LACOUR

Biodiversity Offset Strategy

CLARKE CREEK WIND FARM PROJECT

DECEMBER 2017

Green Tape Solutions

Quality, Integrity, Experience

ngh environmental

Document Verification

Project Title: Clarke Creek Wind Farm Project

Project Number:	17-035 – Clarke Creek Windfarm
Project File Name:	Biodiversity Offset Strategy

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
	29/06/17	GTS & Sam Patmore	James Townsend	
	6/07/17	Kelly Matthews from GTS	James Townsend	
	12/12/17	Kelly Matthews from GTS and Sam Patmore from NGH		

NGH Environmental Pty Ltd (ACN: 124 444 622. ABN: 31 124 444 622) and NGH Environmental (Heritage) Pty Ltd (ACN: 603 938 549. ABN: 62 603 938 549) are part of the NGH Environmental Group of Companies.

www.nghenvironmental.com.au

e: ngh@nghenvironmental.com.au

Bega - ACT and South East NSW
suite 1, 216 carp st (po box 470)
bega nsw 2550 (t 02 6492 8333)

Sydney Region
18/21 mary st
surry hills nsw 2010 (t 02 8202 8333)

Canberra - NSW SE & ACT
8/27 yallourn st (po box 62)
fyshwick act 2609 (t 02 6280 5053)

Brisbane
8 trawalla st
the gap qld 4061 (t 07 3511 0238)

Newcastle - Hunter and North Coast
7/11 union st
newcastle west nsw 2302 (t 02 4929 2301)

Wagga Wagga - Riverina and Western NSW
suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 (t 02 6971 9696)

Bathurst - Central West and Orana
35 morrisset st (po box 434)
bathurst nsw 2795 (t 02 6331 4541)

CONTENTS

TABLES

1 INTRODUCTION

1.1 BACKGROUND AND PROJECT DESCRIPTION

The Clarke Creek Wind Farm project proposes the development of wind turbines and associated infrastructure to be developed within the locality of Clarke Creek, approximately 150 kilometres North-West of Rockhampton in Central Queensland. The region is dominated by agricultural activities (primarily beef cattle production), and large areas of the landscape are extensively cleared, although areas of remnant and regrowth native vegetation are also present in the Clarke Creek area.

NGH Environmental were commissioned by Lacour Energy to undertake a detailed biodiversity (flora and fauna) assessment of the proposed wind farm site to identify potential constraints and opportunities associated with the development of a wind farm project at the site, and subsequently to prepare an impact assessment report to support the eventual submission of a development application for the project.

The project is located over 11 lots with a total area of the Lots of 76,300 Hectares (as defined by the lot boundaries of the involved landholders).

To date, a detailed field survey program was undertaken in March and September of 2017 to document existing vegetation communities, ground-proofing current State Regional Ecosystem mapping, and to document fauna habitat types and communities, including conducting targeted surveys for listed threatened fauna species. The proposed development was found to have the potential to result in a significant impact to some of these species habitat and vegetation communities. A full description of the site investigation methods, results, potential impacts and mitigation measures are provided in the Ecological Assessment report and included with the Referral submission made to the Commonwealth Department of the Environment and Energy (DotEE) under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This report provides summary details of the project impacts and proposed offset measures to compensate for the loss of habitat for identified Matters of National Environmental Significance (MNES), being listed threatened species and ecological communities as described below.

1.2 PURPOSE OF THIS REPORT

This Biodiversity Offset Strategy (BOS) aims to:

- Describe the offset obligation of the Project, being unavoidable impacts on or occurring as a result of the Clarke Creek Wind Farm Project; and,
- Calculate and define suitable offset area(s) for the project.

Note, this version of the BOS has been prepared to facilitate consultation with the Commonwealth Government on offsetting requirements for the Clarke Creek Wind Farm project, including methods by which the offsetting requirement will be calculated and determined, as well as offsetting strategies. At this point in time, an offset site has not been formally selected, and accordingly, the description of management, monitoring and reporting frameworks for an offset site has not been provided in his report. However, we note that the project area contains extensive patches of habitat that may be suitable for offsetting purposes, and also, a number of potential offset sites have been preliminarily assessed as being potentially suitable. Details of these sites and the process by which these sites will be secured and managed will be included in a final offset management plan report following approval of the EPBC referral.

2 LEGISLATIVE REQUIREMENTS

2.1 BACKGROUND

Two offset policies apply to the Project, at the State and Commonwealth levels. The offset requirements for the Project and applicable policy have been assessed within this Strategy.

The offset policies to be considered for the revised Project are:

- *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offset Policy 2012 (EPBC EOP)
- Queensland Biodiversity Offset Policy 2014 Version 1.1 (QBOP)

The impact on two Matters of National Environmental Significance (MNES) discussed in this report include Koala and Semi-Evergreen Vine Thicket (SEVT). These matters are also recognised as Matters of State Environmental Significance (MSES); however, as per the Environmental offset policy requirement, only offsets under the *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offset Policy 2012 (EPBC EOP) will be provided for these matters.

This policy and how it applies to the project is discussed in more detail below.

1.1.1 EPBC EOP

The following has been extracted from the EPBC EOP 2012.

The use of offsets to compensate for adverse impacts to heritage values is appropriate in some circumstances. In cases where offsetting of adverse impacts on heritage values is considered possible and appropriate, the principles of this policy apply with regard to determining what constitutes a suitable offset.

The EPBC Act environmental offsets policy has five key aims, to:

1. ensure the efficient, effective, timely, transparent, proportionate, scientifically robust and reasonable use of offsets under the EPBC Act
2. provide proponents, the community and other stakeholders with greater certainty and guidance on how offsets are determined and when they may be considered under the EPBC Act
3. deliver improved environmental outcomes by consistently applying the policy
4. outline the appropriate nature and scale of offsets and how they are determined
5. provide guidance on acceptable delivery mechanisms for offsets.

Impacts on MNES must not occur until the holder of the project approval has provided a legally secured direct land based offset, or entered into a Deed of Agreement, with the administering authority for an offset transfer, consistent with the EPBC EOP requirements for reporting on progress of securing the offset.

3 ASSESSMENT OF THE RESIDUAL IMPACTS FOR KOALA

3.1 OVERVIEW OF PROJECT IMPACTS

As per the Environmental Offset Policy, an 'Avoid, Mitigate, Offset' framework was applied to the development. This means that, in designing the development, impacts on prescribed environmental matters were in the first place, avoided wherever possible.

