (DAF). The Act provides management measures to protect agricultural and tourism industries and the environment from pests, diseases and contaminants. Under the Act, invasive plants and animals are categorised as either a 'Prohibited Matter' or a 'Restricted Matter' and replace the 'Declared' status under the Land Protection (Pest and Stock Route Management) Act 2002 which has been superseded.</p>
<p><i>Environmental Protection Act 1994</i></p>	<p>The <i>Environmental Protection Act 1994</i> (EP Act) provides the key legislative framework for environmental management and protection in Queensland.</p> <p>The EP Act utilises a number of mechanisms to achieve its objectives. Relevant to this project is the requirement for the establishment of a general environmental duty, under Section 319 of the EP Act.</p> <p>Section 319 of the EP Act places a general environmental duty on MFEP to ensure that 'it does not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm'.</p> <p>By undertaking the preparation of this detailed ecological investigation, MFEP demonstrates that it is cognisant of the responsibilities for environmental protection and management in Queensland.</p>
<p><i>Water Act 2000</i></p>	<p>The purpose of the <i>Water Act 2000</i> is to provide for the sustainable management of water and other resources. Under Section 266 of the <i>Water Act 2000</i>, a riverine protection permit is generally required from the Department of Resources to:</p> <ul style="list-style-type: none"> ▶ Destroy vegetation in a watercourse; ▶ Excavate in a watercourse; and ▶ Place fill in a watercourse. <p>Additionally, water supply for construction purposes (e.g. access track construction/ compaction, dust suppression etc) may be required. Where this water supply is proposed to be sourced from nearby watercourses, a permit in accordance with Section 237 of the <i>Water Act 2000</i> will be required from Department of Resources prior to any water being extracted from the watercourse.</p>
<p><i>Environmental Offsets Regulation 2014</i></p>	<p>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.</p> <p>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</p>

Legislative Act	Brief Description
	<p>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.</p> <p>MSES defined under the SPP and Environmental Offset Regulation 2014 include the following:</p> <ul style="list-style-type: none"> ▶ 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: <ul style="list-style-type: none"> ❖ Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems ❖ Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems ❖ Category R areas on the regulated vegetation management map ❖ areas of essential habitat on the essential habitat map for wildlife prescribed as 'endangered wildlife' or 'vulnerable wildlife' under the NC Act ❖ regional ecosystems that intersect with watercourses identified on the vegetation management watercourse map ❖ 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
<p><i>State Development Assessment Provisions – State code 23</i></p>	<p>Under State Code 23 Wind Farm Development (SDAP), wind farm development is required to ensure that impacts on flora, fauna and associated ecological processes are avoided, or minimised and mitigated, through effective siting, design and operation of the development.</p>

2.0 Overview of Methods

2.1 Desktop Review

Prior to undertaking a field investigation on the project site, an updated desktop review of relevant mapping, databases, legislation and associated plans and policies was undertaken to identify potential matters of ecological significance including species and communities, and other ecological features that may occur on or within the vicinity of the clearing footprint. This review included an assessment of the following information:

- ▶ Aerial Photograph Interpretation (API) to determine the broad categorisation of vegetation within and surrounding the site and to review the extent of historical clearing and land use, and any other significant environmental features such as watercourses and wetlands.
- ▶ Regional Ecosystems Description Database (REDD v11.1) (Department of Environment and Science 2019).
- ▶ Essential Habitat mapping and the most recent version of the DES Regulated Vegetation Management mapping including essential habitat mapping was used to provide an indication of the status and position of remnant vegetation and any mapped essential habitat in relation to landforms. Mapping is all from the QLD spatial catalogue, the essential habitat mapping dataset was accessed 17.8.2020 and RVM data was accessed 18.8.2020.
- ▶ Wildlife Online database of flora and fauna (DES 2021). This database holds records of plants and animals that have either been sighted or collected within a given radius of the site (a search parameter was prescribed limiting the search area to a 10 km radius from the centre point of the works area. The records held in this database are maintained by DES.
- ▶ HERBRECS database of plant records. This database provides confirmed records of plant collections made within a specified area, of which voucher specimens are held by the Queensland Herbarium (DES). Data from this source provides useful information on the location of rare and threatened species and expedites targeted surveys for such plants in the field.
- ▶ Protected Matters database of MNES (DAWE 2020). This database applies a range of bio-models to predict the presence of species of flora and fauna and other MNES within a given radius of the site (a search parameter was prescribed limiting the search area to a 10 km radius around the centre point to encompass the whole site as cited under the Commonwealth's *EPBC Act*).
- ▶ Review of relevant legislation and associated plans and policies, including but not limited to the QLD *NC Act*, *VM Act*, *EPBC Act*, and the *Water Act*.
- ▶ Literature review. A range of scientific papers, recovery and conservation plans, and other literature were reviewed for a number of related matters (such as targeted threatened species).
- ▶ Australian Virtual Herbarium (for voucher notes and other details in relation to flora collections).
- ▶ Digital geological mapping based on the Queensland 1:250,000 detailed surface geology layer, released in June 2018.

-
- ▶ Imagery obtained from Queensland Globe and Q Imagery.
 - ▶ Other databases containing relevant species information, including Bird data (web version of Birds Australia's New Atlas of Australian Birds) and the International Union for the Conservation of Nature (IUCN) Red List.

2.2 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 DAWE 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 site and/or suitable habitat is generally lacking from the project site.

Moderate potential to occur – the species has been recorded in the region (desktop searches), however, suitable habitat is generally lacking from the project site 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 site.

High potential to occur – the species has been recorded in the region (desktop searches) and suitable habitat is present at the project site or immediately adjacent to it.

Known/Confirmed to occur – the species has been within the project site in the recent past (i.e., last 5-10 years) and the site provides suitable habitat for it.

Refer to **Table 6** for further information.

2.3 Collision Risk Assessment

To assess the collision risk of birds/bats with wind turbines, bird/bat utilisation studies were undertaken in 2020 and are continuing. Birds/bats, including Least Concern (*NC Act*) species with a moderate to high likelihood of occurrence, or birds/bats known to occur were assessed. Refer **Section 2.4.7** and **Appendices A and B** for the Bird and Bat Utilisation survey methodologies.

2.4 Field Surveys

2.4.1 Survey Timing

The project was commissioned in February 2020 with field surveys at Mt Fox conducted between February 2020-October 2020. Initial targeted surveys were undertaken in February 2020 during intense wet weather with full field surveys commencing in March 2020. The wet season did not commence until late January in 2020 (**Section 3.0**), therefore surveys were in an optimal survey period for the site. Due to Covid19 restrictions in March 2020, surveys were subsequently stalled and then staggered with staff splitting surveys into smaller survey areas to comply with Covid WHS protocols and animal ethics considerations.

Flora field surveys were undertaken over 19 survey days between 29 March and 10 June, 2020.

Wet season fauna investigations were undertaken across the project site in February to April 2020 to assess the presence/ absence of threatened species and obtain a fauna inventory of general species on the site:

The 10-day generic survey was taken over two consecutive periods (24-28 March and 14-20 April) due to Covid 19 constraints.

Targeted bioacoustics receiver (BAR) survey were conducted from February to March 2020.

Songmeter and camera deployment continued in stages fortnightly from 2 March to 5 May period.

Bird utilisation surveys were undertaken on 31 March-2nd April 2020 and 6-9 October 2020.

2.4.2 Flora

Field surveys were undertaken over 19 survey days between 29 March and 10 June 2020. This survey aimed to recording the ecological character of the project site, and to search for conservation significant vegetation communities and species of flora. This included the following objectives:

- ▶ Establish the accuracy of the regional ecosystem (RE) mapping of 'remnant' vegetation communities, the associated description of these communities, and their landscape context, particularly in relation to the proposed alignment of the project;
- ▶ Identification of novel and important vegetation communities that could have the potential to be important wildlife refuges such as fire-proof niches, wetlands, and unique vegetation types;
- ▶ Compile a floristic checklist of vascular plants found within the project site, with specific emphasis placed on the floristic composition of representative vegetation communities affected by the predicted disturbance area of the proposed wind farm;
- ▶ Ground-truthing vegetation patterns depicted on aerial imagery, to inform the compilation of site-scale vegetation mapping;
- ▶ Record opportunistic observations of weed incursion while traversing the project site, targeting priority declared weeds; and

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- ▶ Prepare vouchered flora specimens for any endangered, vulnerable, or near-threatened species for submission to the Queensland Herbarium.

2.4.2.1 *Regional Ecosystem Characterisation Surveys*

Technical vegetation categorisation across the study site required the use of secondary level site assessments developed under the CORVEG methodology v5.0 (Neldner et al. 2019). Secondary level site assessment is used for classification and detailed descriptions of regional ecosystems and vegetation communities. This methodology includes collection of site survey location, environmental and overall structural information, flora species present and basal area of woody stems (using the Bitterlich stick method), percentage cover, and stem density measures of abundance in the shrub and canopy layers.

A total of 35 secondary level assessments were undertaken across the study site (**Figure 4**). This ensured a minimum of two representative sites per assessment of each regional ecosystem (RE). Exceptions to this were REs that occurred in a single discrete location. A single community (RE 7.12.16a) was not represented in the secondary level assessment as it is located >100 m outside of the proposed alignment.

Prior to field investigation the location of each survey site was determined based on the Regional Ecosystem Description Database (REDD) v11.1. Survey sites were then positioned in the field to a location that was considered characteristic of the target regional ecosystem. In cases where the RE was incorrectly mapped as per (REDD) v 11.1 this was verified by the secondary level assessment.

2.4.2.2 *Regional Ecosystem Verification*

Delineation of regional ecosystem distributions across the study site was achieved using quaternary level assessments, or rapid plots, as per the CORVEG methodology v5.0 (Neldner et al. 2019). These assessments are designed to capture information quickly, targeting soil and landform characteristics and key species within each vegetation structural layer. This information is generally sufficient to determine the identity of a regional ecosystem. This then allows the confirmation or alteration of regional ecosystem polygon boundaries when mapping vegetation communities across the study site. A total of 125 quaternary surveys was undertaken throughout the study site (**Figure 4**). In addition to the quaternary plots a further 25 geological visual assessments relevant to regional ecosystem classification were recorded.

In producing an RE map for the project site, the existing state government REDD map v11.1 was used as a starting point. Changes were made to line work, 1:50,000 scale, and/or RE attribution according to site observations. Where changes were made to the v11.1 map, existing fields in the dataset were updated. Where alterations were required to be made the following changes were made to the dataset:

- ▶ RH edit = indicating the polygon had been altered
- ▶ P = RE polygon altered

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- ▶ RE = regional ecosystem code was changed
 - ▶ P, RE = polygon shape and regional ecosystem altered
 - ▶ N = new polygon created

2.4.2.3 *Threatened Flora Searches*

Desktop analysis determined the potential occurrences of threatened flora within the study site listed under the Federal *Environmental Protection and Biodiversity Conservation Act 1999* and the Qld *Nature Conservation Act 1992*. Searches were undertaken in habitats relating to known ecological requirements during all site traverses undertaken in the survey period. Within suitable habitat types, random meander searches were also conducted, focusing on target species preferential habitat. Seasonal detectability was a key consideration during threatened flora searches and influenced the timing of the survey period in the late wet and early dry season. Detections of conservation significant species during site traverses were GPS located and detailed habitat descriptions recorded. It must be noted that population estimates were not within the scope of this survey.

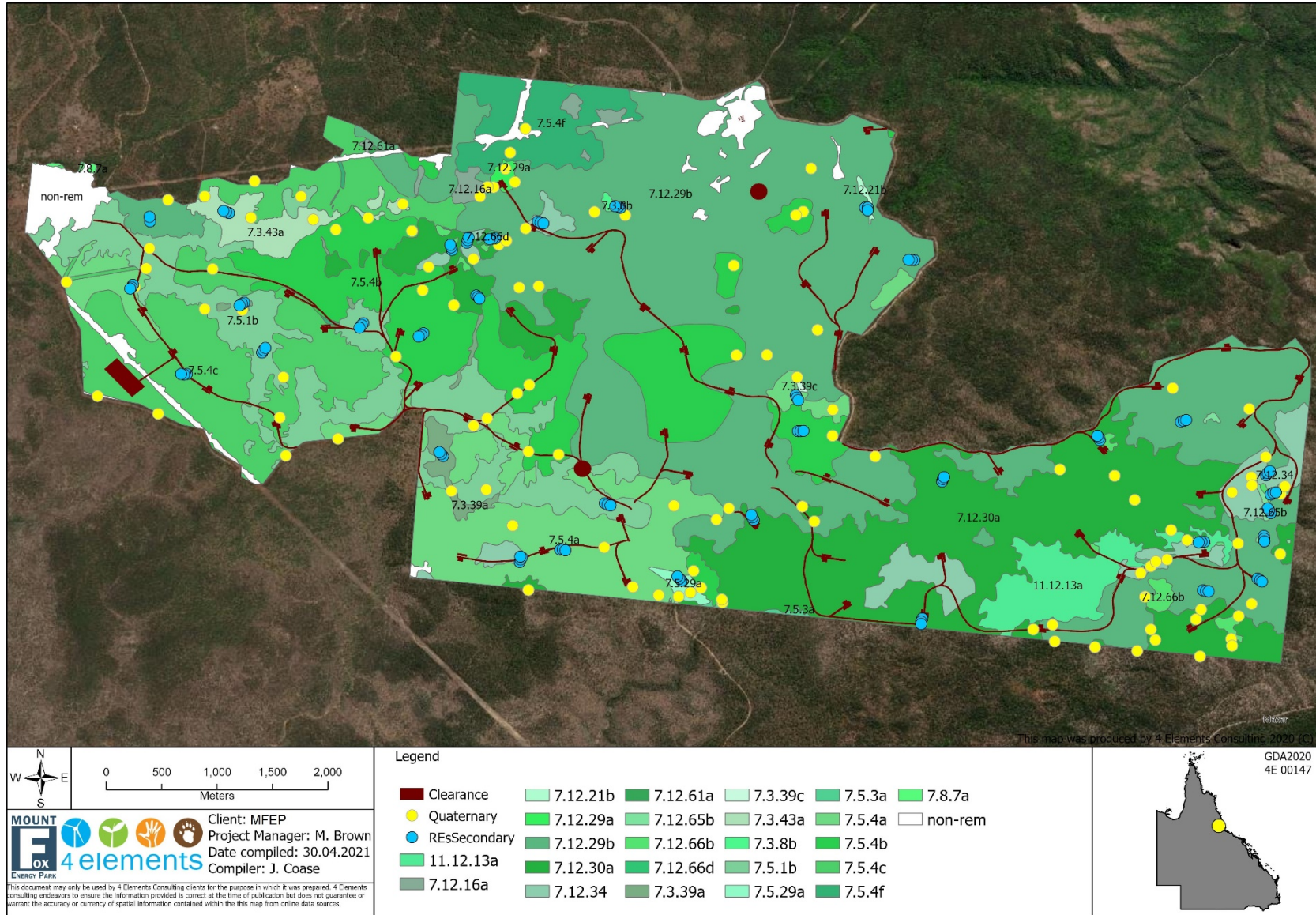


Figure 4 Secondary and Quaternary Survey Locations

2.4.2.4 *Weed Surveys*

Weeds were identified during sites traverses for flora and fauna assessments from March to June 2020. These records were GPS located with infestation size and ecological impacts noted. Any legislative requirement for management of weed species are addressed in **Section 3.0** below.

2.4.2.5 *Flora Detectability Limitations*

The detectability and ability to accurately identify plants to species level may vary greatly with the time of year, prevailing climatic conditions and the presence of reproductive material (e.g. flowers, fruit, and seed capsules). Specifically, native grass species, seasonal herbs and forbs can be difficult to identify due to seasonality and site access constraints. Consequently, the survey conducted for the project should not be regarded as conclusive evidence that certain listed threatened flora species are not present. Every effort has been made by 4 Elements Consulting to detect these species in habitats that were considered suitable.

The survey was conducted by one field team (comprising two botanists) over 19 survey days, and in total covered 145 km of field traverses, recording 308 species of plant from 252 genera and 80 families. This list is considered representative of vegetation community composition across the site and includes species recorded during site traverses from all regional ecosystems on the property. However, an exhaustive list of all flora species is beyond the scope of this project.

Conditions preceding and during the wet season survey (i.e. high rainfall and moderate temperatures) were conducive to plant growth, seeding and fruiting. The late wet/early dry season survey was, therefore, conducted at an ideal time for detecting a significant proportion of flora species.

Regional ecosystem ground truthing prioritised efforts across vegetation communities deemed most likely to be impacted as a result of the proposal. Therefore, the vine forest communities representative of RE 7.12.16a were surveyed at the quaternary level due to these communities occurring outside of the proposed alignment. It was necessary to work within the existing REDD 11.1 description framework, which did not always adequately reflect the communities observed on the ground. However, all sites did generally conform to an appropriate category.

A single threatened species was recorded during the site survey. However, an exhaustive population and distribution assessment has not been undertaken as part of the scope of these works. Once a final corridor and road clearance areas are selected, survey effort will focus on understanding the distribution, population and habitat characteristics of this population.

2.4.3 Fauna Surveys

2.4.3.1 Site Assessment

Wet season fauna investigations were undertaken across the project site from February 2020 (initial frog surveys) to May 2020 (final camera and songmeter recordings returned) to assess the presence/ absence of threatened species and obtain a fauna inventory of general species on the site. The 10-day live trapping survey was taken over two consecutive periods between 24 March - 20 April 2020 due to Covid 19 constraints (**Section 2.4.1**).

