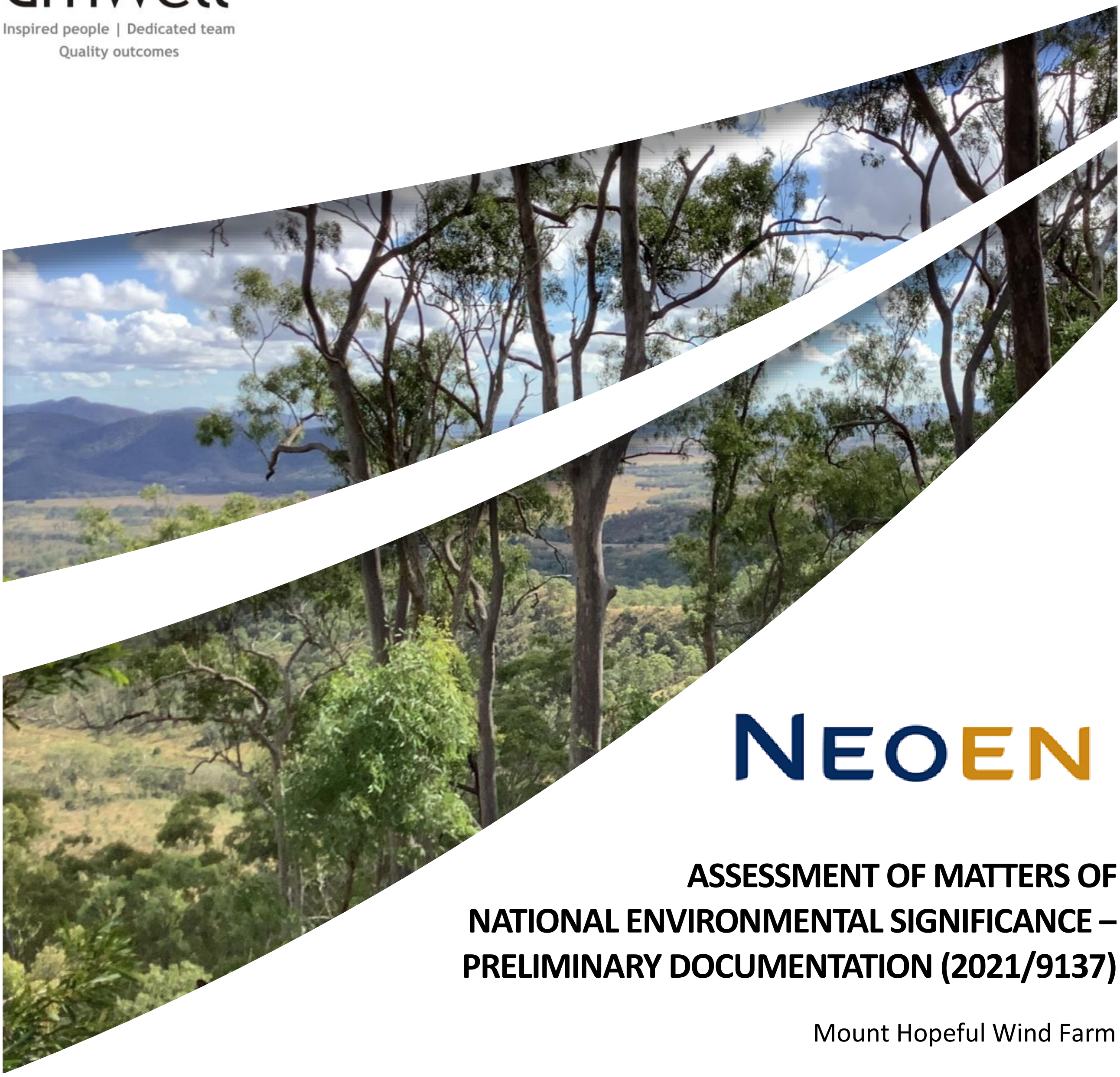

ASSESSMENT OF MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE – PRELIMINARY DOCUMENTATION (2021/9137)

Mount Hopeful Wind Farm

FINAL – ATTACHMENT B4

March 2024

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

Report No. 22753/R03
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Environmental & Social Consultants

Table of Contents

Figures

Tables

Appendices

8.0 Potential Impacts

Potential impacts to ecological values including MNES associated with the Project are outlined in the sections below.