Where impacts could not be avoided, there were carefully managed and minimised. Mitigation measures that will be put in place include:

- Management of potential operational and construction impacts including the retention of native vegetation in defined areas;
- Rehabilitation of riparian vegetation and movement corridors to prevent fragmentation of habitat;
- Presence of fauna spotter-catcher during operational works;
- Provision of suitable fauna management assets such as retention of large hollow-bearing trees and provision for the installation of nesting boxes to replace lost hollows;
- Re-location of structural elements such as hollow bearing logs to areas of vegetation to be retained outside of the development area prior to clearing; and
- The provision of weed management during the construction phase of the development.

Details of the impact assessment process and findings are outlined in the Ecological Assessment Report. The assessment concluded that residual (i.e. after avoidance and mitigation strategies have been applied) significant impacts would occur and accordingly, an offset would be required for impacts on MNES, which includes the clearing of up to 1,425.2 ha of koala habitat and up to 44.7 ha of SEVT TEC. This impact is based on the ground-truthed regional ecosystems (i.e. not on the existing Queensland State Regional Ecosystem mapping).

The Project is proposed over 11 freehold lots with a total area of the lots of approximately 76,300 ha.

The Project construction may be:

- completed in its entirety during one construction period of around 30 months, or
- staggered to construct the project progressively in two or more stages over a 36 month period, or
- staggered over a longer period, where some stages of the wind farm are operational for a period of time, and the balance of the project is completed at some point in the future.

The detailed design stage, where the wind turbine make and model selected will be completed and informed by future work on wind energy modelling from existing onsite monitoring masts, geotechnical investigations, ecological constraints, network capacity connection constraints, and the market for renewable energy.

The Project infrastructure is comprised of linear, non-linear and temporary infrastructure. The overall footprint of the infrastructure is determined by the final wind farm design and design of roads, cabling and overhead lines. To accommodate these various scales and stages of the wind farm, various optional infrastructure has been included within the Project (e.g. several substation locations are included). A

maximum Project is described, within which the Project will be accommodated. The Project layout has been developed to avoid, where possible, and reduce impacts on known environmental constraints.

To accommodate on site constraints, the wind turbines, as well as the required supporting infrastructure (roads, powerlines and underground cables),may move up to 200 metres (m) from their proposed location (known as micro-siting).

In the final design, the clearing areas will not exceed clearing of up to 1,425.2 ha of koala habitat and up to 44.7 ha of SEVT.

Post construction, the areas cleared to create batters and corners will be rehabilitated providing that always roads are maintained and need to remain passable for large turbine loads in the event of a blade replacement during operation. The area for rehabilitation is dependent on the final design.

A more detailed assessment of residual impacts for each identified MNES is provided in the following section.

3.2 ASSESSMENT AGAINST THE EPBC ACT REFERRAL SIGNIFICANT IMPACT GUIDELINES 1.1 (KOALA)

As described by the EPBC Act Referral Guidelines (DotE, 2014), an *e*valuation of the nine significant impact criteria is required to identify the residual impact of an action on koala. The referral guideline states that an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of an important population of a species;
- Reduce the area of occupancy of an important population;
- Fragment an existing important population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of an important population;
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- Introduce disease that may cause the species to decline; or,
- Interfere substantially with the recovery of the species.

The following sections assess the Project's impact against each significant impact criteria.

3.2.1 Assessment of the Project's Impact on the Size of Koala Population

The concept of 'important population' for koala is not defined in the EPBC Act Referral Guidelines for the Vulnerable Koala (DotE, 2014) and, therefore, cannot be addressed in this assessment.

The Spot Assessment Technique (SAT) assessment provides an accurate measurement of relative koala abundance in the project area. The SAT was used with the project area to determine the density of koala population within the project area. A total of 14 SAT transects were undertaken across the project. The

presence of Koala was confirmed across 12 transects either through direct sighting or presence of scats. **Table 1** summarises the results of the SAT assessments.

Table 1 Koala Survey SAT Results

Transect	Average no. trees with pellets/30 trees	Average Activity	Vegetation Community	Sign of Use	Level of Use (refer to Table 6)
1	4	13	Good condition *E. Crebra* open woodland / remnant vegetation	Koala and Scats	High Use
2	4	13	Good condition *E. Crebra* open woodland / remnant vegetation	Koala, Scats and Scratch marks	High Use
3	7	23	Good condition riparian vegetation community	Scats and Scratch marks	High Use
4	3	10	Good condition *E. Crebra* open woodland / remnant vegetation	Scats and Scratch marks, Sighting of one Koala	Medium Use
5	5	16	Good condition *E. Crebra* open woodland / remnant vegetation	Koala, Scats and Scratch marks	High Use
6	4	13	Good condition *E. Crebra* open woodland / remnant vegetation	Scats and Scratch marks	High Use
7	4	13	Good condition *E. Crebra* open woodland / remnant vegetation	Scats and Scratch marks	High Use
8	5	16	Good condition *E. Crebra* open woodland / remnant vegetation	Scats and Scratch marks	High Use
9	9	30	Good condition riparian vegetation community	Scats and Scratch marks	High Use
10	4	13	Good condition *E. Crebra* open woodland / remnant vegetation	Scats and Scratch marks	High Use
11	0	0	Pasture with scarce *Eucalyptus species*	Nil	Low Use
12	0	0	Pasture with scarce *Eucalyptus species*	Nil	Low Use
13	3	10	Average condition *E. Crebra* open woodland / remnant vegetation	Scats and Scratch marks	Medium Use
14	7	23	Good condition riparian vegetation community	Scats and Scratch marks	High Use

Three categories of Koala activity have been defined across three regions in eastern Australia (Phillips and Callaghan, 2011) as presented in **Table 2**. For the East Coast (where the density of Koala is considered low compare to other region), in which the project area site belongs, Low use is defined as having an activity level below 3.33%, medium use is defined as being greater than 3.33% but below 12.59% and high use is defined as being an activity level above 12.59%.

Table 2 Segregation of Koala Activity into Low, Medium (normal) and High Use Categories (Philips and Callaghan, 2011)

Activity Category Area (density)	Low Use	Medium (Normal) Use	High Use
East Coast (low)	**-**	**≥3.33% but ≤12.59%**	**>12.59%**
East Coast (med – high)	<22.52%	≥22.52 but ≤32.84%	>32.84%
Western Plains (med – high)	<35.84%	≥35.84% but ≤46.72%	>46.72%

The assessment of the results in **Table 1** revealed that Koala activities appears to be higher within the riparian vegetation community. However, the overall number of Koala found across the site is significant for this bioregion. Based on these results, all vegetation containing non-juvenile Koala trees within the project areas is assessed as having high use for Koala. Due to the lack of vegetation and lack of evidence of use, the grassland and open paddock section is considered to have low activities and are excluded from the impacted area.