The project site was stratified on the basis of Broad Vegetation Groups (BVG) mapped at 1:2,000,000 scale. Broad vegetation groups (BVGs) are a higher-level grouping of vegetation communities derived from Queensland Herbarium's regional ecosystem mapping. A total of 10 BVGs were present within the project site; however, due to access limitations, only those BVGs that were accessible were targeted for standardised surveys (**Table 2**). These BVGs consisted of the following habitats:

- ▶ 10a-10b Dry woodland/Open forest and Moist/ Dry woodlands to open woodlands dominated by *Corymbia citriodora* (spotted gum)
- ▶ 28e Low open forest/ woodland -Open forests, woodlands and open woodlands dominated by *Corymbia clarksoniana* (grey bloodwood) or *C. novoguineensis* or *C. intermedia* (pink bloodwood) or *C. polycarpa* (long-fruited bloodwood)) frequently with *Erythrophleum chlorostachys* (red ironwood) or *Eucalyptus platyphylla* (poplar gum) predominantly on coastal sandplains and alluvia.
- ▶ 29b Shrubland- Open shrublands to open heaths on elevated rocky substrates.
- ▶ 34f-Sedgeland/grassland/Palustrine- Wetland Palustrine wetlands. Sedgelands/grasslands on seeps and soaks on wet peaks, and other coastal non-floodplain features.
- ▶ 6b -Rainforest- Simple evergreen notophyll vine forests to simple microphyll vine fern thickets on high peaks and plateaus of northern Queensland.
- ▶ 8a Wet Sclerophyll forest- Wet tall open forests dominated by species such as *Eucalyptus grandis* (flooded gum) or *E. saligna*, *E. resinifera* (red mahogany), *Lophostemon confertus* (brush box), *Syncarpia spp.* (turpentine), *E. laevopinea* (silvertop stringybark).
- ▶ 9c-e Open Forest-Open forests of *Corymbia clarksoniana* (grey bloodwood) or *C. intermedia* (pink bloodwood) or *C. novoguineensis*, *C. tessellaris* (carbeen) ± *Eucalyptus tereticornis* (blue gum) predominantly on coastal ranges. Other frequent tree species include *Eucalyptus drepanophylla* (grey ironbark), *E. pellita* (large-fruited red mahogany), *E. brassiana* (Cape York red gum) and *Lophostemon suaveolens* (swamp box)
- ▶ Non remnant
- ▶ Large BVG's were replicated twice, with a total of 13 sites surveyed (**Figure 5**). The various specific generic survey methods used at each of the survey sites are described below.

2.4.3.2 Generic Fauna Surveys

Generic fauna surveys were undertaken in general accordance with the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* developed by the Department of Science, Information Technology, Innovation and the Arts (Eyre et al. 2018) with the aim of characterising the faunal values of the project site, rather than to provide a comprehensive survey of all fauna that has the potential to occur on the site over time. These guidelines have been approved by the Federal Department of Agriculture, Water and Environment (DAWE).

Fauna surveys were carried out using 100 x 100 m (1 hectare) plots, spaced at least 1 km apart where possible, for sampling independence (to ensure the same animal was not counted in more than one site). Ten (10) standardised plots were established and each plot was operational for four consecutive nights during the survey period. Plots consisted of:

- ▶ 20 'Type A' (330 x 100 x 90 mm) Elliot traps, placed along two parallel transects (50 m apart), with each trap placed 10 m apart. Traps were opened in the late afternoon and checked within 2 hours of sunrise each morning. Traps were baited with a standard bait mix of flour, honey, vanilla essence and peanut butter, and 2 small dog biscuits;
- ▶ Eight funnel traps were located along a T section pitfall fence as per live trapping guidelines. These were located in pairs, commencing 2 m from one end of the drift fence. Traps were checked 2-3 times per day, with the first check occurring within 2 hours of sunrise;
- ▶ Two cage traps, set within the plot at the start and end of the 100 m centre line of the plot. Each trap was baited with plum jam and luncheon meat sandwich. Traps were checked and closed within 2 hours of sunrise and opened again in the late afternoon;
- ▶ Two Reconyx Hyperfire camera traps were set 50 m apart along the centre line of each plot. Camera traps were strapped to trees in horizontal orientation and baited with the standard mammal bait used for Elliott traps which was secured in a PVC ventilation cowl;
- ▶ One SM4BAT FS song meters (Wildlife Acoustics) was placed in the centre of each site, including non-remnant areas, to determine presence and species composition of bats within and surrounding the Project Site. The songmeters were programmed to turn on automatically at 6 pm each evening and record for a 12 hour period.
- ▶ Two transects were established (sites 1 and 2) through difficult to access BVG's by hiking for 2 hours and traversing the site for habitat features, conducting a diurnal survey, bird survey and general vegetation survey.

Total survey effort across February 2020 wet season generic and targeted surveys to May 2020 (trap nights) employed within each habitat type is presented in **Table 2** below.

Table 2 Survey Effort on the Project Site

Habitat Type (BVG)	No. Sites	Survey Effort (No. of Trap Nights)				
		Pitfall	Funnel	Elliot	Cage	Motion Camera Detection
10a-Dry woodland/Open forest	0	0	0	0	0	0
10b (Moist Open forest/woodland)	2	32	64	160	16	112
28e Low open forest/ woodland#	0					
29b Shrubland	0	0	0	0	0	0
34f-Sedgeland/grassland/Palustrine Wetland #	0	0	0	0	0	0
6b -Rainforest	1	16	32	80	8	56
8a Wet Sclerophyll forest	0	0	0	0	0	0
9c Open Forest	3	48	96	240	24	168
9d Open Forest	1	16	32	80	8	56
9e Open forest	3	48	96	240	24	168
Non remnant	0	0	0	0	0	0
Total	10	160	320	800	80	560

Additional Fauna Surveys	No. of trap nights
Song meter	162
Additional Motion Detection Cameras	84

Walking transects completed in small, remote locations (3) Camera (1) additional.

2.4.4 Fauna Survey Limitations

All surveys are subject to inherent limitations in the detection success of some species. These limitations often result in a degree of false-negative records (i.e. a species is present, but not detected). It is important, therefore, that survey limitations are identified and the survey results are viewed with these constraints in mind and may have included the following:

- ▶ The survey period not coinciding with the period that some migratory or nomadic species occur in the locality.
- ▶ Species with large home ranges (e.g. owls and raptors) may not be present in this part of their home range during the survey period;

-
- ▶ The difficulty in detecting certain species during the survey period (e.g. cryptic species, species present across the site at very low densities, and trap-shy species); and
 - ▶ Biological factors such as sex, age-class, and breeding biology, which may influence species' habitat use and detectability during different times of the year.

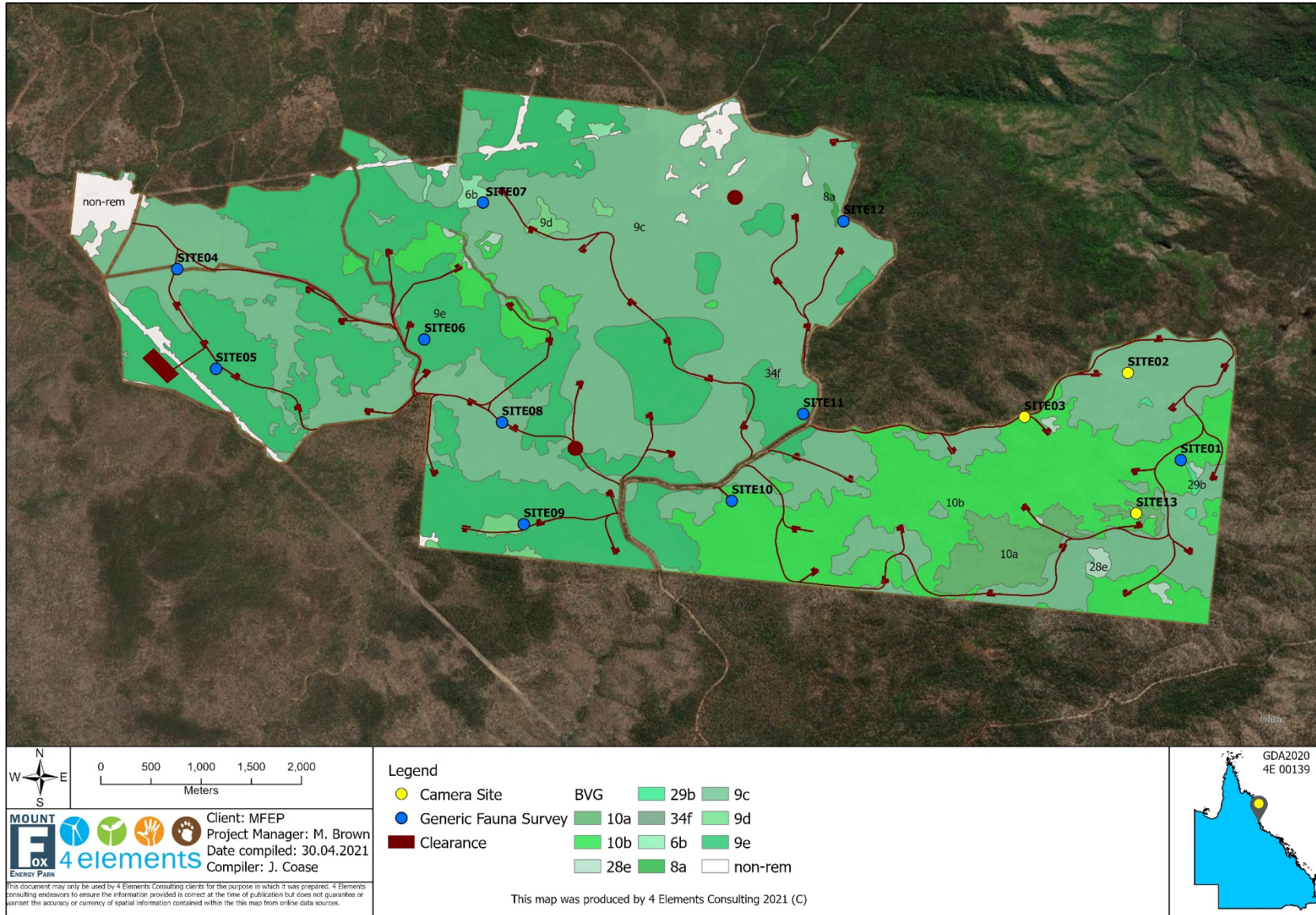


Figure 5 Location of Generic Fauna Survey Point

2.4.5 Diurnal and Nocturnal Active Searches

Diurnal and nocturnal active searches were undertaken within each of the standardised fauna survey sites and at other locations within the Project Site. Active searches consisted of:

Diurnal searches for sheltering or basking reptiles;

Searches for cryptic fauna by turning over logs and rubbish piles, disturbing woodpiles, lifting loose bark on trees, investigating hollow logs and disturbing leaf litter;

Searches for tracks, scats, animal remains, scratch marks, nests/burrows, movement pathways, feeding signs and any other traces of animal presence;

Approximately five person-hours active searching was undertaken within each habitat type, including non-remnant areas, during the generic fauna survey.

2.4.5.1 *Nocturnal Active Searching*

Nocturnal active searching was undertaken at each of the standardised fauna survey sites (**Figure 5**). Surveys involved actively searching for nocturnally active mammals, birds, frogs and reptiles and listening for fauna vocalisations for a period of 45-person minutes at a time (i.e. 3 people searching for 15 minutes).

2.4.5.2 *Vehicle Based Spotlighting*

Spotlighting searches along tracks and roads within suitable habitat across the Project Site commenced after dusk and involved searching potential habitat from a slowly moving vehicle or on foot for 1-2 hours.

Approximately 40 person hours spotlighting was undertaken within and surrounding the Project during the generic fauna survey.

2.4.5.3 *Nocturnal Call Playback*

Nocturnal call playback sessions were undertaken within eight of the ten habitat types. The call playback targeted those threatened species identified during the desktop assessment as having the potential to occur on the project site and that for which this survey method was suitable, namely the northern sub-species of the Masked Owl.

Each call playback session began with five minutes listening period, followed by broadcasting the pre-recorded calls of the target species. Calls were played for approximately three minutes, followed by a two-minute listening period. Approximately 2 hours call-playback were undertaken within and surrounding the Project site during the generic fauna survey.

2.4.6 Opportunist Records

During the survey period, all opportunistic fauna records were recorded.

2.4.7 Targeted Bird Utilisation Survey

The method used for the bird utilisation survey by Nature Advisory (**Appendix A**) was based on the standards for assessing the risks to birds from wind farms in Australia, outlined in the “Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia” (Clean Energy Council, 2018). The bird utilisation survey (BUS) is the most commonly used method for generating quantitative data on bird use of a potential wind farm site. This can be used to provide a ranked abundance of species use of the site at varying heights, including turbine rotor swept area (RSA) height. The method provides the following information.

- ▶ Bird species (diversity) utilising the wind farm site;
- ▶ The relative frequency of activity and density of birds on site;
- ▶ Flight patterns and heights in relation to wind turbine heights;
- ▶ The broad distribution of bird species across the wind farm site.

Two (2) targeted bird utilisation surveys were undertaken by two (2) experienced zoologists. One survey was undertaken in the wet season, 31 March to 2 April 2020, and the second was undertaken in the dry season, 6-9 October 2020. These survey time periods were intentionally designed to account for differing rates of utilisation within the project site relating to migration and seasonal nomadism.

The fixed-point bird count method involved an observer stationed at a survey point for 15 minutes, during which time all birds observed within 200 metres radius were recorded. Seven impact sites and two reference points were surveyed (see **Figure 6**).

The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation surveys was investigated in an earlier study at another wind farm site (Nature Advisory Pty Ltd, unpublished data). This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes used in the formal bird utilisation surveys was considered adequate to generate representative data on the bird species in the area during the survey.

During this period, all bird species and numbers of individual birds observed within 200 metres of the survey point were recorded. The species, the number of birds and the height of the bird when first observed were documented. For species of concern (threatened species, waterbirds and raptors), the minimum and maximum heights were also recorded.

Flight height is presented as below, at or above rotor swept area height (RSA height) indicated below.

- ▶ A = Below RSA (< 40 metres above ground)

- ▶ B = At RSA (40 – 190 metres above ground)
- ▶ C = Above RSA (> 190 metres above ground)

Table 3 indicates when each point was counted on each survey day. This schedule ensured that all points were visited equally at separate times of day to allow for time-of day differences in bird movements and activity. Every survey point (impact and reference) was visited eight times over the survey period.

Table 3 Time schedule for fixed-point counts at Mt Fox (both survey periods example)

(a) Observer 1

Date	0730-0945	0945-1200	1200-1500	1500-1800
31 March 2020	1 2 3	4 5 6	7 R1 R2	1 2 3
1 April 2020	4 5 6	7 R1 R2	1 2 3	4 5 6
2 April 2020	7 R1 R2	1 2 3	4 5 6	7 R1 R2

(b) Observer 2

Date	0730-0945	0945-1200	1200-1500	1500-1800
31 March 2020	7 R1 R2	1 2 3	4 5 6	7 R1 R2
1 April 2020	1 2 3	4 5 6	7 R1 R2	1 2 3
2 April 2020	4 5 6	7 R1 R2	1 2 3	4 5 6

Species of concern (threatened species, raptors and water birds) were recorded out to a distance of up to 2 km where possible (large species such as Wedge-tailed Eagle, Pelican and Ibis can be identified at this range). Records beyond 200 metres from survey points were not used in the BUS however but provided information on such species using the wind farm site.

Over the survey period, nine fixed survey points were established: seven impact points and two reference points. Impact points were located near proposed turbine locations and reference points were located at least 500 metres away from impact points in areas of similar habitat outside the wind farm footprint. The survey points were distributed as evenly as possible (subject to access constraints) across the wind farm to maximise coverage in areas where wind turbines are likely to be sited (**Figure 6**). Impact points were positioned as far as possible on elevated ground, allowing a clear view in all directions.

2.4.8 Bird Assemblage Survey

Bird surveys were also encapsulated as a part the generic fauna survey. Four (4) diurnal bird surveys were carried out at each survey plot by two ecologists with binoculars (10 x 42 magnification) who walked through the plot quietly for 10-minute intervals and recorded all observed/heard bird species. The ecologists walked a different path through the plot on each observation. Samples were taken at different times on each day, as recommended by Perry *et al.* 2012 to maximise the estimate of species richness. At least two (2) of these periods occurred within two (2) hours of sunrise and mid-morning (2-4 hours after sunrise), with the remaining periods randomly selected throughout the day.

2.4.9 Magnificent Broodfrog Surveys

The Magnificent Broodfrog (*Pseudophryne covacevichae*) is a myobatrachid frog which was first described in 1994 (Ingram and Corban 1994). It is listed as Vulnerable nationally within the *Environment Protection and Biodiversity Conservation Act 1999*. In Queensland, the status of this species is Vulnerable under the *Nature Conservation Act 1994*. Until recently, the species was only known from 5 disjunct populations near Ravenshoe and Herberton, North Queensland (Dennis and McDonald 2012), over an area of 27 x 9 km (McDonald et al. 2000). In 2015, an additional population was discovered 160 km south-southeast on the Paluma Range, warranting further surveys which may increase their distribution (Zozaya and Hoskin 2013).

The Magnificent Broodfrog occurs in sites exceeding 800 m elevation, and breeding occurs from October to March where males call from seepage areas and first-order streams in open eucalypt woodlands, usually after rainfall (McDonald et al. 2000, Dennis and McDonald 2012, Antis 2013). Woodlands where populations are known have grassy understoreys and are on acid volcanic and granitic substrates (McDonald et al. 2000). Eggs are deposited under vegetation, or in nests with the males tending to the eggs until they hatch. Larvae are then washed into pools to complete the aquatic tadpole phase of their lifecycle (McDonald, Bolitho et al. 2000). Their call is a short "ark" (McDonald et al. 2000). A number of suitable habitats were located within the project site which required survey within a short window of opportunity due to prevailing heavy monsoon conditions.

2.4.9.1 Bio-acoustic Audio Recorders (BARs)

Given the scale of the area required to be investigated and the importance of reducing the risk of false positive or negative detections, a novel methodology of surveying the Magnificent Broodfrog was undertaken for this study following field trials conducted in 2019 by 4 Elements Consulting which identified success with this method. Bio-acoustic Audio Recorders (BARs) were used as a replacement for more conventional acoustic transects previously conducted by field ecologists to locate the species. The BAR is a professional grade audio recording device designed by Frontier Labs to produce high quality, quantitative evidence of detection of a given target species. Prior acoustic footprint studies of a known population in Ravenshoe identified a conservative 50 m footprint distance for this species. 4 Elements Consulting have also carried out a duty cycle

assessment which identified a 1-minute sample collected each hour of the night was an acceptable sampling effort.

The Magnificent Broodfrog is known to reliably vocalise after heavy rain at the commencement of the wet season persisting until late March (Dennis and McDonald 2012). Within the Bluff State Forest, ecologists have recorded vocalising and egg guarding at a single breeding site by males up to 24 May, 2018. To reduce the likelihood of a false negative detection, all BARs were deployed during the most likely active vocalisation period on the project site. All BAR devices were deployed at sites between 5 February and 26 March, 2020. All BAR devices were deployed at each location for a minimum of seven (7) consecutive nights, equating to a minimum of 84 minutes of sampling across 84 field hours at each sample site.

Bio Acoustic Recorders (BARs) were deployed at first order drainage lines within areas of granitic and rhyolitic soil along suitable habitat in the study site. Deployment occurred across 15 sites deemed to be suitable habitat for the species (**Figure 6**). These were placed 100 m apart as per prior footprint trial study findings (4 Elements 2019) at the Bluff State Forest Ravenshoe. At each BAR deployment site, a detailed habitat investigation was undertaken to provide further detail on the habitat requirements for this species.

2.4.9.2 Habitat Descriptions

At each BAR deployment point a 50 m transect (25 m upstream and 25 m downstream) was walked recording structural and floristic characteristics as per the predictors outlined in the species recovery plan (McDonald et al. 2000). The stream width was categorised within either 0.5-1.5 m or >1.5 m. Dominant tree, shrub and ground layer species were recorded to determine the regional ecosystem category. Microhabitat features recorded were: availability of temporary pools; seepage areas; tussock grass structures; coarse woody debris entanglements; and leaf litter (McDonald, Bolitho et al. 2000). Signs of cattle grazing were recorded when it was identified to be at a point where vegetation structure and/or stream bank was altered reducing the likelihood of suitable microhabitat.

2.4.9.3 Survey Limitations

We assume in our study sites that the vocalisation footprint from Ravenshoe is representative of all deployment sites assessed in this study. The acoustic footprint was estimated to be 50 m on each side of a focal calling male (100 m span). This assumes that the footprint is indicative of any calling male, in any of the sites sampled. Varying environmental conditions are likely to impact the call footprint, however detailed habitat descriptions that were undertaken at each BAR deployment site identified all sites were relatively similar in structure with a small creek dissecting a rocky granite and grassy ground layer within low open woodland to open forest. The best effort to mitigate the risk of inflating the acoustic footprint as a result of either differences in male calls, or environmental variables was to use a more conservative distance of 50 m rather than the 60 m distance (the maximum detectable acoustic footprint).

BARs were deployed within a single breeding season from 5 February to 26 March 2020. This survey period is consistent with the data published in the Commonwealth Recovery Plan (McDonald et al 2000) and site-specific data collected by 4 Elements in the previous year's surveys.

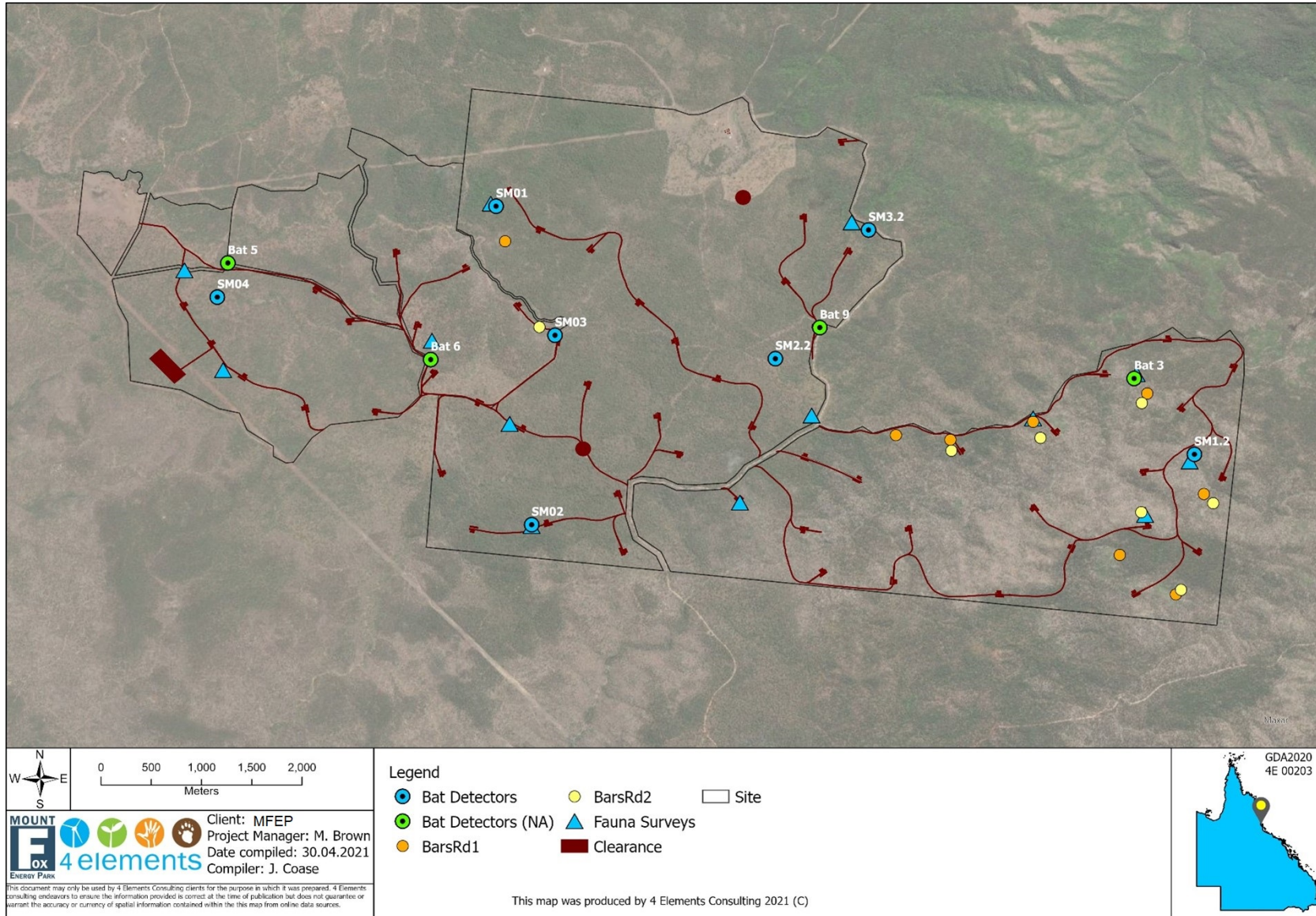


Figure 6 BAR and Bat Detection Deployment Locations

2.4.10 Microbat Surveys

Microbat surveys were conducted with the use of ultrasonic acoustic recorders across the Mount Fox project site (**Figure 6**). This method was conducted in accordance with generic fauna survey guidelines (Eyre, Ferguson et al. 2018) which enabled an analysis of microbat species richness and for the identification of the four potentially occurring threatened microbat species within the site. The potentially occurring threatened microbat species are:

- ▶ Bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudicluniatus*, V- EPBCA, E- NCA);
- ▶ Semon's leaf-nosed bat (*Hipposideros semoni*, V-EPBCA, E-NCA)
- ▶ Greater large-eared horseshoe bat (*Rhinolophus robertsi*, V-EPBCA, V-NCA)
- ▶ Ghost Bat (*Macroderma gigas*, V-EPBCA, E-NCA)

2.4.10.1 Species Overview

The Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus*) is a small, insectivorous bat which occurs in tropical woodlands and tall open forests from Bowen to Iron Range in North Queensland (Hall, Thomson *et al.* 2008, Dennis 2012). This species roosts in groups (4 to 40 individuals) in hollows of a number of eucalypt species, generally preferring those with high rainfall along coastal areas (Churchill 2008, Dennis 2012). Confirmed roosting and maternity sites are from long, deep hollows in poplar gum *Eucalyptus platyphylla*, and stringybark *Eucalyptus tetradonta* (Schulz and Thomson 2007). Based on only a few observations, females in Queensland appear to give birth to a single young in December-January each year (Dennis 2012). Threatening processes to the species are generally unknown, due to the limited data available, however it is likely to be clearing and increased competition for hollows (Duncan, Baker et al. 1999, Schulz and Thomson 2007, Dennis 2012). This species is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* and Endangered in Queensland under the *Nature Conservation Act 1992*.

The Ghost bat (*Macroderma gigas*) is the largest microchiropteran native to Australia, distributed throughout both tropical and subtropical Australia. This species utilises a range of habitats, with permanent and breeding roosting sites located within deep cave systems. There are only 14 currently identified maternity colonies across the country (Worthington-Wilmer 2012, Committee 2016). Single pups are born between September and November, and juveniles hunt with their mothers until they gain full independence. During the wet season its diet consists primarily of grasshoppers and beetles, incorporating small vertebrates into its diet (frogs, lizards, birds and small mammals including other bat species) during the drier months (Tidemann, Priddel et al. 1985). There have been large historical contractions of this species and they are highly vulnerable to human impacts, primarily quarrying and the revival of disused and abandoned mines (Worthington-Wilmer 2012). This species is listed as Endangered in Queensland (*Nature Conservation Act 1992*) and Vulnerable nationally (*Environment Protection and Biodiversity Conservation Act 1999*).

Semon's Leaf-nosed Bat (*Hipposideros semoni*) is a small insectivorous bat identified by its square-shaped noseleaf that covers most of its muzzle. The species is distributed in north-eastern Australia, between Cape York Peninsula and Townsville and occurs mainly in rainforests and stream-side and river vegetation, however also occurs in sclerophyll forests and savannah woodlands. Roosting sites take the form of tree hollows, caves, and abandoned buildings. The female gives birth to single young in November. Threatening processes for this species are broad and include the destruction of roosting sites (such as clearing old growth trees) and general habitat loss due to land clearing and pastoralism. Increased fire extent and intensity can also impact this species.

Greater large-eared Horseshoe Bat (*Rhinolophus robertsi*) is identified from other *Rhinolophus* species by its extremely large ears and large nose-leaf on its muzzle. This bat is distributed from the tip of Cape York to as far south as the Townsville region. Habitat type for this species appears to be broad, ranging from rainforests to open eucalypt forests and woodlands. Roosting sites include tree hollows, vegetation, and open areas such as under creek banks, rock piles and road culverts. Females give birth to single young in October/ November.

2.4.10.2 Echolocation Surveys

Microbats echolocate in order to navigate their surroundings for general movements and for feeding. Most microbats in Australia echolocate at a much higher frequency than typical human hearing and are thus inaudible. These echolocation calls can however be recorded with ultrasonic bat detectors and then analysed later to identify species.

Field investigations included:

- ▶ Deployment of SM4BAT FS song meters (Wildlife Acoustics) Bat detectors at ten fauna survey locations (5 nights per sample) over two surveys (**Figure 6**) in the wet season (24-28 March and 14-20 April);
- ▶ Additional deployment of 4 rotating SM4BAT FS song meters (Wildlife Acoustics) Bat detectors between 29 March -5 May 2020, (14 nights per sample at each habitat/corridor) in order to provide a more adequate sampling coverage of the project site.
- ▶ Nature Advisory deployments of Anabat Swift recorders at 4 sites (**Figure 6**) on the nights of 30 March – 2nd April 2020 and 5-8 October 2020 (4 nights per sample).

Each Songmeter/Anabat unit was securely fastened to the trunk of a tree and a SMM-U1 Ultrasonic Microphone was attached to the Songmeter/Anabat unit via a two-metre-long cable. The ultrasonic microphone was then attached approximately two metres up the tree to record a higher number of quality bat calls. Each detector was set to record high frequency sounds emitted by the echolocation of microbats between 6 pm and 6 am (when microbats become active). Songmeters were strategically placed in areas where flyways were present and in areas of different broad vegetation groups, to maximize the sampling of species variation and activity across the site. Echolocation calls were analysed using Anabat Insight software in both zero crossing and full

spectrum format. Call identification was conducted using call keys and descriptions published for Queensland (Reinhold, 2001) and the Northern Territory (PWCNT, 2002). Identification was further refined by assessing the geographic distribution and preferred habitat of each species of bat as described in Churchill (2008). Bat call expert Greg Ford at *Balance Environmental* provided a peer review of the bat calls and analysis.

2.4.11 Northern Greater Glider (*Petauroides volans minor*)

The Northern Greater Glider (*Petauroides volans*) is the largest of the gliding possums, living in a variety of eucalyptus dominated forests (Van Dyck and Strahan 2008). The species is more abundant in higher altitude forests, preferring areas with highly fertile soils (Braithwaite, Binns et al. 1988, Menkhorst 1995). Densities of this species are recorded as 0.6 – 4 individuals per ha from survey data (Menkhorst 1995). Greater gliders are a hollow dependant species, which is reasonably sedentary due to their folivorous diet. Due to their dependency on hollows, they require mature forests for denning (Menkhorst 1995). Males and females have reasonably small home ranges, which overlap and are known to be between 1 and 11.5 ha (Smith, Mathieson et al. 2007).

The presence of Forest Blue Gum (*Eucalyptus tereticornis*) and Lemon-scented Gum (*Corymbia citriodora*) were identified as part of a modelling study from over 500 sites to be an important resource for this species, as well as hollow-bearing trees in Southern Queensland (Eyre 2006). A tracking study undertaken by 4 Elements (2019) showed a clear correlation of utilising large diameter *Eucalyptus tereticornis* and *Eucalyptus grandis* trees growing within fertile basalt and alluvial derived soils. A key food tree was found to be *Corymbia intermedia* when growing in fertile soils.

Abundance is positively correlated in this species by increasing the basal area of *C. citriodora* and *E. tereticornis*, which are selected for denning, rather than foraging. These species only form hollows once they are large (>80cm diameter breast height (DBH)) (Eyre 2005), therefore forests with higher basal area of *C. citriodora* and *E. tereticornis* are likely to contain a higher proportion of large, hollow bearing den trees (Eyre 2006). Where basal area of species such as Iron Barks (e.g. *Eucalyptus crebra*) and Grey Box (*Eucalyptus moluccana*) are high, this strongly interacted in Southern Queensland with lower abundance/absence of Greater Gliders (Eyre 2006). This may be due to lower foliar nutrients found in these species (Recher, Major *et al.* 1996), and both form hollows at extremely slow rates (Eyre 2005).

It is predicted similar trends will be identified within the project site, where glider abundance is higher relative to availability of dens within fertile soils; and where the basal area of suitable denning trees (e.g. *E. tereticornis*) is above 1 m diameter at breast height. Understanding this balance within the vegetation communities within the turbine alignment will enable informed best practice management recommendations for local Greater glider populations.

Survey efforts were preliminary for the Northern Greater Glider to date. The records of this species have largely been restricted to those obtained in opportunistic sightings during both diurnal and nocturnal site traverses during other targeted surveys.

To gain a better understanding of the population and distribution of the species on site, and to determine the extent of favourable habitat further surveys have commenced. Spotlighting surveys undertaken along transects through favourable habitat are the most effective strategy and these locations are being resurveyed over continuing nights. Diurnal surveys to determine the extent of feed trees and major den trees if located along the alignment will be mapped. This data will then inform an alignment that can mitigate clearing impacts.

2.5 Taxonomy and Nomenclature

Nomenclature and taxonomy of flora and fauna species generally follows that of the Australian Government Department of Agriculture, Water and the Environment (DAWE) and the Queensland Museum. A range of references were used to assist with the field identification and or confirmation of a particular species.

2.6 Data Analysis Methods

2.6.1 GIS Analysis

Spatial data collected during the field survey was imported into ArcView GIS (Version 10.1) to be analysed with the data obtained from the desktop assessment. Vegetation community and habitat boundaries were refined using the collected spatial data and general observation made during the assessments. The ground-truthed extent of vegetation communities and habitat types, including associated satellite imagery and listed ecological communities were then mapped in GIS.

2.6.2 Bat Call Analysis

Analysis of all bat calls collected during the survey period was undertaken by 4 Elements Consulting. Calls that were difficult to identify were given to a microbat call specialist (Greg Ford at Balance Environmental) for further analysis. Call identification was based on comparisons with published call descriptions and with reference calls collected. All of the collected calls were analysed using Anabat Insight software. The format and content of the analysis summary reports complies with nationally accepted standards for the interpretation and reporting of songmeter data (Reardon 2003, Reardon 2009).