The project area (defined by the property/lot boundaries of the involved landholders) is estimated as having approximately 39,560 ha of suitable koala habitat. An estimated maximum clearing extent of up to 1,425.19 ha of Koala habitat is expected as a consequence of the proposal. This will result in a loss of less than 4% of the area available within the project area. Large areas of good quality and refugia habitat will be retained, which will be capable of supporting the existing koala population. Additionally, the project is located at the edge of a much larger and well-connected koala habitat in the local region. Post-construction and rehabilitation, the access roads within the site are likely to be between 6 – 15 metres in width, and all users of the roads (restricted to only authorised staff, with no public access allowed) will be required to adhere to strict speed limits. In general, these roads are expected to have very low operational traffic volumes.

Given this, the proposed clearing is considered likely to result in only minimal long-term impacts on the local koala population, and accordingly, would not lead to a long-term decrease in the size of a koala population living in the project area.

3.2.2 Assessment of the Project's Impact on the Area of Occupancy

While some sections of the project area contain vegetation for which evidence of koala were not found, 12 SAT transect out of 14 undertaken revealed the presence of koala. Clearing activities associated with the Project will occur within existing disturbed areas as well as within riparian vegetation and within good quality Koala habitat (Eucalyptus woodland). The surveys have demonstrated that some clearing will directly impact on vegetation in which koalas were sighted. Provision will be made to minimise impacts on koala as much as possible. For instance, the impact of construction activities (e.g. noise, light, dust) on

occupied areas will be minimised be through the implementation of the Environmental Management Plan. Further, with the current design, a total of up to 811.25 ha of disturbed land (including 800.87 ha of *Eucalyptus crebra* vegetation community and up to 10.38 ha of riparian vegetation) will be directly rehabilitated around the infrastructure, roads and hardstand areas. The rehabilitation work will include the use of preferred Koala food tree species and will minimise the overall residual impact by reinstating some of the habitat loss as part of the project. While the final residual impact is still considered significant for Koala, the rehabilitation of up to 811.25ha of Koala habitat is used in the EPBC offset calculation as detailed in **Section 5.2.2**. Other measures such as restricting the work during daylight periods, where possible, will be implemented. The final area available for rehabilitation is depended on the scale of the project or stage of project and subject to the final design.

Notwithstanding the above mitigation measures, the clearing of koala habitat cannot be fully avoided and accordingly, a biodiversity offset will be provided to compensate the loss of this habitat. The offset site(s) will, at a minimum, match the quality of the habitat impacted by the proposed action, and managed and resourced over a defined period of time so that its habitat quality is maintained or improved to meet the habitat quality requirements for the offset site.

3.2.3 Assessment of the Project's Impact on Koala Habitat Fragmentation

Fragmentation from agriculture practices and rural land use is already present within and surrounding the project area. However, large remnant vegetation patches occur within the project area and the vegetation is well connected to more than 500 ha of suitable vegetation for koala.

The Project will result in localised losses of habitat from the construction of future roads which may introduce new barriers to koala movement. However, traffic on the road will mainly occur during the construction stage of the wind farm and will be limited during the operation stage.

Connectivity for koala will not be compromised in the project area. The impact of vehicles on the koala within the project area can be mitigated and managed through measures.

Considering the above, it is unlikely that the Project would further contribute to fragmentation of the existing population of koala.

3.2.4 Assessment of the Koala Habitat Affected by the Project

The Koala Habitat Assessment Tool in Table 4.3 of the EPBC Act Referral Guidelines for the Vulnerable koala (DotE, 2014) assists in determining the sensitivity, value and quality of the impact area and, therefore, assist in identifying whether the project area contains Habitat Critical to the Survival of the Koala (DotE, 2014).

The habitat assessment tool categorises five primary koala habitat attributes: koala occurrence, vegetation composition, habitat connectivity, existing threats and recovery value. Each habitat attribute is scored between zero and two and the scores are added together to give a total out of 10, providing an indication of the overall value of habitat in the impact area.

The assessment of the Project's koala habitat against the EPBC referral guidelines for the Vulnerable koala is provided in table 3.

Table 3 Segregation of Koala Activity into Low, Medium (normal) and High Use Categories (Philips and Callaghan, 2011)

Attributes	Score	Coastal	Assessment within the Project Area
Koala Occurrence	+2 (High)	Evidence of one or more koalas within the last 2 years.	2 A number of koalas were sighted on site during the first seasonal survey (March 2017)and again during the second field survey (September 2017).
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.	
	0 (low)	None of the above	
Vegetation composition	+2 (High)	Has forest or woodland with 2 or more known koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	2 The project area contains woodland with two (2) or more known koala food tree species.
	+1 (medium)	Has forest or woodland with only 1 species of known koala food tree present.	
	0 (low)	None of the above	
Habitat connectivity	+2 (High)	Area is part of a contiguous landscape ≥ 500 ha.	2 Area is part of a contiguous landscape ≥ 500 ha with limited roads and infrastructure existing on site.
	+1 (medium)	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.	
	0 (low)	None of the above.	
Key existing threats	+2 (High)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	2 Little or no evidence of koala mortality from vehicle strike or dog attack.
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, OR Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, OR Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	

Recovery value	+2 (High)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	1 There is currently no interim recovery plan for Koalas. Therefore, it is uncertain that the habitat is important for achieving the recovery of koala.
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	
Total			**9**

According to the EPBC Act Referral Guidelines for the Vulnerable Koala (DotE, 2014), impact areas that score five or more using the habitat assessment tool for the koala contain habitat critical to the survival of the koala. Impact areas that score four or less using the koala habitat assessment tool do not contain habitat critical to the survival of the koala.

The assessment above reveals that the project area scores a total of nine (9) using the Koala Habitat Assessment Tool. Consequently, most of the remnant vegetation on site is considered habitat critical to the survival of koala. This area of habitat is estimated at 39,560 ha (total area of Eucalyptus woodland and riparian vegetation) within the project area. The clearing of 1,425.19 ha critical habitat for koala would result in a reduction of less than 4% of suitable habitat in the project area. In the context of the broader landscape which is likely to support koala habitat over a much more extensive area beyond the site, this clearing is considered insignificant.

As explained previously, much of the clearing will be linear, involving the removal of strips of vegetation along the proposed roads and turbines, leaving the core habitat largely intact, which will maintain sufficient habitat to support the existing population in the longer term. Moreover, areas of habitat to be cleared contain a low to medium abundance and diversity of koala food trees and limited dense understorey. The adverse effect on this habitat is considered to have minimal impact within the context of the surrounding landscape and the likely population density.

At both a regional and more localised level, it is unlikely that the removal of this vegetation will have a significant impact on the habitat critical to the survival of koala.