3.0 Review of Alignment

The proposed wind turbine layout used as the basis for the environmental assessment of the Proposal comprised 57 WTG's identified in **Figure 3**. The development disturbance footprint was 131ha, based upon 1.1ha construction hardstands and 20-metre-wide access roads required for construction (old alignment). The operational footprint of the project encompassed 102ha. Modifications to this layout were undertaken after consultation with DSGILGP, DAWE, DR and SARA. In developing this layout a number of factors were taken into consideration including:

- ▶ ecological impact to remnant vegetation and habitat for the Vulnerable Koala
- ▶ ecological Impact on Vulnerable *Corymbia leptoloma* population
- ▶ creek crossing and siting of towers to avoid where potential impact to waterways may occur;
- ▶ project site extent, comprising the cadastral boundaries of the involved landowners;
- ▶ turbine spacing;

Total disturbance footprint has been refined to **94.3 ha** with 94.1ha being remnant (Of concern 39.5ha, Least Concern 54.6ha) and 0.2ha non remnant vegetation (**Table 4**). This is **2.93%** of the impact site.

Table 4 Vegetation Clearing Extents

Vegetation Clearing Extents	Original	Updated (excluding existing access tracks)
Total (Temp)	154.53	94.3
Total (Operational)	121.78	84.8 (~10%)
OC (Temp)	52.67	39.5
OC (Operational)	43.97	35.5 (~10%)

The individual wind turbine locations may still be subject to minor adjustments, or 'micro-siting', prior to construction in response to various factors including:

- environmental constraints, such as avoidance of significant vegetation, denning habitat and prevailing geotechnical conditions;
- final wind speed and energy yield analysis;
- detailed site survey and geotechnical/civil engineering considerations;
- turbine manufacturers recommendations; and
- resource and cost-efficiency.

4.0 Environmental Assessment

4.1 Climate

The dominant rainfall pattern of the local area is monsoonal, with alternating wet and dry seasons that typically last for four and eight months respectively, varying on the severity of the El Nino/Southern Oscillation. The nearest weather station to the site (Michael Creek Alert) is located immediately to the east of Ewan Road that dissects approximately the centre of the study site. Records from Michael Creek Alert indicate 471 mm of rainfall was recorded throughout the survey period (5 February- 10 June 2020), and 630mm of rainfall for the six-month period prior (Bureau of Meteorology, 2020).

The Michael Creek Alert 2019-20 November to April wet season period totalled 686 mm. Historic rainfall records for this weather station (based on 20 years of records, from 2000) provide a mean rainfall of 1086.4 mm for the November-April wet season period. Therefore the 2019-20 wet season was 400.4mm or 37.9% less than the mean expected falls at this location with a late start to the season in late January 2020.

The closest BOM climate data is provided from the Ingham Composite site with historic climate data going back to 1968. **Table 5** compares basic climate information for the site against the survey period.

Table 5 Historical and survey period climate data

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul
Mean maximum temperature (°C)							
Historical Average*	32.4	31.8	30.8	29.1	27.1	25.3	25
Survey period (2020)	33.4	34.8	31.5	30.8	25.8	26	24.5
Mean minimum temperature (°C)							
Historical Average*	23.1	23.2	22.4	20.4	17.8	14.9	13.8
Survey period (2020)	24.1	24.1	22.8	20.9	16.1	15.4	13.9
Mean rainfall (mm)							
Historical Average*	388.9	480.5	396.7	196.2	109.4	45.2	35
Survey period (2020)	380.2	488.8	343.2	75.3	219.8	33.1	38.9
* Historical average since 1968							

4.2 Soils and Landforms

The topography of the study site is mountainous, ranging in elevation from approximately 640-810 m asl. The highest point is a ridgeline present within the south eastern section of the study site comprised of granite and

rhyolitic rock. The solid geology underlying soils within the study site is dominated by Paleozoic granitic rock of the Ingham Batholith which is classed as an intrusive igneous rock (Qld Globe, 2020). Across the project site, the surface geology predominantly comprises the following:

- ▶ TQr – deposited clay, silt, sand gravel and soil material over much of the western and central sections;
- ▶ Cgk - Kennedy Province Carboniferous intrusive rocks in the eastern section;
- ▶ Qa – Alluvium within the north west sections of the project site.

A basaltic flow has overlaid the granitic parent material which is of varying thickness depending on variable accumulation potential related to the underlying granitic material. This has then been followed by a deep and intense weathering resulting in laterization of this material (land zone 5) (**Plate 1**). In depositional areas some alluvial material is present (land zone 3). In the context of scale, this landform is present as a minor occurrence on the property. In the western section some of the high ridgelines are exposed and comprise rhyolite and granite material (land zone 12) (**Plate 2**). The dominance of granite (land zone 12) increases towards the east of the property. Laterite, (land zone 5) is the dominant landform in the central and eastern sections of the study site. (*pers comm* Andrew Biggs- Senior Scientist DNRME).



Plate 1 Laterised soil profile exposed on eroded creek bank in the centre of the Project Site



Plate 2 Granite boulders stacks in the east of the Project Site

4.3 Hydrology

The entire study site is located within the Burdekin catchment and Upper Burdekin sub-catchment with waterways generally flowing in a westerly direction through the study site. The Herbert catchment is located directly adjacent to the north east with the division of the catchments marked by Ewan Road (**Figure 7**). The most significant waterway is ephemeral and runs west between two granite ridgelines in the eastern section of the property (**Plate 3**). Some small pools may persist through the dry season within this waterway. Michael Creek runs roughly west in the north west of the project site with several small ephemeral drainage lines feeding into this creek from the north (**Figure 7**). Some alluvial deposits are present within the project site although these do not hold water for more than a few weeks after heavy rain. A single permanent wetland is present beside Ewan Road that would persist through the dry season. Much of the project site is free draining and is generally relatively free of surface water between April and November.



Plate 3 Ephemeral creek draining west in the eastern section of the Project Site

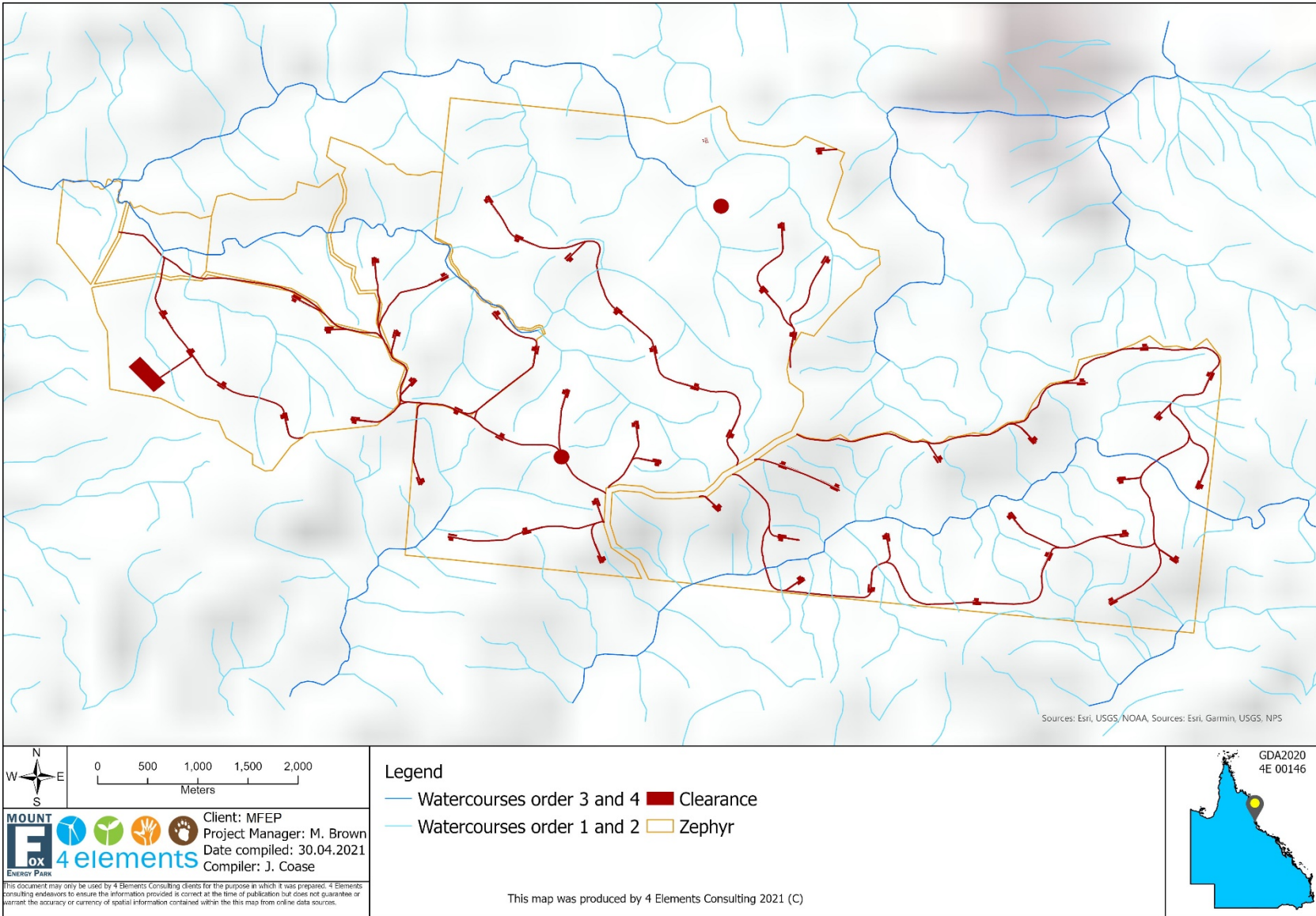


Figure 7 Project Site Waterways

5.0 Desktop Results

5.1 NC Act Wildlife Online

The *Nature Conservation Act 1992 (NC Act)* Wildlife Online database search returned records of six (6) conservation significant species. This comprised three mammals and three plant species. A radius of 10 km was applied. The complete online search results are provided in **Appendix C**.

5.1.1 EPBC Act Protected Matters Search Tool Search Results

Searches of the EPBC Act Protected Matters Search Tool (PMST) returned records of 41 threatened species pursuant to the EPBC Act (1999). A radius of 10 km from the centre of the site was applied (**Appendix D**). This was comprised of nine (9) birds, four (4) amphibian, two (2) reptile, 14 mammal and 12 plant species. Due to the relatively limited prior ecological evaluations present within the region, two (2) additional species were incorporated into the potential occurrence tables based on the consultant's knowledge of the region (**Table 6**).

Table 6 Potentially Occurring Threatened Species (EPBC Act and NC Act)

Common Name	Scientific Name	Status	Status
		NC Act	EPBC Act
Threatened Fauna			
Birds			
Curlew Sandpiper	<i>Calidris ferruginea</i>	E	CE
Southern Cassowary	<i>Casuarius casuarius johnsonii</i>	E	E
Red Goshawk	<i>Erythrotriorchis radiatus</i>	E	V
White-throated Needle-tail	<i>Hirundapus caudacutus</i>	-	V
Eastern Curlew	<i>Numenius madagascariensis</i>	E	CE
Southern Black-throated Finch	<i>Poephila cincta cincta</i>	E	E
Australian Painted Snipe	<i>Rostratula australis</i>	V	E
Buff-breasted Button-quail	<i>Turnix olivii</i>	E	E
Masked Owl (Northern subspecies)	<i>Tyto novaehollandiae kimberli</i>	V	V
Frogs			
Australian Lacelid	<i>Litoria dayi</i>	E	E
Waterfall Frog	<i>Litoria nannotis</i>	E	E
Common Mistfrog	<i>Litoria rheocola</i>	E	E

Common Name	Scientific Name	Status NC Act	Status EPBC Act
Magnificent Broodfrog	<i>Pseudophryne covacevichae</i>	E	V
Mammals			
Northern Bettong	<i>Bettongia tropica</i>	E	E
Northern Quoll	<i>Dasyurus hallucatus</i>	-	E
Spotted-tailed Quoll	<i>Dasyurus maculatus gracilis</i>	E	E
Semon's Leaf-nose Bat	<i>Hipposideros semoni</i>	E	V
Ghost Bat	<i>Macroderma gigas</i>	E	V
Black-footed Tree-rat	<i>Mesembriomys gouldii rattoides</i>	-	V
Northern Greater Glider	<i>Petauroides volans</i>	V	V
Mahogany Glider	<i>Petaurus gracilis</i>	E	E
Sharman's Rock Wallaby	<i>Petrogale sharmani</i>	V	V
Koala	<i>Phascolarctos cinereus</i>	V	V
Spectacled Flying-fox	<i>Pteropus conspicillatus</i>	V	E
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	-	V
Large-eared Horseshoe Bat	<i>Rhinolophus robertsi</i>	V	V
Bare-rumped Sheath-tail Bat	<i>Saccolaimus saccolaimus nudicluniatus</i>	E	V
Reptiles			
Atherton Delma	<i>Delma mitella</i>	NT	V
Yakka Skink	<i>Egernia rugosa</i>	V	V
Estuarine Crocodile	<i>Crocodylus porosus</i>	V	-
Threatened Flora			
-	<i>Acacia tingoorensis</i>	V	V
-	<i>Acacia longipedunculata</i>	NT	-
-	<i>Aristida granitica</i>	E	E
-	<i>Bulbophyllum globuliforme</i>	NT	V
-	<i>Corybas cerasinus</i>	NT	-
-	<i>Corymbia leptoloma</i>	V	V
-	<i>Cyathea celebica</i>	NT	-

Common Name	Scientific Name	Status NC Act	Status EPBC Act
-	<i>Cycas platyphylla</i>	V	V
-	<i>Dichanthium setosum</i>	LC	V
-	<i>Dodonaea uncinata</i>	NT	-
Brown Quandong	<i>Elaeocarpus coorangooloo</i>	NT	-
-	<i>Glossocardia orthochaeta</i>	E	-
-	<i>Homoranthus poteri</i>	V	V
-	<i>Lindsaea pulchella var. blanda</i>	Ext.	V
Halifax Fan Palm	<i>Livistona drudei</i>	V	-
-	<i>Marsdenia brevifolia</i>	V	V
-	<i>Myrmecodia beccarii</i>	V	V
-	<i>Phaius australis</i>	E	E
Forest Swamp Orchid	<i>Phaius pictus</i>	E	V
	<i>Phalaenopsis amabilis subsp. rosenstromii</i>	-	E
	<i>Tephrosia leveillei</i>	V	V
	<i>Zeuxine polygonoides</i>	-	V
Key: CE: Critically Endangered; E: Endangered; V: Vulnerable; NT: Near Threatened			

5.2 EPBC Act MNES Search Tool

Matters of National Environmental Significance (MNES) are matters pursuant to the *EPBC Act*. The results of the MNES search are provided in **Table 7**. The search was undertaken using a 10 km search radius from the centre of the property. The full PMST results are contained within **Table 8**.

Table 7 Protected Matters Search Results

Category	Result
Matters of National Environmental Significance	
World Heritage Properties	1
National Heritage Places	2
Wetlands of International Importance	None
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	1
Listed Threatened Species	41
Listed Migratory Species	19
Other Matters Protected by the EPBC Act	
Commonwealth Land	None
Commonwealth Heritage Places	None
Listed Marine Species	25
Whales and other cetaceans	None
Critical Habitats	None
Commonwealth Reserves Terrestrial	None
Commonwealth Reserves Marine	None

5.3 Migratory Species

Migrants associated with estuarine wetlands and other marine dependant environments were excluded from assessment due to lack of suitable habitat on site. With the removal of these species, 24 terrestrial and marine migrant species were identified in the search area by the PMST. Three (3) species were confirmed present on site. One threatened Marine Migratory species was a confirmed flyover. The full listed output PMST report is presented in **Appendix D**.

A summary list of potential occurrences for migratory species is described in **Table 8**. Tables indicating the likelihood of these species being present on the site based on the availability of habitat is provided in **Appendix E**.

Table 8 Potential Occurrences – Migratory Species

Common Name	Scientific Name	EPBC Act Status	NC Act Status
Fork-tailed Swift	<i>Apus pacificus</i>	Mi, Ma	SLC
Oriental Cuckoo	<i>Cuculus optatus</i>	Mi	SLC
Barn Swallow	<i>Hirundo rustica</i>	Mi, Ma	SLC
Black-faced Monarch	<i>Monarcha melanopsis</i>	Mi, Ma	SLC
Spectacled Monarch	<i>Monarcha trivirgatus</i>	Mi, Ma	SLC
Grey Wagtail	<i>Motacilla cinerea</i>	Mi, Ma	SLC
Yellow Wagtail	<i>Motacilla flava</i>	Mi, Ma	SLC
Rufous Fantail	<i>Rhipidura rufifrons</i>	Mi	SLC
Common Sandpiper	<i>Actitis hypoleucos</i>	Mi, Ma	SLC
Curlew Sandpiper	<i>Calidris ferruginea</i>	CE, Mi	CE
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Mi, Ma	SLC
Pectoral Sandpiper	<i>Calidris melanotos</i>	Mi, Ma	SLC
Latham's Snipe	<i>Gallinago hardwickii</i>	Mi, Ma	SLC
Osprey	<i>Pandion haliaetus</i>	Mi	SLC
Common Greenshank	<i>Tringa nebularia</i>	Mi	SLC
Magpie Goose	<i>Anseranas semipalmata</i>	Ma	SLC
Great Egret	<i>Ardea alba</i>	Ma	SLC
Cattle Egret	<i>Ardea ibis</i>	Ma	SLC
Black-eared Cuckoo	<i>Chrysococcyx osculans</i>	Ma	SLC
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Ma	LC
White-throated Needletail	<i>Hirundapus caudacutus</i>	V, Mi, Ma	V
Rainbow Bee-eater	<i>Merops ornatus</i>	Ma	SLC
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	Mi, Ma	SLC
Painted Snipe	<i>Rostratula benghalensis (sensu lato)</i>	E, Ma	E

Key: Mi: Migratory, Ma: Marine, SLC: Special Least Concern

5.4 Essential Habitat VMA Act

A review was made of the essential habitat mapping, which is associated with the RE mapping to determine whether particular sections of the project site and potential alignment are identified by DES as holding special environmental characteristics and habitat values for conservation significant flora and fauna. Essential habitat

is mapped for the Southern Cassowary (*Casuaris casuaris*) within all mapped remnant Regional Ecosystem 7.12.16a (simple to complex notophyll vine forest on granite and rhyolites).