3.2.5 Assessment of the Impact of Project on the Breeding Cycle of Koala Population

Koalas are seasonal breeders, with peak births occurring in November and December and young gain independence at around 12 to 18 months of age (AMBS, 2012). The gender ratio in most populations is 1:1, but whiles 50% of all adult females can be expected to raise a young each year, only about a quarter of all adult males will produce young in any season (DotE, 2015).

The factors that govern koala dispersal, breeding and home-ranging include the social relationships between individuals, the size, density, and reproductive health of the population, and the proximity and connection to neighbouring populations (AMBS, 2012). In turn these factors depend on the tree species available locally, the tree size, the amount of plant secondary metabolites, the terrain, the soil, and the many components of successful water balancing (Moore and Foley, 2005). These factors vary from region

to region and from individual to individual, thereby resulting in different patterns of dispersal and home-range features in different areas.

Koalas can locate each other even at very low population densities (Moore and Foley, 2005). Melzer and Lamb (1994) considered that extremely low density populations appeared to be breeding well as long as connectivity between suitable habitat is maintained. This is confirmed by Thompson (2006), who recognised that block size, habitat fragmentation, connectivity and disturbance levels in nearby areas contribute to the quality of Koala habitat and therefore the breeding activity. The net migration into a breeding area is then critical.

As the project would not impact on the connectivity or result in habitat fragmentation relevant to koala, it is unlikely that the project will disrupt the breeding cycle of the local koala population.

3.2.6 Assessment of the Availability or Quality of Habitat Impacted by the Project

Critical koala habitat was identified within the project area using the results of habitat surveys. Transect and surveys were also undertaken randomly across the Project area to assess the quality of the koala habitat surrounding the project area. The result of this survey revealed that most of the vegetation is in low to good condition. Low quality areas are located where heavy grazing occurs and where there is currently little or no ground cover or shrub layers present. These areas are represented sparsely across the project area. Properties to the north of the project are generally in better good condition as grazing density is well managed across the landscape.

The removal of up to 1,425.19 ha will result in a decrease in the total area available for koala, however, as stated at least 96% of the total habitat area within the project area will be retained (with substantial areas of habitat available in adjacent lands bordering the site), and importantly, most of the good quality habitat for koala within the project area will still be available for koala following the project. While good connectivity between large remnant patches will remain and be available for the use by koala, the clearing will have some impact on sections of the koala habitat. Given these unavoidable impacts, an offset will be required to compensate the loss of vegetation and availability of suitable habitat.

3.2.7 Assessment of the Invasive Species Impact as a Result of the Project

The Project will not result in the introduction of invasive species within koala habitat. Mitigation measures will be provided in the Environmental Management Plan. Ongoing weed and pest monitoring will prevent weeds and pest species from increasing in density within the project area.

3.2.8 Assessment of the Potential for Introduction of Diseases to Koala

Chlamydia is harmless in populations with unlimited resources, but manifests in times of stress, which happens when habitat is reduced (AKF, 2016). The proposed clearing of vegetation may cause stress to existing koala located within the project area.

Mitigation measures will be put in place to reduce and manage the risk of disease for koala. Measures involving washing down vehicle and equipment that may carry vegetation pathogens known to affect koala food trees will be enforced. Quarantine and biosecurity procedures will be maintained throughout the life of the action's impact and a procedure will be in place for koalas which are found to be affected by disease.

Considering the project impacts and the proposed mitigation measures, the project is considered unlikely to facilitate the spread of or introduce disease or pathogens into habitat critical to the survival of the koala

which could otherwise significantly reduce the reproductive output of female koalas or reduce the carrying capacity of the habitat.

3.2.9 Assessment of the Project's Impact on the Recovery of the Koala

There is currently no interim recovery plan for koalas. Therefore, it is uncertain that the habitat is important for achieving the recovery of koala.

In 2008, New South Wales developed a recovery for koala (DECC, 2008). The plan outlines a series of threats for koala including habitat loss, habitat degradation, road kills, dog attack, logging and disease. It is considered that the Project would not significantly result in an increase of threats for koala.

As per the assessment provided in this report, it is unlikely that the Project will interfere substantially with the recovery of the species.

3.3 ASSESSMENT AGAINST THE EPBC ACT REFERRAL GUIDELINES FOR THE VULNERABLE KOALA

An assessment of the impact of the project on koala was also undertaken against the EPBC Act Referral Guidelines for the Vulnerable Koala (DotE, 2014), particularly Section 8.0 of the guidelines. Tables 5-9 of Section 8.0 of the guidelines are provided as reference in the following assessment.

3.3.1 Koala Fatalities due to Dog Attacks

The project will not result in the introduction of dogs into the koala habitat. This is consistent with the high effective mitigation measures outlined in Table 5 of the guidelines. Further, pest animal management measures will be implemented to monitor and control pest animals within the wind farm site. This will include measures to deal with feral dogs. Therefore, it is unlikely that the Project will increase koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that will result in multiple, ongoing mortalities.

3.3.2 Koala Fatalities due to Vehicle-Strikes

The project will result in the introduction of vehicles into area that currently see very little (almost no) vehicle traffic, however overall operational traffic volumes are expected to be minimal, and limited primarily to maintenance staff, with no public access allowed, and traffic speeds will be low and managed under an Operational Management Plan. This is consistent with the high effective mitigation measures outlined in Table 6 of the guidelines. Therefore, it is unlikely that the project will increase koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that will result in multiple, ongoing mortalities.

3.3.3 Introduction or Spread of Disease

Mitigation measures involving washing down vehicle and equipment during vegetation clearing and construction will be enforced, reducing any risk of disease spreading. A procedure will be in place for koalas which are found to be affected by disease (i.e. treatment prior to release) and quarantine and biosecurity procedures will be maintained throughout the life of the action's impact.

This is consistent with the high effective mitigation measures outlined in Table 7 of the guidelines. Therefore, it is unlikely that the Project will facilitate the introduction or spread of disease or pathogens to habitat critical to the survival of the koala, that will significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.

3.3.4 Barriers to Koala Movement

Some fragmentation from current agriculture practices and rural land use is already present within the project area. While the project will require the clearing of habitat for koala, the required infrastructure and roads will not create and continuous/ongoing threats to koala and are unlikely to create additional barriers to koala movement. Therefore, it is unlikely that the Project will create a major barrier to movement to, between or within habitat critical to the survival of the koala that will result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.

3.3.5 Hydrology of Habitat Critical to the Survival of the Koala

An Environmental Management Plan will be developed to address the requirements relating to water management and erosion and sediment control to meet the requirement outlined in Table 9 of the DotE Koala Guidelines.

This is consistent with the moderate effective mitigation measures outlined in Table 9 of the guidelines. Therefore, it is unlikely that the Project will change hydrology which degrade habitat critical to the survival of the koala the extent that the carrying capacity of the habitat is reduced in the long-term.