Essential habitat mapping is not a reflection of actual habitat values represented, for example, by novel or important vegetation communities. As a result of the ground surveys of this study, specific project area mapping has been prepared which shows areas of land that have been delineated as environmental sensitive zones, and which are considered to hold comparatively high ecological values.

5.4.1 Potential Occurrence Assessment

Information contained in **Appendix E** details all species listed in the relevant *EPBC Act 1999* and *NC Act 1992* desktop searches and considers the site ecology to determine the predicted potential of occurrence for each species on site. Additional species to those returned in the desktop searches have been added to this table based on the consultant’s understanding of the region.

5.5 Matters of State Environmental Significance (MSES)

MSES within the project site include:

- ▶ MSES waterways and vegetation intersecting a watercourse
- ▶ Regulated vegetation (essential habitat)
- ▶ Regulated vegetation (endangered or of concern RE under the VM Act)
- ▶ Protected wildlife habitat.

Table 9 describes these MSES and the triggers on the project site. Please see **Appendix F** for the full MSES Report.

Table 9 Matters of State Environmental Significance (MSES)

Matters of State Environmental Significance	Triggers
Regulated Vegetation (VMA)	
(1) The prescribed regional ecosystems that are endangered regional ecosystems comprise a matter of State Environmental Significance. (2) The prescribed regional ecosystems that are of concern regional ecosystems comprise a matter of State environmental significance. (3) A prescribed regional ecosystem is a matter of State environmental significance if it is— (a) a regional ecosystem that intersects with an area shown as a wetland on the vegetation	<ul style="list-style-type: none"> ▶ Areas of Category B vegetation on the regulated vegetation management map that are ‘of concern’ under the VMA are present within the proposed clearance area Figure 3. The turbine alignment and associated tracks require the removal of 39.5 ha of “Of Concern” vegetation (VM Act status) and 0.00 ha of endangered (VM Act status). ▶ The estimated impact remains below 1% of the total extent for each Of Concern and endangered regional ecosystem present on site for all but a

Matters of State Environmental Significance	Triggers
<p>management wetlands map (to the extent of the intersection); or</p> <p>(b) an area of essential habitat on the essential habitat map for an animal that is endangered wildlife or vulnerable wildlife or a plant that is endangered wildlife or vulnerable wildlife.</p> <p>(4) A prescribed regional ecosystem is a matter of State environmental significance to the extent the ecosystem is located within a defined distance from the defining banks of a relevant watercourse.</p>	<p>single RE 7.5.1. This RE currently requires clearance of 1.3% of the 2017 total remnant extent. With the additional 244.8ha mapped as a result of ground truthing the total 2017 remnant extent (600 ha) becomes 844.8 ha. This reduces the clearance percentage to 0.97% of 2017 extent. With the micro-siting and utilisation of <u>already cleared roads for access tracks this clearance area is likely to be further reduced.</u></p> <ul style="list-style-type: none"> ▶ Wetland areas are not present on and adjacent to the project area or associated corridors. No significant impact. ▶ Essential habitat is present within RE 7.12.16a. This vegetation community is avoided entirely by the proposed alignment. <p>No significant impact.</p>
Connectivity Areas	
<p>(1) This section applies to a prescribed regional ecosystem—</p> <p>(a) to the extent the ecosystem contains remnant vegetation; and</p> <p>(b) if the ecosystem contains an area of land that is required for ecosystem functioning (a connectivity area).</p> <p>(2) The prescribed regional ecosystem is a matter of State environmental significance if the administering agency is satisfied, having had regard to criteria in the environmental offsets policy about connectivity areas, that—</p> <p>(a) the connectivity area is of sufficient size or configured in a way that maintains ecosystem functioning; and</p> <p>(b) the prescribed regional ecosystem will remain despite a threatening process within the meaning of <i>the Nature Conservation Act 1992</i>.</p>	<ul style="list-style-type: none"> ▶ The nature of clearing for the project does not require broad scale clearance of vegetation. Turbine pads will be isolated from each other and joined by a series of narrow unsealed tracks). ▶ Existing vehicle tracks will be utilised over much of the western portion of the property where the highest proportion of the Of Concern RE's occur on the property. Where clearance for tracks occur, this will be no greater than 15 m in any Of Concern RE. <p>No significant impact.</p> <ul style="list-style-type: none"> ▶ Connectivity is sufficiently maintained throughout the study site with adequate buffers to riparian areas and surrounding remnant vegetation. ▶ The proposed clearing will not have a significant impact on the core ecosystem at the local scale, the clearing will not significantly impact on connectivity areas and there will not be a

Matters of State Environmental Significance	Triggers
	significant loss or reduction of core remnant areas at the site scale.
Wetlands and Watercourses	
<p>(1) Each of the following matters is a matter of State environmental significance—</p> <p>(a) a wetland;</p> <p> i. in a wetland protection area; or</p> <p> ii. of high ecological significance shown on the Map of referable wetlands;</p> <p>(b) a wetland or watercourse in high ecological value waters.</p>	The project area does not intersect or contain a wetland or waterway in high ecological values waters
Designated Precinct in a Strategic Environmental Area	
<p>(1) A designated precinct in a strategic environmental area is a matter of State environmental significance.</p>	The project area does not intersect or contain a strategic environmental area.
Protected Wildlife Habitat	
<p>(1) An area that is shown as a high-risk area on the flora survey trigger map and that contains plants that are endangered wildlife or vulnerable wildlife is a matter of State environmental significance.</p> <p>(2) An area that is not shown as a high-risk area on the flora survey trigger map, to the extent the area contains plants that are endangered wildlife or vulnerable wildlife, is a matter of State environmental significance.</p> <p>(3) A non-juvenile koala habitat tree located in an area shown as bushland habitat, high value rehabilitation habitat or medium value rehabilitation habitat on the map called 'Map of Assessable Development Area Koala Habitat Values' that applies under the South East Queensland Koala Conservation State Planning Regulatory Provisions is a matter of State environmental significance.</p>	<ul style="list-style-type: none"> ▶ Habitat for four (4) vulnerable listed species: (1) flora and (3) fauna species are recognised within the Regulated Vegetation Areas of the site. A significant impact assessment was conducted on each of these species in Appendix I. Impacts to each of these species can be managed with the implementation of appropriate mitigation measures, in particular buffers to these areas from all operations and limited clearing activities within known habitat. ▶ No high-risk areas are identified on the flora trigger map. <p>Suitable Koala habitat was recorded over much of the Laterite and Alluvial landzones. There are known proximate records for this species off site. However, no evidence of this species was recorded during the site survey.</p>

Matters of State Environmental Significance	Triggers
(4) A habitat for an animal that is endangered wildlife or vulnerable wildlife, or a special least concern animal is a matter of State environmental significance.	
Protected Areas	
A protected area is a matter of State environmental significance.	There are no protected areas under the <i>Nature Conservation Act 1992</i> present on the site.
Highly Protected Zones of State Marine Parks	
A highly protected area of a relevant Queensland marine park is a matter of State environmental significance.	There are no marine parks or land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone present on the site.
Fish Habitat Areas	
An area declared under the <i>Fisheries Act 1994</i> to be a fish habitat area is a matter of State environmental significance.	There are no fish habitat areas under the Fisheries Act 1994 present on the windfarm site or any associated corridors as these creeks are all ephemeral high-altitude waterways.
Waterway Providing for Fish Passage	
1) Any part of a waterway providing for passage of fish is a matter of State environmental significance only if the construction, installation or modification of waterway barrier works carried out under an authority will limit the passage of fish along the waterway.	<p>Small waterways providing fish passage are present within the project site.</p> <p>Waterway barrier works may be required and will be carried out under an authority. Works can be conducted within the dry season to avoid areas of fish passage between lagoons.</p> <p>No significant impact.</p>
Marine Plants	
A marine plant within the meaning of the <i>Fisheries Act 1994</i> is a matter of State environmental significance.	There are no marine plants under the Fisheries Act 1994 recorded on the site.
Legally Secured Offset Areas	
A legally secured offset area is a matter of State environmental significance.	There are no legally secured offset areas intersecting the site.

5.6 World Heritage Properties

The Wet Tropics of Queensland World Heritage Area (WTWHA) includes 900,000 ha of land between Townsville and Cooktown. This area was placed on the World Heritage List in 1988 and has a number of natural criteria critical for listing as discussed below. **Table 10** identifies the values of the project site in relation to the WTWHA:

Table 10 Project Impact to the World Heritage Values on the WTWHA

Criterion	Response
<p>C7: Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance</p>	<p>The WTWHA is approximately 5.5 km to the north of the site and approximately 8.5 km to the east, therefore does not contain any direct values associated with a World Heritage property. The study site is located within the Wet Tropics bioregion and contains vegetation in relatively good condition. This area of the project site has high natural integrity and supports poorly represented vegetation communities. It contains high value habitat for narrow distribution endemic flora and conservation significant fauna. However, the development will not fragment or degrade the habitat such that it has an impact on the WTWHA. The WTWHA will not be directly impacted through clearing, fragmentation, edge effects or impact on habitat values of the area.</p>
<p>C8: Be an outstanding example representing the major stages of Earth's history, including the record of life, and significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features.</p>	<p>Although the site is not within the WTWHA or does not have a contiguous landscape connection, the site does have an interesting geological formation which provides for the diversity of landscapes.</p> <p>These areas are not contiguous with the WTWHA and will not impact the WTWHA values.</p>
<p>C9: Be an outstanding example representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.</p>	<p>The project site does not meet the criteria for representing significant impact on ongoing ecological and biological processes in the evolution of fresh water and coastal environments because of the absence of these features within and adjacent to the site.</p>
<p>C10: Contain the most important significant habitats for in situ</p>	<p>The site does contain important significant habitats for the conservation significant species <i>Corymbia leptoloma</i> and</p>

Criterion	Response
conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation	Northern Greater Glider, Bare-rumped Sheathtail Bat and Greater large-eared Horseshoe Bat. These habitats are not representative of the WTWHA.

5.7 National Heritage Values

The National Heritage List contains places or groups of places with outstanding heritage value to Australia – whether natural, Indigenous, or historic or a combination of these. There are no listed National Heritage Values (indigenous areas) on the site. The Wet Tropics World Heritage area are listed as National Heritage place and is considered in the significant assessment in **Table 10** above.

On the basis of mitigation measures the project is not considered to have impacts on World Heritage or National Heritage values such that it would result in loss or degradation to that value. **Section 10** provides details of the mitigation measures to be applied to the project to minimise impacts to MNES/MSES.

5.8 North Queensland Regional Plan

The North Queensland Regional Plan (NQRP) identifies areas of unique ecological value based on multiple biodiversity facets and co-location of features including topographical, hydrological, geomorphic and climatic features (The State of Queensland 2020). Policies and mapping in the NQRP consider important biodiversity and landscape values, that are not mapped as Matters of State Environmental Significance (MSES). They include strategic environmental areas, regional biodiversity values, regional biodiversity corridors and regional landscape values. Approximately 75% of the proposed Mt Fox Energy Park site falls within a designated Strategic Environmental Area (SEA) and wholly within an ecological corridor designated by Wet Tropics Management Authority (WTMA) (see **Figure 8**) and a bioregional corridor of regional significance (**Figure 9**) as mapped under the Biodiversity Planning Assessment (BPA). **Table 11** identifies the regional policies and expected outcome in regard to these features as defined by the North Queensland Regional Management Plan.