4 ASSESSMENT OF THE RESIDUAL IMPACTS FOR TEC

As described by the EPBC Act Referral Guidelines, any occurrence of critically endangered or endangered threatened ecological communities (TECs) were assessed according to the significant impact criteria to identify if the project would be likely to result in a significant impact to these matters. An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community;
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- Adversely affect habitat critical to the survival of an ecological community;
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
    - assisting invasive species, that are harmful to the listed ecological community, to become established, or
- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which can kill or inhibit the growth of species in the ecological community, or
- Interfere with the recovery of an ecological community.

The impact assessment (refer to Section 8.6 of the Ecological Assessment report, NGH 2017) revealed that a residual impact will occur on the *Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions* (SEVT) TEC. A summary of the assessment against each of the above criteria is provided below.

Given that a residual impact on the SEVT TEC is likely an offset will be required in accordance with the provisions of the EPBC Act. Refer to Section 5 for further on offsetting requirements and provisions.

4.1 REDUCE THE EXTENT OF AN ECOLOGICAL COMMUNITY

The project will remove up to 44.72 ha of SEVT TEC. There were no other TECs identified within the project area. Impacts on the TEC are limited to several small patches located on the top of hills. These patches occur within the proposed turbines or proposed roads.

Following the ground-truthed vegetation communities surveys, the total extent of the vegetation community representing the TEC within the project area equates to 3,719.3 ha. The proposed loss of 44.72 ha equates to a reduction of 1.2% of the community within the project area and is therefore considered

non-significant as it will not reduce the known extent of the SEVT TEC to the point where it would be placed at risk. No long-term net loss of the community would occur as a result of the project**.**

4.2 FRAGMENT OR INCREASE FRAGMENTATION OF AN ECOLOGICAL COMMUNITY

Several patches of SEVT TEC are proposed to be cleared. These patches are small (less than 5 ha in area). Most of these patches identified through both desktop assessment (DNRM mapping), ground-truthing and aerial photo interpretation which are in good condition and have not been disturbed.

These patches occur on rocky hills and gullies, on light clays on hillsides and the project will require the clearing of 44.72 ha of TEC located on top of hills, mainly clearing area on the edge of the SEVT patch. While this clearing will be a minor reduction in the size of the SEVT patch (of about 1%), it will not result in additional fragmentation.

4.3 ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF AN ECOLOGICAL COMMUNITY

The SEVT communities ranged in condition from 'Fair to Good' to 'Very Good to Excellent'. In areas where grazing pressure is reduced or excluded, the vegetation condition was 'Very Good' to 'Excellent', indicating a community where the vegetation structure is intact or nearly so, with weed minimal disturbance.

To the greatest extent possible the design process should seek to minimise further fragmentation of SEVT by positioning the project in the more highly disturbed components of the project area. Where the project intersects areas of SEVT, micro-siting will be used to minimise further fragmentation. For example, infrastructure could be moved outside of a remnant boundary or an infrastructure pathway (e.g. access track) could be aligned to minimise impact on significant ecological features.

The project is expected to remove a total of 44.72 ha of SEVT. However, as outlined in the previous section, the survey revealed the site covers a total of 3,719.3 ha of SEVT. This includes areas of Very Good to Excellent condition which will benefit the overall TEC within the region. The project will also reinstate up to 30.24ha of SEVT directly around the roads and infrastructures, where SEVT would be disturbed, reducing the overall residual impact. This area is used in the offset calculation and further details are included below. The final area available for rehabilitation is depended on the scale of the project or stage of project and subject to the final design.

By rehabilitating and offsetting a total of approximately 140 ha of suitable land and/or securing existing SEVT TEC through offset (detailed provided in Section 5), the proposed loss of 44.72 ha is therefore a not significant impact.

4.4 MODIFY OR DESTROY ABIOTIC (NON-LIVING) FACTORS NECESSARY FOR AN ECOLOGICAL COMMUNITY'S SURVIVAL

Both, abiotic and biological edge effects can occur as a result of the project. Abiotic edge effects are those that relate to changed environmental conditions along the edge of a project area and include changes to air moisture and temperature, solar radiation levels, soil moisture and temperature (Murcia, 1995). Other abiotic edge effects include changes to wind speed and pattern.

Biological edge effects involve changes in species abundance and distribution, either directly due to changed environmental conditions at the forest edge or indirectly through changes in species interactions such as pollination and seed dispersal (Murcia, 1995).

Clearing of native vegetation associated with the proposed action will increase the edge/area ratio within retained habitats. This is likely to render these edge areas more vulnerable to weed invasion, rubbish dumping, predation from exotic fauna and changes in light/wind regimes. These potential edge effects may ultimately result in changes to the condition and fitness of native vegetation communities present.

It is proposed that the loss of and potential edge effects on the TEC associated with the project will be offset by rehabilitating and protecting SEVT through either the rehabilitation of suitable area and/or the management of existing unmapped SETV TEC patches within the project area through an offset site. Additional mitigation measures have also been included to directly manage and prevent associated impacts resulting from potential edge effects. No long-term net loss of the community would occur as a result of the project.

4.5 CAUSE A SUBSTANTIAL CHANGE IN THE SPECIES COMPOSITION OF AN OCCURRENCE OF AN ECOLOGICAL COMMUNITY

Mitigation measures involving washing down vehicle and equipment during vegetation clearing and construction will be enforced, reducing any risk of weed spreading. A quarantine and biosecurity procedures will be maintained throughout the life of the action's impact.

There will be no It is proposed that the loss of the TEC associated with the project will offset by rehabilitating and protecting a total of approximately 140 ha SEVT through either the rehabilitation of suitable land around infrastructure and/or securing this land through an offset site comprising existing unmapped SETV TEC patches within the project area. Based on this, no long-term net loss of the community is expected to occur as a result of the project.

4.6 CAUSE A SUBSTANTIAL REDUCTION IN THE QUALITY OR INTEGRITY OF AN OCCURRENCE OF AN ECOLOGICAL COMMUNITY

Several patches of SEVT TEC are proposed to be partially cleared to facilitate the construction of turbines and roads. As the patches are generally small, the clearing may have some impacts on the quality and integrity of the SEVT. However, it is proposed that the loss of the SEVT TEC associated with the project will be offset through the management and/or rehabilitation of approximately 140 ha of suitable land within the project area. No long-term net loss of the community would occur as a result of the project. Potential offsets are discussed in detail in **Section 5**.

5 OFFSET CALCULATION

5.1 COMPLIANCE WITH OFFSET PRINCIPLES

The '*EPBC Act 1999* Environmental Offsets Policy' (DSEWPaC, 2012) outlines a set of principles that a proposed offset must meet in order to be assessed under the referral process. An assessment of how the proposed offset site is consistent with the offset policy is provided in **Table 4**.

Table 4 Consistency of proposed offset approach with the principles of the EPBC Act Environmental Offset Policy

No	EPBC Act Offset Principles (DoE, 2012)	Project Compliance
1	Must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The project will result in the loss of 1,425.19 ha of critical habitat for koala and 44.72 ha of SEVT TEC. The final selected offset sites will be chosen on their suitability to protect land which currently contains suitable (core) habitat for koala and TEC, and which is not specifically protected under the Council or State legislation. Overall conservation outcomes for koala and TEC are expected to be improved based on the enhancement of proposed offset sites through an Offset Management Plan (OMP) to include measures such as stock, pest animal and weed management.
2	Must be built around direct offsets but may include other compensatory measures.	Koala and TEC offsets will be achieved through direct offsets. The offset site will be secured by a legally binding mechanism. Management of the values will consider key points for protection and management of the koala and TEC. No other compensatory measures are proposed for the project.
3	Must be in proportion to the level of statutory protection that applies to the protected matter.	The landowner and proponent will enter into an on-title agreement (for example, Voluntary Declaration) will secure the site once the project's Offset Management Plan (OMP) has been approved. The OMP will outline management and monitoring actions that must be implemented in order to maintain and improve the habitat values. Adaptive management will identify the procedures to be followed if the objectives have not been met. The project's Land Manager will report against any specific monitoring and auditing obligations established under the EPBC Act approval conditions.
4	Must be of a size and scale proportionate to the residual impacts on the protected matter.	The loss of 1,425.19 ha critical koala habitat and 44.72 ha TEC has been processed through the Offset Assessment Guide offset calculator (Refer to Section 5.2). The proposed offsets are in proportion to the level of statutory protection that applies to the species and TEC. Using the EPBC Act offset calculator, it was determined that 3,016.5 ha were required for offsetting the project's impacts on koala. Providing this offset and the long-term rehabilitation and protection of approximately 140 ha for SEVT TEC will provide a conservation gain of greater than

		100% of that required to be proportionate to the impact. Consequently, the offset site will exceed the EPBC Act offset requirement for the project.
5	Must effectively account for and manage the risks of the offset not succeeding.	The offset site will be protected through a legally binding mechanism. An on-title agreement (for example, Voluntary Declaration) will secure the site once the OMP has been approved. An OMP will be developed which outlines management and monitoring actions that must be implemented in order to maintain and improve the site. Adaptive management will identify the procedures to be followed if the objectives have not been met. The project's Land Manger will report against any specific monitoring and auditing obligations established under the EPBC Act approval conditions.
6	Must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6).	The proposed offset site is mapped under the *Vegetation Management Act 1999* as having Least Concern Vegetation and is currently grazed with minimal management and/or protection of the vegetation on site. Without proper management, the vegetation will be continually degraded over time, and restoration of these communities becomes more difficult, or not possible at all. Moreover, under the State legislation, this vegetation can be legally cleared for rural purposes. Therefore, there is currently limited protection of the vegetation on site proposed to be offset. The assumed area proposed for the offset is not already in use as an offset site for any other parties, nor has it already been set aside for any other conservation program. As such, the proposed offset is additional to what is required under the planning regulations or determined by law.
7	Must be efficient, effective, timely, transparent, scientifically robust and reasonable	The direct protection and management of koala habitat and TEC on site is the most effective and efficient means of achieving offsets. This management plan will be implemented once the offset areas are secured.
8	Must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	The OMP will set out clear objectives, measurable performance indicators, monitoring and reporting requirements. In addition, the Land Manager will report against any specific monitoring and auditing obligations established under the EPBC Act approval conditions.

5.2 COMPLETED OFFSET ASSESSMENT GUIDE CALCULATOR

As specified by the EPBC EOP, 'offsets' (also referred to as 'environmental offsets') refer to measures that compensate for the residual adverse impacts of an action on the environment. Offsets provide environmental benefits to counterbalance the impacts that remain after avoidance and mitigation measures. These remaining, unavoidable impacts are termed 'residual impacts'. Avoidance and mitigation measures can reduce and, in some cases, remove the need for offsets if the residual impact is not significant. Offsets are not considered until all reasonable avoidance and mitigation measures are

considered, or acceptable reasons are provided as to why avoidance or mitigation of impacts is not reasonably achievable.

Offsets can comprise a combination of 'direct offsets' and 'other compensatory measures'. Direct offsets are those actions that provide a measurable conservation gain for an impacted protected matter (e.g. through securing and managing another area of habitat for the same protected matter), and are an essential component of a suitable offset package. A minimum of 90% of the offset requirements for any given impact must be met through direct offsets. The remaining 10% of the offset requirement may be met through 'other compensatory measures'; these are actions that do not directly offset the impacts on the protected matter, but are anticipated to lead to benefits for the impacted protected matter (e.g. funding for research or educational programs).

The Offset Assessment Guide Offset Calculator has been completed to determine the area of offset required to adequately compensate for the removal of koala habitat and TEC as a result of the wind farm.

The guide is an excel spreadsheet with embedded formulae, which can be downloaded at www.environment.gov.au/epbc/publications/environmental-offsets-policy.html.

A detailed assessment is provided below for each MNES and a copy of the spreadsheet accompanies this report.

As per the calculations completed using the offset calculator, an area of 3,016.5 ha of koala habitat and the long-term protection of a minimum approximately 140 ha of suitable land for SEVT TEC will provide a conservation gain of greater than 100%.

5.2.1 Annual Probability of Extinction

The *annual probability of extinction* is an estimate of the average chance that a species or ecological community will be completely lost in the wild each year, given recent rates of decline (DSEWPaC, 2012). The *annual probability of extinction* is incorporated into the impact and offset calculation process as a discounting factor for aligning activities that occur at different points in time. This figure is derived from the International Union for the Conservation of Nature (IUCN) Red List for threatened species, as shown in **Table 5**.

Table 5 International Union for the Conservation of Nature (IUCN) Red List for threatened species

Conservation status of MNES	IUCN criteria for probability of extinction in the wild	Annual probability of extinction	Annual probability of extinction (geometric mean) + probability of catastrophe
Critically Endangered	At least 50% in 10 yrs	6.7%	6.8%
Endangered	At least 20% in 20 yrs	1.1%	1.2%
Vulnerable	At least 10% in 100 yrs	0.1%	0.2%

The Koala listed as 'Vulnerable' under the EPBC Act, therefore the annual probability of extinction, based on IUCN category definitions, is 0.2%.