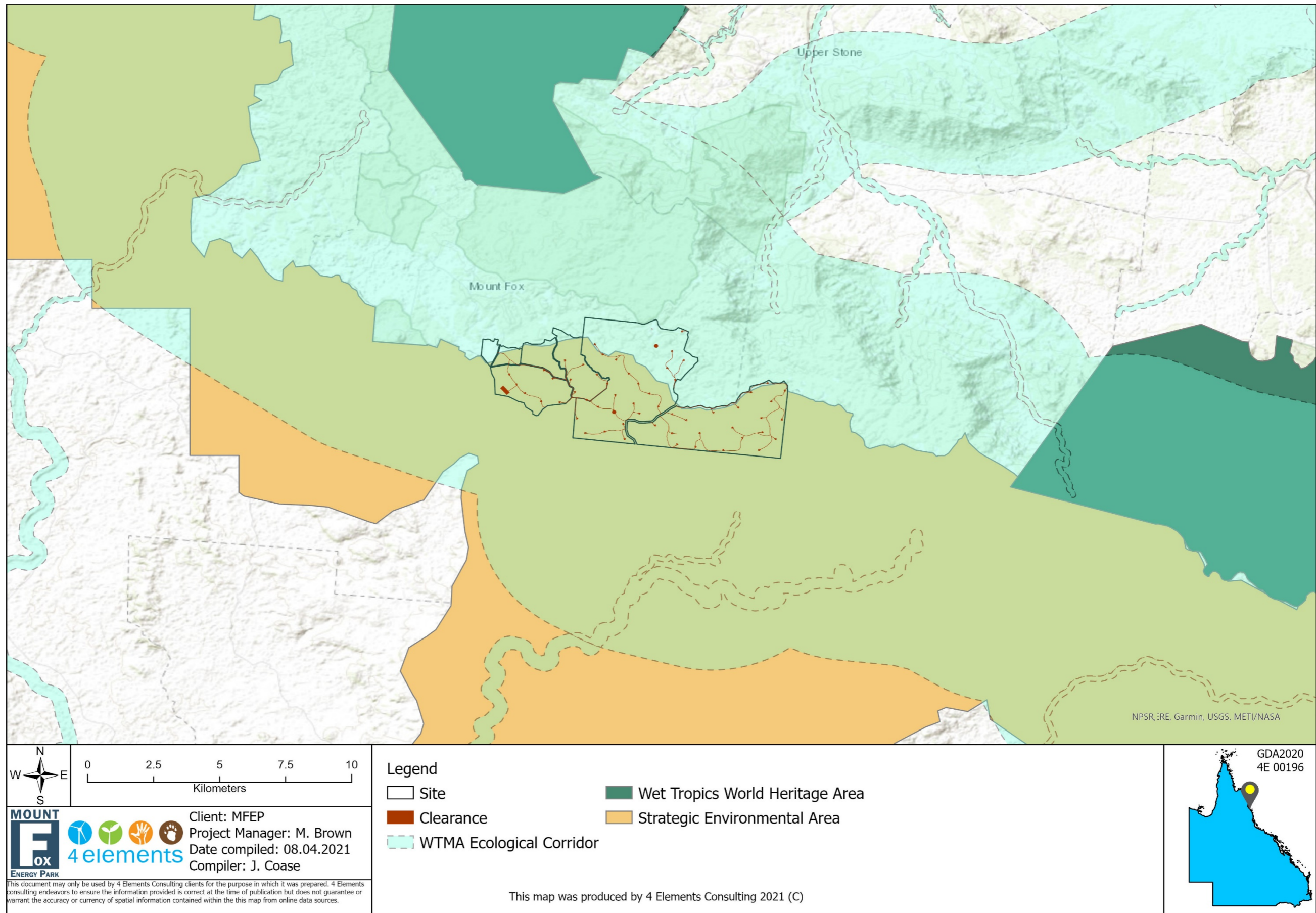


Figure 8 Strategic Environmental Area and WTMA Ecological Corridors

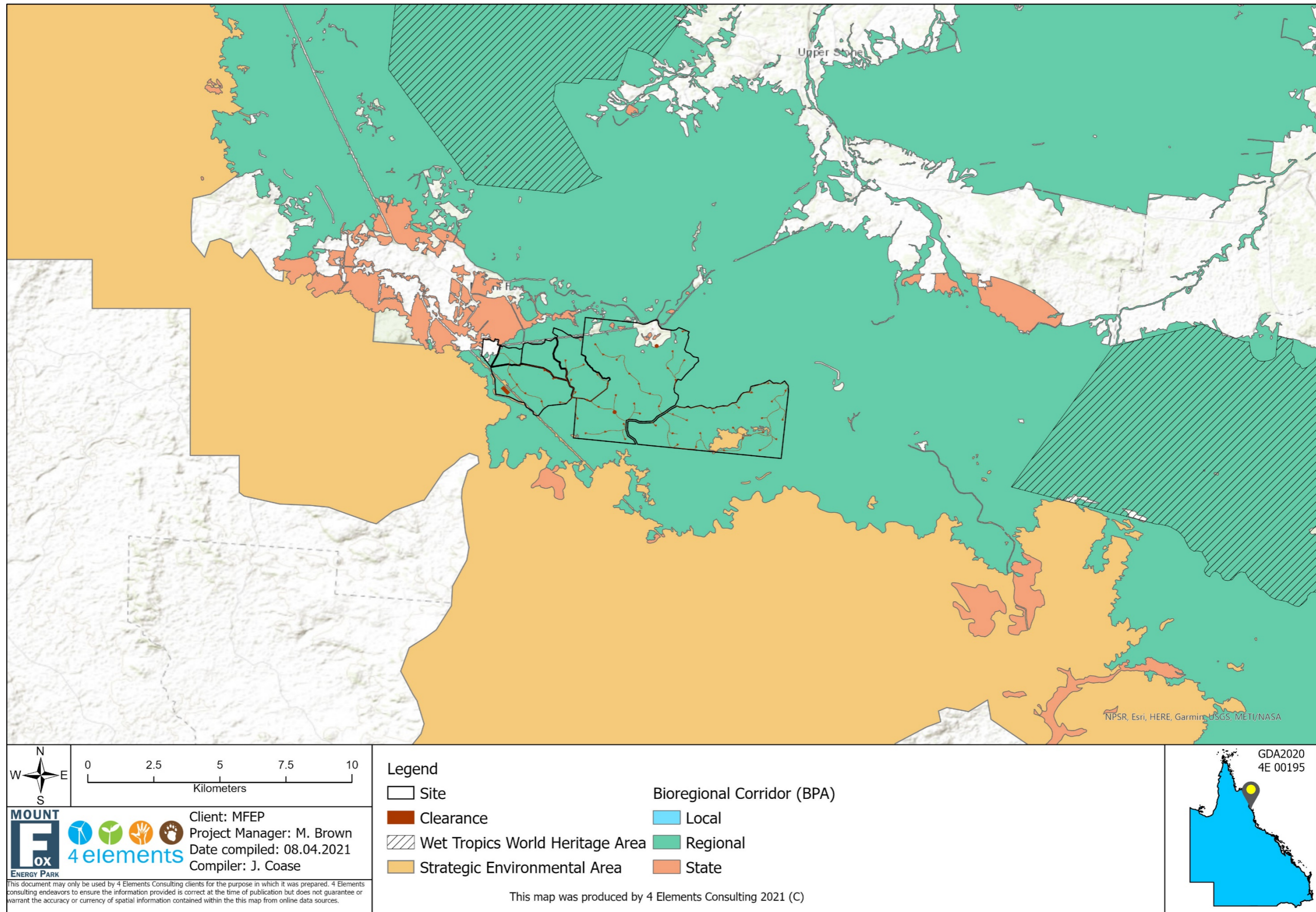


Figure 9 Biodiversity Planning Assessment Bioregional Corridor

Table 11 North Queensland Regional Plan

NQRP Outcome	Response
<p>Outcome</p> <p>2.1: Ensure the region’s areas of high biodiversity and landscape value, and the ecological processes that support them, are identified, protected and sustainably managed.</p>	<p>The proposed MFEP can co-exist with and does not risk widespread or irreversible impacts on the area’s ecological integrity. The nature of the disturbance footprint is primarily a network of roads through mixed use lands, including cleared, grazed and remnant areas.</p> <p>Ecological and landscape values have been identified throughout the entirety of the site, not being limited to the SEA and a hierarchical approach of avoidance, mitigation and offsetting has been applied to retain the integrity of the ecological processes and values present within the site and surrounding region.</p> <p>The site, encompassed within the SEA, WTMA ecological corridor, and BPA bioregional corridor, is not a contiguous remnant landscape. The region is a patchwork of remnant vegetation, regrowth, agricultural and fenced pastoral lands with a myriad of cleared roads and tracks following fence lines, property boundaries and access tracks. The addition of access roads and tower pads required in the development of the MFEP is not expected to propose a significant increase or barrier to dispersal of fauna found within the site or in the greater region in the context of terrestrial migration corridors between bioregions or WTWHA.</p>
<p>NQRP Policies</p>	<p>Response</p>
<p>2.1.1 Protect the biodiversity and ecological integrity of SEAs from incompatible development.</p>	<p>Ecological and landscape values have been identified throughout the entirety of the site, not being limited to the SEA and a hierarchical approach of avoidance, mitigation and offsetting has been applied to retain the integrity of the ecological processes and values present within site and surrounding region. Targeted surveys and individual management plans have been developed (Bird and Bat Adaptive Management Plan, Koala Management Plan, Vegetation Management Plan for example) and implemented for EVNT species and the proposed MFEP is not considered an incompatible development under the policies outlined in the NQRP. Renewable energy resources such as wind will help protect biodiversity and the ecological integrity as well as provide sustainable economic and social benefits to the region.</p>
<p>2.1.2 Protect and enhance the biodiversity and ecological integrity of regional biodiversity corridors and regional biodiversity values (Map 5) to optimise biodiversity conservation outcomes.</p>	<p>The site, encompassed within the SEA, WTMA ecological corridor, and BPA bioregional corridor, is not a contiguous remnant landscape. The region is a patchwork of remnant vegetation, regrowth, agricultural and fenced pastoral lands with a myriad of cleared roads and tracks following fence lines, property boundaries and access tracks. The addition of access roads and tower pads required in the development of the MFEP is not expected to</p>

NQR Outcome	Response
	propose a significant increase or barrier to dispersal of taxa found within the site or in the greater region in the context of terrestrial migration corridors.
<p>2.1.3 Protect regional landscape values and functions to sustainably manage and provide social, environmental, cultural and economic benefits to the region.</p>	<p>Regional landscape values and functions will be retained within the site as ecological and landscape values have been identified and management of impacts will be implemented throughout the development. In addition to the retention and protection of environmental values, the development will also bring economic benefits to the region associated with any large infrastructure program throughout construction, operation and decommissioning phases. Flow on effects will also provide opportunity and social and cultural benefit the small communities in the region.</p>
<p>2.1.4 Identify and manage priority rehabilitation areas to enhance biodiversity values and ecological functionality using local environmental offsets, landcare programs or other environmental improvement initiatives.</p>	<p>The use of EPBC and NC listed <i>Vulnerable Corymbia leptoloma</i> in revegetation works within suitable granite land zones east of Ewan Road will be beneficial to improving biodiversity values on the project site by potentially expanding the current extent of this species within the project site. Priority management of environmental weeds that currently exist within the project site (<i>Lantana camara</i>) and ensuring that any temporary disturbance areas are colonised by native vegetation and not invasive weeds will also have beneficial impacts on biodiversity values of the project site. The reduction of <i>Lantana camara</i> within the alluvial and lateritic landzones of the site will reduce fire intensity and promote higher diversity vegetation structures to benefit fauna diversity. Where possible local environmental improvement initiatives and local environmental services will be utilised to achieve these outcomes.</p>
<p>2.1.5 Provide opportunities for the co-location of environmentally sensitive commercial, recreational and community activities in and around SEAs and the regional biodiversity network, where they complement the area's natural values and have no impact on the function of these areas.</p>	<p>The proposed MFEP is wholly within an active grazing property and will allow for the current land use to continue without impediment to environmentally sensitive commercial, recreational or community activities. The project will complement the area's natural values by providing sustainable and renewable power to help slow and reverse the release and accumulation of greenhouse gasses into the atmosphere and will not significantly impact on ecological processes within the SEA or surrounding terrestrial corridors and environment.</p>

6.0 Flora Survey Results

6.1 Vegetation Communities and Regional Ecosystems

For the purpose of this study, the project site has been broken down into discreet sub-categories based broadly on land zone and bio-regions (wet tropics/brigalow belt). It is within these project site land zones that patterns relating to the ecological values can be determined. These values relate to the spatial locations of critical site values of vegetation communities, threatened species and weed invasion. The vegetation management property reports are provided in **Appendix G**.

A total of four (4) project site land zones have been identified for the report (see **Figure 10** below). These include:

- ▶ Land zone 12 (granite and rhyolite soils);
- ▶ Land zone 5 (laterite soils);
- ▶ Land zone 3 (alluvial deposits);
- ▶ Brigalow belt Land zone 12 (granite and rhyolite soils).

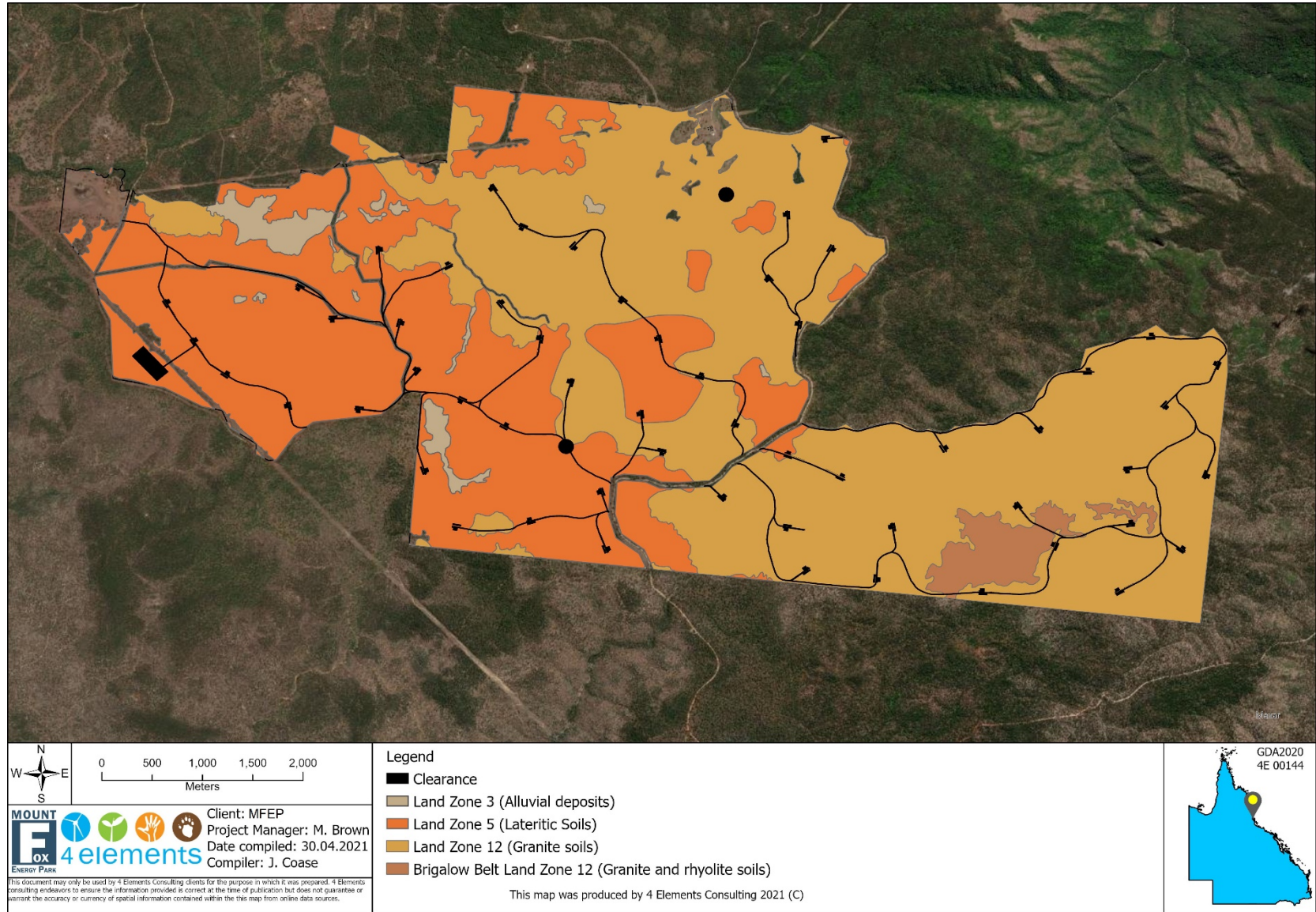


Figure 10 Project Site Land Zones

6.1.1 Land Zone 12 (Granite and Rhyolite soils)

Land zone 12 covers an extensive proportion of the north east of the project site and some isolated polygons within the west. Within the project site, this landform is the most topographically varied with elevation ranges between 660 m and 810 m asl. Landforms ranged from undulating plains at the base of rolling low hills to steep gullies below narrow ridgelines in the east of the project site. The varied elevations and landforms support a greater diversity of habitats compared to other land zones within the project site.

The predominant surface geology is Kennedy Province Carboniferous intrusive rocks with rhyolite being the most commonly recorded surface rock. Rhyolite is a light coloured, fine-grained intrusive volcanic rock and comprises the majority of the elevated landforms in the east of the project site.

Vegetation communities vary depending on slope and aspect that permit different accumulation rates of topsoils and in some cases provide fire refugia. In sheltered locations open forest is the dominant vegetation community with RE 7.12.30a (**Plate 4**) and RE 7.12.29b occurring over much of the sub-category. In more exposed locations granite boulders and rhyolite pavements comprise a common surface component often with a thin layer of skeletal soil supporting dense shrubby vegetation RE 7.12.66 and RE 7.12.65 (**Plate 5**). Some minor occurrences of complex notophyll vine forest (RE 7.12.16a) and tall open wet sclerophyll forest (re 7.12.21a) occur in the central north of the project site. These communities are all located in highly sheltered locations within gullies containing a significant component of rhyolite surface rock to assist in fire suppression.

The predominant land use of this land zone is for grazing of cattle. However, due to the lower nutrient levels of rhyolitic soils these sections of the project site have a lower livestock carrying capacity evidenced in a relatively low grazing intensity.



Plate 4 RE 7.12.30a Dominant Within Land Zone 12 (Granite and Rhyolite Hills)



Plate 5 RE 7.12.65a and 7.12.66b Common on Exposed Ridgelines (granite and rhyolite hills)

6.1.2 Land Zone 5 (Laterite soils)

Land zone 5 covers an extensive proportion of the south west of the project site and some isolated polygons within the central north of the study site. Within the project site, this land zone ranges in elevation from 660 m to 770 m asl. Landforms ranged from undulating plains and low rolling low hills.

The predominant surface geology is Tertiary – Quaternary period deposits of clay, silt, gravel, and soil. A basalt flow has covered much of this area and subsequently laterised to form a deep and unremarkable soil profile.

Vegetation communities are relatively uniform in structure throughout this land zone being comprised of open forest and woodland with a sparse understorey and grassy ground layer. The relatively higher fertility and water holding capacity of these soils have facilitated the growth of frequent large diameter *Eucalyptus tereticornis* and *Corymbia intermedia* present across much of the land zone distribution (**Plate 6**).

The predominant land use of this land zone is for the grazing of cattle. Much of the cattle grazing is concentrated in these areas due to the higher fertility and much lower rock content of the soil. Significant portions of this land zone have been heavily grazed previously. Management of liana and woody weeds has occurred in the western section of the project site. However, in the central section management of weeds has been less effective and a dense thicket of lantana to a height of 2 m is common.



Plate 6 RE 7.5.4b Dominant Within Land Zone 5 (lateritic soils)

6.1.3 Land Zone 3 Alluvial Deposits

Land zone 3 comprises a minor proportion of the west of the project site occurring as isolated polygons. An additional alluvial deposit occurs in the east. The very nature of this landform being depositional requires that it is a low flat feature within the landscape locally.

The predominant surface geology is Tertiary – Quaternary period deposits of clay, silt, gravel, and soil. This landform occurs within depositional areas adjacent to open forest and woodlands of land zone 5 (lateritic soils). The accumulation of run-off material from these areas has created a deep black soil with an elevated organic matter content relative to adjacent areas.

Vegetation communities are uniform in structure throughout this land zone. Almost all of the land zone is comprised of RE 7.3.39a *Eucalyptus tereticornis* woodland with a sparse understorey and grassy ground layer (**Plate 7**). The elevated fertility and water holding capacity of these soils have facilitated the grow of some very large diameter *Eucalyptus tereticornis* present across much of the land zone. Within the central north of the project site a small area of RE 7.3.39c occurs as a naturally treeless ephemeral swamp and sedgeland.

The predominant land use of this land zone is for the grazing of cattle. Much of the cattle grazing is concentrated in these areas due to the higher fertility of the accumulating soils. Significant portions of this land zone have been heavily grazed. The understorey and ground layer vegetation has largely been transformed to that of a diverse composition of invasive species particularly giant rat's tail grass *Sporobolus spp.* and *Lantana camara*. The canopy structure remains intact throughout.



Plate 7 RE 7.3.39a Dominant Within Land Zone 3 (alluvial depressions)

6.1.4 Brigalow Belt - Land Zone 12 (Granite soils)

Brigalow Belt - Land zone 12 covers a minor proportion of the west of the project site occurring as isolated polygons. Within the project site, this land zone ranges elevation from 690 m to 780 m asl.

The predominant surface geology is Tertiary – Quaternary period deposits of clay, silt, gravel, and soil. The single landform consists of an exposed north-north west facing slope below high rhyolite ridgelines.

Vegetation communities are uniform in structure throughout this land zone. All vegetation communities comprise RE 11.12.13a low *Eucalyptus exserta* woodland with a sparse understorey and grassy ground layer (**Plate 8**). The low fertility and water holding capacity of these soils have facilitated low open woodland Eucalypt forest. Due to the high presence of rhyolitic surface rock a varying degree of fire refugia is present within this community that likely contributes to a higher diversity of flora in all structural layers.



Plate 8 RE 11.12.13a Dominant Within Brigalow Belt - Land Zone 12 (rhyolitic slopes)

6.2 Salinity Expression Areas

Clearing is not to contribute to or accelerate land degradation through waterlogging, or through the salinisation of groundwater, surface water or soil (PO22 of State Code 16). The code generally prevents or limits the extent of clearing within 100 metres of a salinity expression area, which is defined as an area containing more than one of the following salinity indicators:

- ▶ Plant species tolerant of saline conditions, shallow water tables or poor drainage (waterlogging)
- ▶ Wet areas in lower parts of the landscape or bare soil (soil scalding)
- ▶ Dieback of larger trees in low, wetter parts of the landscape (outside drought conditions or the effects of fire)
- ▶ Salt accumulations on the surface (often white and powdery, sometimes crystalline)
- ▶ Areas of shallow groundwater.

Results of on ground surveys identified:

-
- ▶ No evidence of salinity expression areas were recorded during the extensive vegetation mapping survey (Score of 0 was given to salinity for each of the 35 REDD v11.1 field sites).
 - ▶ Low lying or areas were targeted in the vegetation survey as they were relatively infrequent in the landscape and were considered areas important for diversity in the landscape.
 - ▶ Where land had been cleared there was dense grass cover with little opportunity to see the soil.
 - ▶ Even during the wet season standing water was very rare (exception being RE 7.3.39c).
 - ▶ No canopy die back of large canopy trees was noted at any wetland site. Trees were noted as being very large and healthy in these areas.
 - ▶ No soil scalding was noted or salt accumulations.
 - ▶ There were no salt preferential species such as Halophytes recorded within any of the comprehensive species lists undertaken for the RE mapping (35 sites).
 - ▶ Several common salt tolerant species were noted in these wet areas although none of these species are considered to be saline soil indicators as they also occur in freshwater environments – *Themeda triandra*, Water chestnut- *Eleocharis dulcis*, Large bluegrass- *Ischaemum australe*, Blady grass- *Imperata cylindrica* etc.

Due to the nature of the project, there is little need to clear riparian and wetland vegetation. It is also anticipated that there is no requirement to place roads or turbine infrastructure within any alluvial vegetation communities, therefore it is highly unlikely there would be acceleration of land degradation due to salinisation from this proposed development.

6.3 Regional Ecosystems

The vegetation assessments focused on ground truthing RE mapping within the project site and correcting mapping where necessary from REDD version 11.1. This process resulted in several changes. Most significantly, modifications to the area within the alignment for *VM Act* and *EPBC Act* 'Endangered' or 'Of Concern' RE's changes were required (**Table 12**). With ground truthed mapping, the area of RE designated 'Of Concern' under the *VM Act* and the *NC Act* has slightly decreased, and areas designated currently as 'Least Concern'/'No Concern' have slightly increased (**Table 12**). These areas are a summary of the total proposed clearing alignment based on 57 wind turbine generator pads (approximately 0.4 ha each) and an associated track network connecting infrastructure to a central road network (15 m width). Proposed clearing of remnant vegetation is shown **Table 13**. The updated Regional Ecosystem polygons for the entire project site are visually represented in **Figure 11**, **Figure 12**, and **Figure 13**.

Table 12 Project Site Regional Ecosystem changes following ground truthing

	Biodiversity ¹			VM Act ²			Total RE Units
	Endangered	Of Concern	No Concern at Present	Endangered	Of Concern	Least Concern	
RE v 11.1	69.8 ha	1365.9 ha	1696.4 ha	0.0 ha	1291.2 ha	1840.8 ha	16 RE/ 24 sub category
Ground truthed 4 Elements	311.0 ha	973.0 ha	1848.0 ha	0.0 ha	1276.0 ha	1856.0 ha	15 RE/ 21 sub category
¹ Designated under the <i>EPBC Act 1992</i> ² Vegetation Management Act 1999							

Clearing impacts of the proposed construction of wind turbine pads and access roads are considered for each regional ecosystem below (**Table 13**). It is assumed that each tower pad will have an area of disturbance (0.4 ha). An allowance for disturbed areas associated with access tracks of 15 m width that will join all towers are also considered. Where the track is aligned within a previously formed road no clearance of vegetation is considered to be required. The total proposed area for the clearing of remnant vegetation is currently proposed to be 94.3 ha.

A general species list for the site is provided in **Appendix H**.

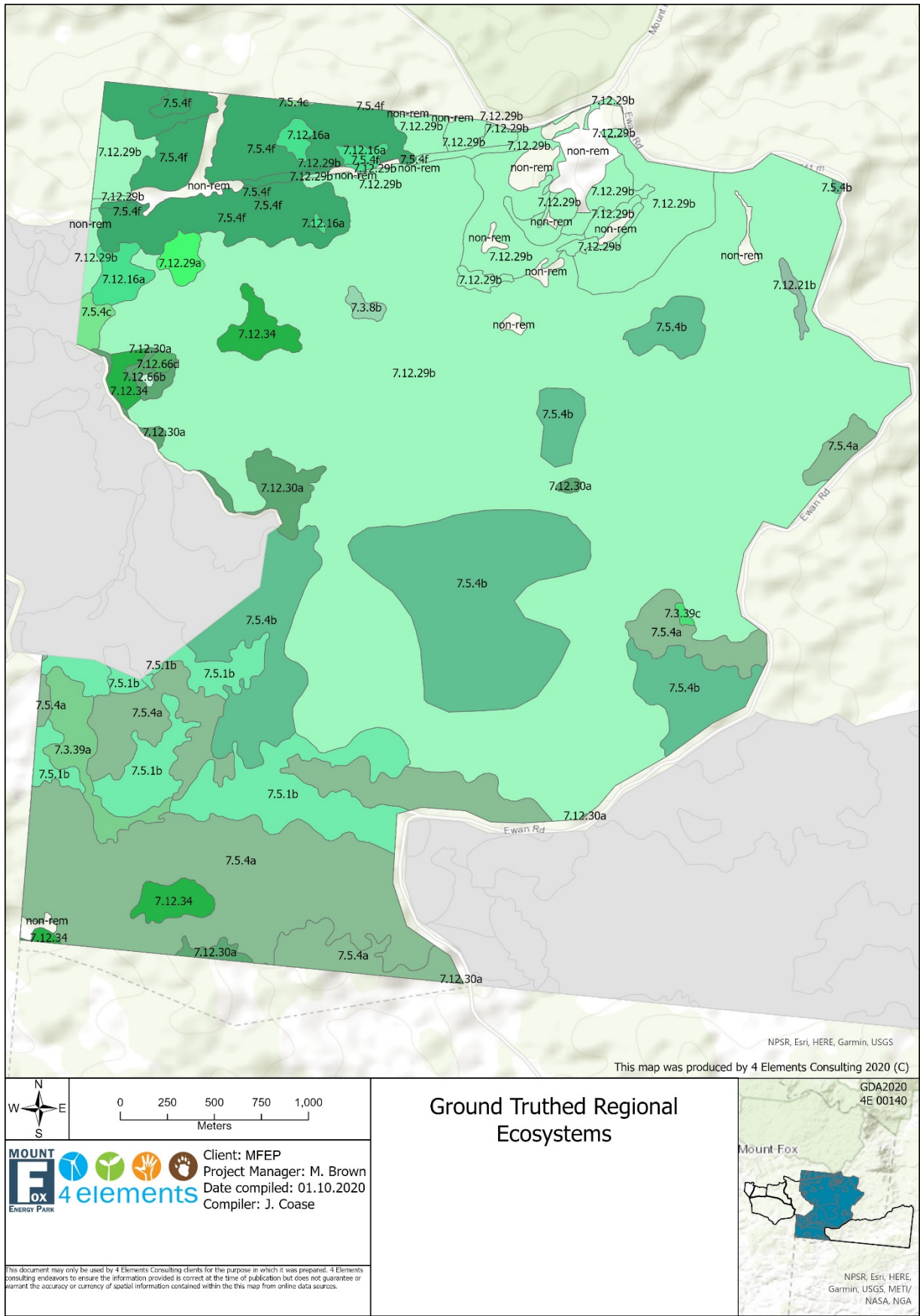


Figure 12 Regional Ecosystem (RE) mapping (central)

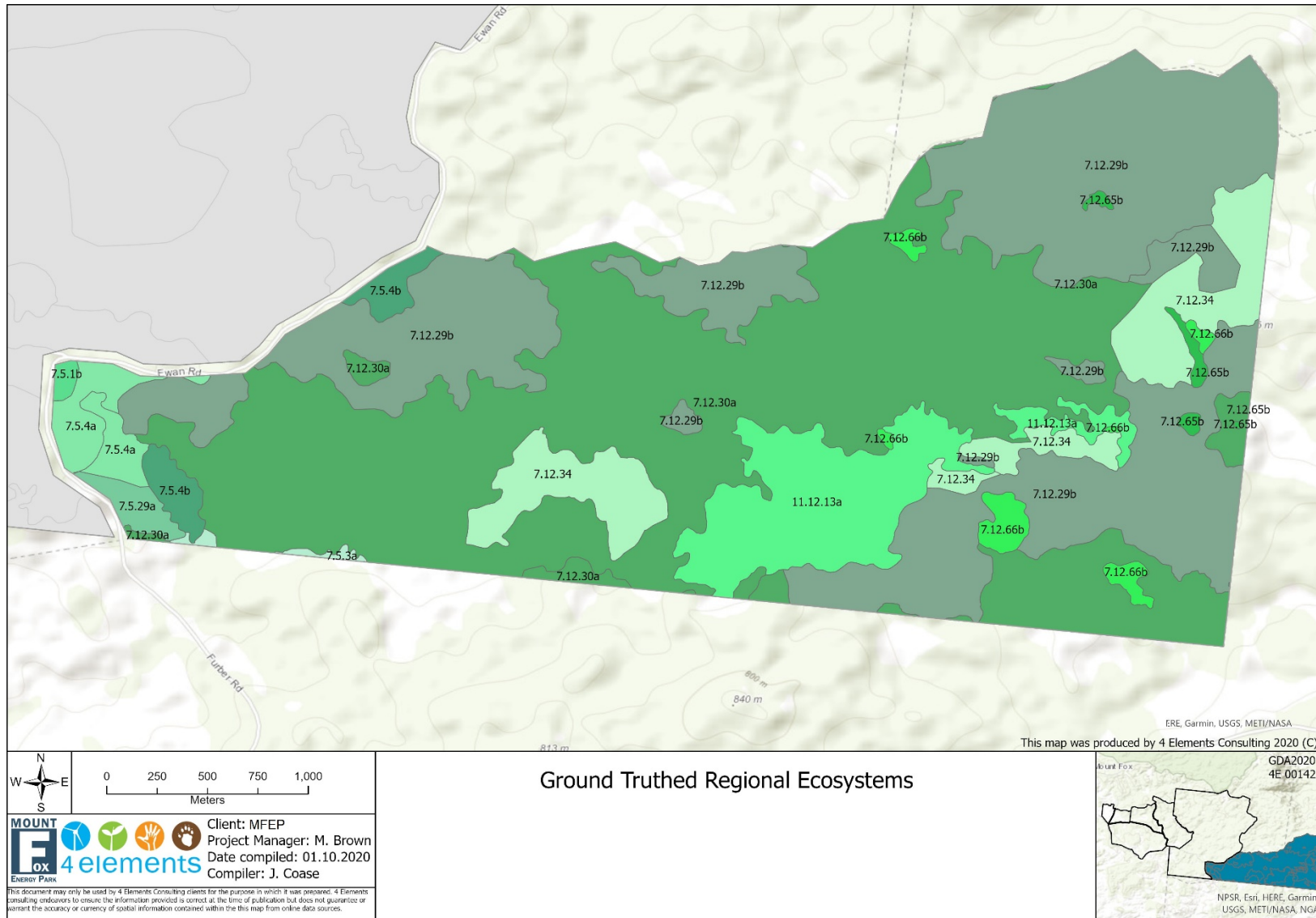


Figure 13 Regional Ecosystem (RE) mapping (eastern lots)

Table 13 Project Site Ground Truthed Regional Ecosystems and Proposed Individual Regional Ecosystem Clearance Areas

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
Brigalow Belt Bioregion				
11.12.13 LC/NOC	0.6 ha	<i>Eucalyptus crebra</i> , <i>Corymbia erythrophloia</i> , <i>C. dallachiana</i> and <i>C. tessellaris</i> +/- <i>C. intermedia</i> +/- <i>E. acmenoides</i> +/- <i>Canarium Australianum</i> mixed woodland or open forest. Occurs on coastal hills formed on Mesozoic to Proterozoic igneous rocks (BVG1M: 13c)	Within the exposed granites outcrops situated to the south east of the property.	Habitat for regional endemics and threatened flora species including the endangered <i>Aristida granitica</i> . Potential habitat for Northern Quoll. Pre-clear extent= 43,000 ha; 2017 extent = 40,000 ha
Wet Tropics Bioregion – Alluvial Soils				
7.3.8b LC/E	0.0 ha	<i>Melaleuca viridiflora</i> open forest to open woodland with eucalypt emergents (or sparse eucalypt overstorey) of species such as <i>Corymbia clarksoniana</i> , <i>Eucalyptus platyphylla</i> , <i>Lophostemon suaveolens</i> and <i>E. drepanophylla</i> . Poorly drained alluvium, mostly on the coastal plains. Floodplain (other than floodplain wetlands) (BVG1M: 21a)	Present at a single discreet location within the central north of the property within a catchment area dissected by a small ephemeral drainage line.	Threatened plant species include: <i>Calochilus pzednus</i> , <i>Corunastylis tecta</i> , <i>Myrmecodia beccarii</i> , <i>Hypochrysops apollo apollo</i> , <i>Eulophia bicallosa</i> and <i>Pachystoma pubescens</i> . There are many poorly known ground layer species, particularly in southern, drier areas. The vast majority of species occur in the very diverse ground layer, which may in places exceed 90 species in a 50x10 m plot. Pre-clear extent= 39,000 ha; 2017 extent = 15,000 ha

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
7.3.39a OC/E	0.0 ha	<i>Eucalyptus tereticornis</i> open woodland. Small groves of <i>E. platyphylla</i> occur as a lower layer in some areas. Seasonal swamp of broad drainage lines in uplands. Moist rainfall zone. Floodplain (other than floodplain wetlands) (BVG1M: 9e)	Within low lying drainage areas of laterite plains in the west of the property.	Potential habitat for NCA listed species: <i>Oenanthe javanica</i> . High local value for cattle grazing. Suitable habitat for the Northern Greater Glider and Koala. Pre-clear extent = 2,000 ha; 2017 extent = 1,000 ha
7.3.39c OC/E	0.0 ha	Ephemeral freshwater swamp. Drainage depressions in upland situations. Palustrine wetland (e.g. vegetated swamp) (BVG1M: 34f)	Within low lying drainage areas of laterite plains in the west of the property.	Provides a natural watering point throughout much of the year. High local value grazing habitat. Suitable habitat for the Northern Greater Glider and koala. Pre-clear extent = 2,000 ha; 2017 extent = 1,000 ha
7.3.43 OC/E	0.0 ha	<i>Eucalyptus tereticornis</i> open forest, tall open forest and woodland including communities ranging from those dominated by <i>E. tereticornis</i> to mixtures of that species with <i>Corymbia intermedia</i> , <i>E. drepanophylla</i> , <i>Lophostemon suaveolens</i> and <i>Allocasuarina torulosa</i> . Uplands on alluvium. Contains palustrine wetland (e.g. in swales) (BVG1M: 9e)	A low-lying drainage feature for the surrounding laterite communities. Located in the north west of the property.	Suitable habitat for the Northern Greater Glider and Koala. High local value grazing habitat. Pre-clear extent = 3,000 ha; 2017 extent = 2,000 ha

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
Wet Tropics Bioregion – Landforms comprising lateritic soils				
7.5.1b OC/E	8.2 ha	<i>Eucalyptus tereticornis</i> , <i>E. drepanophylla</i> , <i>E. portuensis</i> , <i>Corymbia intermedia</i> , <i>C. tessellaris</i> , <i>Allocasuarina torulosa</i> , <i>Angophora floribunda</i> woodland to low woodland. Deep weathered soils of uplands (BVG1M: 9d)	Well represented in the western end of the property.	Suitable habitat for the Northern Greater Glider and Koala. Pre-clear extent = 800 ha; 2017 extent = 600 ha
7.5.3a OC/E	0.0 ha	<i>Corymbia citriodora</i> , <i>Eucalyptus portuensis</i> , <i>E. drepanophylla</i> , <i>C. intermedia</i> woodland to low woodland with <i>Acacia calyculata</i> and <i>Xanthorrhoea johnsonii</i> . Laterite. (BVG1M: 10b)	Present in the far south of the western side of the property.	Suitable habitat for the Northern Greater Glider and Koala. Pre-clear extent = 300 ha; 2017 extent = 300 ha
7.5.4a OC/OC	9.2 ha	<i>Corymbia intermedia</i> +/- <i>Eucalyptus tereticornis</i> woodland and open forest with <i>Allocasuarina torulosa</i> , <i>A. littoralis</i> , <i>Lophostemon suaveolens</i> , <i>Acacia flavescens</i> , <i>Banksia aquilonia</i> and <i>Xanthorrhoea johnsonii</i> . Weathered soils and laterite of a remnant surface. (BVG1M: 9e)	Present in the centre of the property.	Suitable habitat for the Northern Greater Glider and Koala. Pre-clear extent = 6,000 ha; 2017 extent = 5,000 ha
7.5.4b OC/OC	10.1 ha	<i>Corymbia intermedia</i> , <i>Allocasuarina torulosa</i> , <i>Lophostemon suaveolens</i> woodland and open forest. Laterite. (BVG1M: 9e)	Well represented in the western and central sections of the property.	Suitable habitat for the Northern Greater Glider and Koala. Pre-clear extent= 6,000 ha; 2017 extent = 5,000 ha