The TEC listed as 'Endangered' under the EPBC Act, therefore the annual probability of extinction, based on IUCN category definitions, is 1.2%.

5.2.2 Protected Matter Attributes

Protected Matter Attributes show the various options to calculate a suitable offset depending on a protected matter's habitat or ecology that a proposed action may be likely to impact, for example, area of habitat or birth rate. The type and quality of the data available will also inform this decision

The area of habitat calculated to be removed by the action equates to the direct loss of 1,425.19 ha of Koala habitat and 44.72 ha of TEC.

Koala

As part of the mitigation measures, a total of 811.25 ha (800.87 of *Eucalyptus crebra* vegetation community and 10.38 ha of riparian vegetation) will be rehabilitated around the infrastructure, roads and hardstand areas. The rehabilitation work will include flora species suitable to Koala and will reduce the overall residual impact by reinstating some of the habitat loss directly within the project footprint. The final area available for rehabilitation is depended on the scale of the project or stage of project and subject to the final design. While the final residual impact is still considered significant for Koala, the rehabilitation of 811.25 ha of Koala habitat has been included in the EPBC offset calculation by reducing the overall residual impact using a ratio of 2.25% as follows:

- Direct impact: 1,425.19ha
- Rehabilitated areas: 811.25 ha
- The state government generally uses a ratio of 4:1 for offset area and a ratio of 16:1 for rehabilitation area per hectare of direct impact. This means there is a factor of 4 between the ratios used to calculate rehabilitation and offset, per hectare of direct impact.
- The Federal Government uses a ratio of 2.25:1 for offset area per hectare of direct impact. If the same factor of 4 is applied to this ratio then the ratio for rehabilitation area would be 9:1. (2.25 x 4 = 9)
- The rehabilitated area of 811.25 ha represents a direct impact of 90.14 ha (811.25 / 9 = 90.14)
- If this is subtracted from the total direct impact, an area of 1,335.05 ha (1425.19 – 90.14 = 1335.05) must be offset
- A direct impact of 1,335.05 ha equates to 3,016.5 ha of offset, using the offset calculator (and the values outlined in the following sections).

SEVT

Similarly, the residual impact for the SEVT is calculated as follow:

- Direct impact: 44.72 ha
- Rehabilitated areas: 30.24 ha
- The ratio for rehabilitation area is 9:1 as discussed above.
- The rehabilitated area of 30.24 ha represents a direct impact of 3.36 ha (30.24 / 9 = 3.36).

- If this is subtracted from the total direct impact an area of 41.36 ha (44.72– 3.36 = 41.36) must be offset
- A direct impact of 41.36 ha equates to 137.5 ha of offset, using the offset calculator (and the values outlined in the following sections).

5.2.3 Quality

The quality score for *area of habitat* or *area of community* is a measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability. There are three components that contribute to the calculation of habitat quality: site condition, site context, and species stocking rates. Each of these components has been considered to determine the quality of habitat /TEC in the impact area and proposed offset area.

Quality of Critical Habitat being Removed

The Koala Habitat Assessment Tool in Table 4.3 of the EPBC Act Referral Guidelines for the Vulnerable koala (DotE, 2014) assists in determining the sensitivity, value and quality of the impact area. The start quality of the habitat being removed determined via the Koala Habitat Assessment Tool, is 9.

The patches of TEC to be removed were assessed using the Queensland BioCondition Assessment which incorporates both site and landscape values (Eyre *et a*l. 2015). The BioCondition scores were determined as having an average score of 0.75. As the offset calculator only enables whole numbers to be entered, the start quality was determined as 0.7 (rounded to the closest whole number). The quality of the community determined via the BioCondition Assessment Start Quality: 7/10.

Start Quality of Offset Area

Ideally, the offset site would need to be lower in quality than the proposed clearing area. For instance, areas with less non-juvenile Koala trees, areas that have not illustrated evidence of the presence of Koala or areas which presence threats to Koala are the most suitable for offset. We assume that the offset for koala would be 8/10.

Proposed offset areas of SEVT TEC will include existing TEC within the project area and/or suitable land that will be rehabilitated. For the purpose of the offset calculation, we have assumed that around 140 ha of existing SEVT TEC will be used as offset. The quality of habitat was determined using the Biocondition assessment method and is similar to the proposed clearing site. The quality of the SEVT TEC is 7/10.

Future Quality without the Offset

It is expected that in its current status, the offset area for koala would continue to decrease over time due to the presence of cattle and the current rural land use. We assume the current grazing would continue and may even increase in the project area which will further degrade the offset site.

Future quality of the offset site without the offset could be estimated at 8/10 for koala.

As grazing is unlikely to occur in the current SEVT TEC patches due to their location being in steep slopes, the future quality of the SEVT TEC site would remain unchanged. It is calculated as being 7/10.

Future Quality with the Offset

The management of offset area for koala would include the provision of weed management which will improve the quality of site. Weed management will ensure the site is maintained in its good condition and the offset will protect the habitat in the long-term. Suppression of grazing in the offset area will also likely

increase the use by koala and therefore, if we used the koala habitat assessment tool, the quality of the site will likely increase. The future quality of the offset site for koala would be estimated at 9/10.

As no management is proposed for the SEVT TEC offset patches, the future quality of the SEVT TEC site would remain unchanged. It is calculated as being 7/10.

5.2.4 Time over which Loss is Averted

The *time over which loss is averted* is the foreseeable timeframe (in years) over which changes in the level of risk to a proposed offset site can be considered and quantified (see section F of the Offset calculation guidelines). That is, it is the time that any measures for securing a site for conservation purposes, such as conservation covenants on title, are intended to last. Longer time frames are valued more highly than shorter time frames (DSEWPaC, 2012).

The proposed offset site must be strategically located and must play an important role in providing core habitat for koala within the broader landscape. Where the offset site is secured via an on-title agreement will secure the site for at least 15 years.

5.2.5 Time until Ecological Benefit

The *time until ecological benefit* is the estimated time (in years) that it will take for the community quality improvement of the proposed offset to be realised.

The proposed weed management and suppression of cattle in the offset site will likely enhance existing vegetation condition. If the offset site is heavily weed infested, management actions will have immediate value from weeding/removal of cattle. The timeframe to undertake weed management of the site has been determined as 5 years.

The time until ecological benefit is estimated at 20 years (maximum) for the SEVT TEC as no management actions are proposed.

5.2.6 Risk of Loss (%) Without Offset

The proposed koala offset site must be strategically designated to enhance linkages between areas of remnant vegetation within the broader landscape. In its current status and under the *Qld Vegetation Management Act 1999*, most of the vegetation can be cleared for rural purposes. The current state and local governmental legislation do not fully protect the site against clearing activities. As the site is currently grazed, the risk of loss without an offset is estimated to be 50%.

The risk of loss of the SEVT TEC offset area without an offset is minimal in part of the site due to the TEC being located on steep hills. However, large patches of TEC occurring in lower sections of the grazing area are currently not mapped by DNRM and may be cleared at any time to facilitate additional grazing land. The risk of loss of TEC offset site is estimated at 50%.

5.2.7 Risk of Loss (%) With Offset

The offset will ensure that the vegetation is enhanced and protected through a Voluntary Declaration, covenant, nature refuge or another suitable legally binding mechanism. By increasing the resilience of the ecosystem through weed management and by protecting the site against disturbances from future development/rural activity, the risk of losing the habitat will decrease.

The protection through a Voluntary Declaration, covenant, nature refuge or another legally binding mechanism will provide a lower risk of loss in comparison to not being an offset. Therefore the risk of loss with an offset is considered to be 5%.

5.2.8 Confidence in result (%)

Within the Offsets Assessment Guide, the confidence in results is determined to be 80% for both the change in quality and averted loss. This confidence level is based on the demonstrated experience of the Land Manager in managing his land and the legislative requirement that will be placed on the project to retain and manage the offset area to enhance the quality of the habitat. However, we recognise that, although low risk, unforeseen events may occur beyond their control.

It is expected that a condition of the approval will be that the authority holder must comply with the agreed delivery arrangement, including the agreed offset delivery plan. This will ensure maintenance is ongoing until the performance criteria defined in the OMP are achieved.

There is 80% confidence in the quantified averted loss.

5.2.9 Percentage of Impact Offset

The attached excel spreadsheets (Appendix 1) illustrate the offset calculations for the koala and SEVT TEC.

6 CONCLUSION AND SUMMARY

The Ecological Assessment of the proposed Clarke Creek Wind Farm noted that the project has the potential to result in a significant impact to two MNES, being the koala and the SEVT TEC. Specifically, the assessment noted that the proposed action would result in the removal of up to 1,425.2 ha of koala habitat, and up to 44.7 ha of SEVT TEC. As a consequence, and environmental offset is required for these impacts.

Using the prescribed criteria for determining the offset requirements, it was determined that approximately 3,016.5 ha were required for offsetting the project's impacts on koala, and 137.5 ha were required for offsetting the project's impacts on the SEVT TEC. Note that these calculations have taken into account a proposed reduction in the overall offset area required based on the proposed rehabilitation of land (which we have suggested reduces the project's impact area for the purposes of completing the offset calculations).

The project area (as defined by the lot boundaries of the involved landholders) contains approximately 39,560 ha of koala habitat, and approximately 3,719.3 ha of SEVT TEC. It is expected that with the cooperation of the involved landholders, it will be possible to find and secure sufficient areas of land that meet the offset site requirements detailed above. As the project further develops through the approvals process, specific sites will be selected, assessed and a Offset Management Plan will be developed and submitted for approval to detail the site features, land management actions, and proposed means to legally secure the land as an offset site.

7 REFERENCES

AKF. 2016. *Koalamap* [Online]. Available: https://www.savethekoala.com/ [Accessed].

AMBS 2012. Investigation of the Impact of Roads on Koalas. Sydney: Report prepared for the NSW Roads and Maritime Services by Australian Museum Business Services.

DECC 2008. Recovery plan for the koala (*Phascolarctos cinereus*) *In:* DEPARTMENT OF ENVIRONMENT AND CLIMATE CHANGE (ed.). Department of Environment and Climate Change,.

DNRM 2016. Regulated Vegetation Management Map (Version 8.0). *In:* DEPARTMENT OF NATURAL RESOURCES AND MINES (ed.). Brisbane,.

DOTE 2014. EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) *In:* DEPARTMENT OF THE ENVIRONMENT (ed.). Canberra.

DOTE 2015. Species Profile and Threats Database (SPRAT). *In:* DEPARTMENT OF THE ENVIRONMENT (ed.). Canberra: Commonwealth of Australia.

DSEWPAC 2012. Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. *In:* DEPARTMENT OF SUSTAINABILITY, E., WATER, POPULATION AND COMMUNITIES (ed.). Canberra.

MELZER, A. & LAMB, D. 1994. Low density populations of the Koala (Phascolarctos cinereus) in Central Queensland. *Proceedings of the Royal Society of Queensland***,** 98-93.

MOORE, B. & FOLEY, W. 2005. Tree use by Koalas in a chemically complex landscape. *Nature***,** 488-490.

MURCIA, C. 1995. Edge effects in fragmented forests: implications for conservation. . *Trends in Ecology and Evolution,* 10**,** 58-62.

THOMPSON, J. A. 2006. *The comparative ecology and population dynamics of Koalas in the Koala coast region of south-east Queensland.* University of Queensland.

APPENDIX 1

A. OFFSET ASSESSMENT GUIDE – EXCEL SPREADSHEET

Offset Calculation for SEVT TEC (Commonwealth Spreadsheet)

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 199*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	SEVT TEC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	Yes		Area	41.36	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	28.95	Adjusted hectares	
Threatened species habitat						

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirem
Ecological Communities																		
Area of community	Yes	28.95	Adjusted hectares	137.5	Risk-related time horizon (max. 20 years)	15	Start area (hectares)	137.5	Risk of loss (%) without offset	50%	Risk of loss (%) with offset	5%	61.88	80%	49.50	41.39	28.97	100.07%	Yes
									Future area without offset (adjusted	68.8	Future area with offset (adjusted	130.6						
					Time until ecological benefit	20	Start quality (scale of 0-10)	7	Future quality without offset	7	Future quality with offset	7	0.00	80%	0.00	0.00		
Threatened species habitat																		

Offset Calculation for Koala (Commonwealth Spreadsheet)

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Koala
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat Clear row	Yes		Area	1335	Hectares	
			Quality	9	Scale 0-10	
			Total quantum of impact	####	Adjusted hectares	

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirem	Co te
Ecological Communities																				
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted	0.0	Risk of loss (%) with offset Future area with offset (adjusted	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset		Future quality with offset									
Threatened species habitat																				
Area of habitat	Yes	1201.50	Adjusted hectares	3350	Time over which loss is averted (max. 20 years)	15	Start area (hectares)	3016.5	Risk of loss (%) without offset Future area without offset (adjusted	50% 1508.3	Risk of loss (%) with offset Future area with offset (adjusted	5% 2865.7	1357.43	90%	1221.68	1185.61	1201.44	100.00%	Yes	
					Time until ecological benefit	5	Start quality (scale of 0-10)	8	Future quality without offset	8	Future quality with offset	9	1.00	90%	0.90	0.89				