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
7.5.4c OC/OC	11.7 ha	<i>Corymbia intermedia</i> +/- <i>Eucalyptus tereticornis</i> , +/- <i>Lophostemon suaveolens</i> open forest to low open forest with <i>Allocasuarina torulosa</i> , <i>A. littoralis</i> , <i>Acacia flavescens</i> and <i>Banksia aquilonia</i> . Deep weathered soils of basalt origin. (BVG1M: 9e)	Well represented in the western end of the property.	Suitable habitat for the Northern Greater Glider and Koala. Pre-clear extent = 6,000 ha; 2017 extent = 5,000 ha
7.5.4f OC/OC	0.2 ha	<i>Corymbia intermedia</i> , <i>Allocasuarina torulosa</i> , <i>Lophostemon suaveolens</i> open forest and woodland. Deep weathered soils of basalt origin. (BVG1M: 9e)	Located in the central north sections of the property.	Suitable habitat for the Northern Greater Glider and Koala. Pre-clear extent = 6,000 ha; 2017 extent = 5,000 ha
Wet Tropics Bioregion – Granite and Rhyolite Soils				
7.12.16 LC/NOC	0.0 ha	Simple to complex notophyll vine forest, including small areas of <i>Araucaria bidwillii</i> (Bunya pine). Uplands and highlands on granites and rhyolites, of the cloudy wet to moist rainfall zones. (BVG1M: 6b)	Sheltered steep granite gullies within the central north of the property.	Habitat for regional endemics and threatened flora species. Suitable habitat for Southern Cassowary. Pre-clear extent = 242,000 ha; 2017 extent = 230,000 ha

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
7.12.21b LC/E	0 ha	<i>Eucalyptus grandis</i> tall open forest and woodland with a well-developed vine forest understorey. Granites and rhyolites. (BVG1M: 8a)	Located within a single sheltered gully in the central north of the property.	Habitat for arboreal mammals including Northern Greater Glider and Yellow-bellied Glider. Suitable feeding habitat for the EPBC listed Endangered Spectacled flying-fox. Habitat for plant species of limited distribution including <i>Bertya polystigma</i> , <i>Pityrodia salviifolia</i> , <i>Pomaderris argyrophylla</i> , <i>Dodonaea uncinata</i> , <i>Phebalium longifolium</i> and <i>Persoonia tropica</i> . Pre-clear extent = 16,000 ha; 2017 extent = 16,000 ha
7.12.29a LC/NOC	0.5 ha	<i>Corymbia intermedia</i> , <i>Eucalyptus tereticornis</i> , <i>E. drepanophylla</i> open forest to low open forest and woodland with <i>Allocasuarina torulosa</i> , <i>A. littoralis</i> , <i>Lophostemon suaveolens</i> , <i>Acacia cincinnata</i> , <i>A. flavescens</i> , <i>Banksia aquilonia</i> and <i>Xanthorrhoea johnsonii</i> . Uplands, on granite and rhyolite. (BVG1M: 9c)	Located within a single hill slope in the central north of the site. May occur as a minor component within extensive sections of 7.12.29b in the east of the property where <i>E. tereticornis</i> was occasionally present as a canopy component.	Potential habitat for NCA listed species: <i>Corybas cerasinus</i> and <i>Dodonaea uncinata</i> . Pre-clear extent = 88,000 ha; 2017 extent = 87,000 ha

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
7.12.29b LC/NOC	33.1 ha	<i>Corymbia intermedia</i> , <i>Allocasuarina torulosa</i> , <i>Lophostemon suaveolens</i> open forest and woodland. Uplands, of the moist rainfall zone, on granite and rhyolite. (BVG1M: 9c)	Dominates the eastern and central portions of the property. Present in small pockets in the north west.	Potential habitat for NCA listed species: <i>Corybas cerasinus</i> and <i>Dodonaea uncinata</i> . <i>Corymbia leptoloma</i> was confirmed to be present within this RE in the east of the site. Pre-clear extent = 88,000 ha; 2017 extent = 87,000ha
7.12.30a LC/NOC	14.6 ha	<i>Corymbia citriodora</i> , <i>Eucalyptus portuensis</i> , <i>C. intermedia</i> , <i>Syncarpia glomulifera</i> woodland to low woodland to open forest with <i>Callitris intratropica</i> , <i>Acacia calyculata</i> and <i>Xanthorrhoea johnsonii</i> . Uplands and highlands, of the moist and dry rainfall zones. (BVG1M: 10b)	Dominates the eastern and central portions of the property. Present in small pockets in the north west in slightly less sheltered locations to 7.12.29b.	Potential habitat for NCA listed species: <i>Acacia longipedunculata</i> , <i>Acacia purpureopetala</i> , <i>Acacia tingoorensis</i> , <i>Corymbia rhodops</i> , <i>Diuris oporina</i> , <i>Dodonaea uncinata</i> , <i>Grevillea glossadenia</i> , <i>Homoranthus porteri</i> , <i>Melaleuca sylvana</i> , <i>Micromyrtus delicata</i> . Potential habitat for the EPBC listed Endangered Northern Quoll, Northern Greater Glider and <i>Corymbia leptoloma</i> # Pre-clear extent = 43,000 ha; 2017 extent = 43,000ha

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
7.12.34 LC/NOC	5.8 ha	<i>Eucalyptus portuensis</i> (white mahogany) and/or <i>E. drepanophylla</i> (ironbark), +/- <i>C. intermedia</i> (pink bloodwood) +/- <i>C. citriodora</i> (lemon-scented gum), +/- <i>E. granitica</i> (granite ironbark) open woodland to open forest. Uplands on granite, of the dry rainfall zone. (BVG1M: 9d)	Present occasionally on exposed west facing granite ridge lines in the central and eastern sections of the site.	Potential habitat for NCA listed species: <i>Acacia longipedunculata</i> , <i>Calochlaena villosa</i> , <i>Croton densivestitus</i> , <i>Grevillea glossadenia</i> , <i>Homoranthus porteri</i> , <i>Plectranthus amoenus</i> , <i>Solanum angustum</i> , <i>Zieria obovata</i> . Pre-clear extent = 52,000 ha; 2017 extent = 51,000 ha
7.12.61a LC/OC	0.0 ha	<i>Eucalyptus tereticornis</i> , <i>Corymbia intermedia</i> , <i>E. reducta</i> , tall open forests and tall woodland with <i>Allocasuarina torulosa</i> . Uplands and highlands on granite and rhyolite, of the moist rainfall zone. (BVG1M: 9c)	Present in the south east of the property on high ridge lines.	Potential habitat for NCA listed species: <i>Arthraxon hispidus</i> , <i>Cucumis costatus</i> , <i>Dendrobium bigibbum</i> , <i>Dendrobium johannis</i> , <i>Dodonaea uncinata</i> , <i>Plectranthus gratus</i> . Pre-clear extent = 26,000 ha; 2017 extent = 25,000 ha <i>Corymbia leptoloma</i>
7.12.65b LC/OC	0.0 ha	Rock pavement communities of the dry rainfall zone with <i>Acacia leptostachya</i> , <i>Eucalyptus lockyeri</i> subsp. <i>exuta</i> , <i>Lophostemon confertus</i> , <i>L. suaveolens</i> , <i>Persoonia falcata</i> , <i>Ficus rubiginosa</i> and <i>Allocasuarina inophloia</i> . Far northern areas including Adeline Creek. (BVG1M: 29b)	Within exposed rhyolite outcrops and major creek lines in the east of the property.	Potential habitat for NCA listed species: <i>Homoranthus porteri</i> , <i>Corymbia leptoloma</i> #, <i>Corymbia rhodops</i> , <i>Diuris oporina</i> , <i>Dodonaea uncinata</i> , <i>Grevillea glossadenia</i> . Potential denning habitat for the Northern Quoll where complex boulder piles are present. Pre-clear extent = 16,000 ha; 2017 extent = 16,000 ha

RE & Status ¹	Area ²	Description (REDD Ver 11.1 ³)	Location	Site Value ⁴
7.12.66b OC/OC	0.1 ha	<i>Lophostemon confertus</i> shrubland. Exposed rocky slopes on granite and rhyolite. (BVG1M: 28e)	Within elevated and exposed ridgelines on rhyolite pavement in the east of the property. A minor extent occurs in the north west of the property.	Provides a structurally complex shrub layer element contrasting that present within all other representative vegetation communities present on site. Pre-clear extent = 5,000 ha; 2017 extent = 5,000 ha
7.12.66d OC/OC	0.0 ha	<i>Lophostemon confertus</i> shrubland. Exposed rocky slopes on granite and rhyolite. (BVG1M: 28e)	Within elevated and exposed ridgelines on rhyolite pavement in the east of the site. A minor extent occurs in the north west of the property.	Provides a structurally complex shrub layer element contrasting that present within all other representative vegetation communities present on site. Pre-clear extent = 5,000 ha; 2017 extent = 5,000 ha

¹ VMA status/Biodiversity status: E=endangered, OC=of concern, LC=least concern (VMA only), NC=not of concern at present (biodiversity only). REs with a letter postfix are a sub-unit of the main RE e.g. 7.12.66b is sub-unit 'a' of RE 7.12.66 and has the same VMA and Biodiversity status as the main RE.

² Area proposed to be cleared. This is represented in hectares and is post RE ground truthing and remapping (4 Elements, 2020).

³ Regional Ecosystem Description Database version 11.1. (Department of Environment and Science, 2019).

⁴ Pre-clear and 2017 RE extents are from Regional Ecosystem Description Database version 11.1. (Department of Environment and Science, 2020).

Confirmed present within the project area during this survey (but not necessarily within that nominated RE).

6.3.1 Significant Impact on Of Concern Regional Ecosystem 7.5.1b

Based on the current alignment design, the total area of remnant vegetation to be cleared is approximately 94.1 ha (**Table 14**). These statistics indicate that only one RE has more than one percent of its entire 2017 remnant extent on site - the of concern RE 7.5.1b, described as *Eucalyptus tereticornis*, *E. drepanophylla*, *E. portuensis*, *Corymbia intermedia*, *C. tessellaris*, *Allocasuarina torulosa*, *Angophora floribunda* woodland to low woodland on deep weathered soils of uplands. This RE is mapped primarily along the western end of the project site. Despite this RE retaining 75% of its pre-clear area as of 2017, it is listed as of concern under the VM Act as the pre-clearing extent was 600 ha (i.e. less than 10,000 ha – (footnotes **Table 14**). A total of 1.30% of RE 7.5.1b is within the current proposed clearing area (8.2 ha). However, it should be noted that this RE was not mapped in the project site in the v 11.1 REDD mapping (on which the 2017 remnant area statistic is based). The entire 244.9 ha of this RE mapped within the project site was mapped as a result of this survey. Therefore, it is 'additional' to the 600-ha figure. Calculating the total clearance area as a proportion of 844.9 ha current total extent the percentage proposed to be cleared is less than 1%. It is expected that once a detailed access road alignment is designed by utilising all existing internal tracks for access tracks to turbine pads, with more detailed micro-siting the clearing area can be minimalised significantly from this current figure. On the assumption that the use of existing roads can be maximised within this RE, the impact of clearing RE 7.5.1b is likely to be well below the 1% threshold.

Table 14 Proposed Clearance Impact to Regional Ecosystems

RE	VM Act Status ¹	Biodiversity Status	2017 Extent ²	Proposed Clearance Area ³	Clearance % of 2017 Extent
11.12.13	Least Concern	No Concern at Present	43,000 ha	0.6 ha	0.00%
7.3.8	Least Concern	Endangered	15,000 ha	0.00 ha	0.00%
7.3.39	Of Concern	Endangered	1,000 ha	1.04 ha	0.10%
7.3.43	Of Concern	Endangered	2,000 ha	0.00 ha	0.00%
7.5.1	Of Concern	Endangered	600 ha	8.2 ha	#1.30%
7.5.3	Of Concern	Endangered	300 ha	0.00 ha	0.00%
7.5.4	Of Concern	Endangered	5000 ha	31.2 ha	0.62%
7.12.16	Least Concern	No Concern at Present	230,000 ha	0.00 ha	0.00%
7.12.21	Least Concern	Endangered	16,000ha	0.000 ha	0.00%
7.12.29	Least Concern	No Concern at Present	87,000 ha	33.6 ha	0.04%
7.12.30	Least Concern	No Concern at Present	43,000 ha	14.6 ha	0.03%
7.12.34	Least Concern	No Concern at Present	51,000 ha	5.8 ha	0.01%
7.12.61	Least Concern	Of Concern	25,000 ha	0.00 ha	0.00%
7.12.65	Least Concern	Of Concern	16,000 ha	0.00 ha	0.00%
7.12.66	Of Concern	Of Concern	5,000ha	0.1 ha	0.00%

¹ Least concern – >30% pre-clear extent remains and extent is >10, 000ha;

Of concern – 10-30% of pre-clear extent of an RE remains unaffected by moderate degradation &/or biodiversity loss; extent is < 10,000ha. Or >30% remains but extent is <10,000ha.

Endangered – <10% pre-clear extent remains, or extent remaining is 10-30% and <10,000ha, or <1000ha is the pre-clear natural extent and there is an identified threatening process.

² from regional ecosystem description database (REDD v11.1) (Department of Environment and Science, 2020).

³ These statistics are based on the ground-truthed RE mapping produced for this survey, not official v.11.1 REDD mapping. Represent the entire proposed clearance for each regional ecosystem present on the project site

#Note that the entire 244.9 ha of this RE mapped within the project site was mapped as a result of this survey. Therefore, it is 'additional' to the 600-ha (2017 Clearing extent) figure. Calculating the total clearance area as a proportion of 844.9 ha current total extent the percentage proposed to be cleared is less than 1%.

6.4 Threatened Flora

A single threatened species was detected during the vegetation survey. The likelihood of occurrence of all other potential threatened species are assessed individually within **Appendix I**. A full species list is found in **Appendix H**.

6.4.1 *Corymbia leptoloma* – Vulnerable EPBC Act 1999, NC Act 1992.

Corymbia leptoloma is a member of the Myrtaceae family. It has a narrow distribution being restricted to the western slopes of the Paluma Range between Breakaway Road near Mt Fox and Hervey Range Road, ~80km west of Townsville (DAWE, 2020). The records collected for this species present a minor range extension for this species. The nearest previous record was slightly north of Breakaway Road approximately 6 km to the east of the study site.

Corymbia leptoloma is a medium sized tree with a single trunk to a height of 20 m. The bark is rough with a layered and flakey texture similar to that of the closely related *Corymbia leichhardtii* or *Lophostemon suaveolens* as another example. The inner bark is brightly yellow which can be seen under recently shed bark or by peeling back a thin layer. The leaves are strongly discoloured being a dark glossy green on the upper side and paler green below. This gives a relatively distinct appearance from the sympatrically occurring and close relative *C. leichhardtii*.

Where present on the study site *C. leptoloma* occurs as a common component of the canopy layer within Eucalypt open forest and woodland. Throughout its distributional range, it is known to occur within both wet and dry sclerophyll forests on well drained sandy soils derived of granite and rhyolite material.

This species was recorded at the far east of the study site, on land zone 12 and within several regional ecosystems (**Plates 9 and 10**). These included;

- ▶ RE 7.12.30a: *Corymbia citriodora*, *Eucalyptus portuensis* and *C. intermedia* open forest on granite and rhyolite.
- ▶ RE 7.12.29a/b: *Corymbia intermedia*, *Eucalyptus tereticornis* and *E. drepanophylla* open forest on granite and rhyolite.
- ▶ RE 7.12.65b: *Acacia leptostachya*, *Eucalyptus lockyeri* subsp. *exuta*, *Lophostemon confertus* rock pavement communities of the dry rainfall zone.
- ▶ RE 7.12.66b *Lophostemon confertus* low shrubland 2-3m in height with emergent *Eucalyptus drepanophylla*, *C. intermedia* and *C. leptoloma* on elevated rhyolite rock pavements.

Most individuals were located in positions containing a high proportion of surface rock boulders and pavements which would likely provide some element of fire refugia (limiting fire intensity). Despite this, many individuals were noted to have been burned within the past 5 years indicated by the presence of fire scars (<2 m in height).

This species was not observed in flower at the time of survey. However, the canopy of many trees had retained fruits from the previous flowering event and recruitment of juvenile trees was readily observed.

6.4.1.1 *Significant Impact Assessment/Significant Residual Impact Assessment*

Corymbia leptoloma listed Vulnerable under the *EPBC 1999 and NC Act 1992*, is present within proposed turbine 12, 13 and 14 pads and associated access tracks. A pre-mitigation significant impact is likely. It will however be feasible to avoid many impacts to this species given it is a canopy species of open forest and woodland communities distributed widely in the east of the project site (refer **Figure 14**). Refer to **Section 9** for SIA AND SRI of *Corymbia leptoloma* species.

6.4.1.2 *Extent of Distribution*

To determine the potential habitat clearance for *C. leptoloma* the total extent of the relevant regional ecosystems has been reduced, with only those areas to the east of Ewan Road included (see above **Table 14**). No evidence of this species was recorded during the extensive vegetation community mapping undertaken for the MFEP Ecological Assessment (4 Elements 2021). The current potential extent for *C. leptoloma* is provided below (**Figure 14**).

6.4.1.3 *Corymbia leptoloma Mitigation Options*

Impacts can be minimised by micro-siting in association with a comprehensive population survey that maps the locations of individuals and population clusters. This species is considered a likely candidate for translocation as a method of mitigating significant population impacts. This could be confirmed through the collection of seed within the project site for use in nursery propagation trials. It is expected that the propagation success would be similar to that of the closely related and sympatrically occurring *C. leichhardtii*. This species has been successfully propagated and established into revegetation plots on other projects within the wet tropics bioregion by the report co-author (R. Hughes). It is expected that potential rehabilitation areas may be utilised for establishing these plants where feasible. It is also expected that there would be numerous opportunities to establish nursery grown individuals within suitable remnant woodland habitats (see **Section 5.3**. above for listed Regional Ecosystems). These options should be researched as a method of mitigating impacts on this significant population.



Plate 9 Mature *Corymbia leptoloma* growing as a common canopy component in open forest on well drained granite soils. Distinctive glossy green foliage is visible.



Plate 10 The distinctive flaking yellow bark of *Corymbia leptoloma*. The outer exposed grey layer has been lightly peeled away to reveal the distinctive colouration.