Proposed mitigation and management measures to reduce the severity or extent of potential impacts on the relevant MNES values are outlined in **Section 9.0**.

Activities proposed as part of the Project have been categorised into three phases: construction, operation and maintenance, and decommissioning and rehabilitation. A description of Project related activities and the duration of their disturbance is provided in **Table 8.1**.

Table 8.1 Description of Required Activities for each Project Phase

Work Stage	Description of Activities	Duration of Disturbance[1]
Construction		
Site preparation	Vegetation clearing	Permanent
	Topsoil stripping	Medium term / permanent
	Construction of temporary site compounds including temporary fencing as required	Medium term
	Installation of offices, hardstands	Permanent
	Stockpiling	Medium term
Installation of electrical reticulation	Excavation	Temporary
	Trenching	Short term
	Modification, diversion and realignment of utilities and associated infrastructure	Short term / medium term
Civil works	Cutting construction	Permanent
	Embankment construction using cut to fill or from external borrow sources, where required	Permanent
	Drainage controls	Permanent
Road works	Construction of permanent access roads and road upgrades	Permanent
Turbine logistics	Component stockpiling	Medium term
	Concrete batching	Medium term
Turbine construction	Ground excavation and installation of turbine foundations	Permanent
	Erection of infrastructure components	Short term
Fencing	Establish permanent fencing where strictly required (i.e. substation)	Permanent

Work Stage	Description of Activities	Duration of Disturbance[1]
	Establish temporary fauna exclusion fencing around laydown areas	Temporary
Reinstate ground surfaces	Ensure ground surfaces immediately post construction are safe and stable	Short term
Operation and maintenance		
Turbine operation	Movement of turbine blades resulting in noise and collision with avian species	Permanent
Rehabilitation	Restoration of disturbed areas, including revegetation where required	Temporary
Operational maintenance	Ongoing vehicle movement along established access tracks and ground-slashing and pruning in required areas	Medium term
Vegetation maintenance	Ongoing vegetation (primarily slashing and pruning) maintenance for safe operation and fire safety	Permanent
Decommissioning and rehabilitation		
Removal of wind turbines, site services and ancillary infrastructure	De-energising wind turbines, disposing of oils, lubricants and coolants, disassembling turbines, removing site services	Short term
Covering and grading foundations	Cover foundations with fill material and grade to reflect the slope of the surrounding area, dress in topsoil and revegetate	Short term
Revegetation	Restoration of disturbed areas, including revegetation where required	Temporary

[1] *'Temporary' indicates days to months, 'short-term' indicates up to 2 years, 'medium-term' indicates from 2 years to 10 years, 'long-term' indicates from 11 years to 20 years and 'permanent' indicates more than 21 years.*

8.1 Construction Phase

The greatest risk of adverse impact on MNES values and biodiversity more broadly will occur during the construction phase. The Disturbance Footprint, which occupies a subset of the Development Corridor, has been used as the assessment unit when undertaking the assessment of direct impacts. The extent of clearing represented by the Disturbance Footprint is considered to be a 'worst-case' scenario.
When assessing potential indirect impacts resulting from the Project, the Disturbance Footprint and the wider surrounding area have been considered.

The construction activities to support the installation of turbines, associated electrical lines, ancillary infrastructure, access tracks and road upgrades will involve vegetation clearing and earth works including excavation and ground reinstatement. Potential direct and indirect impacts on MNES associated with these activities are described below.

8.1.1 Direct Impacts

8.1.1.1 Vegetation Clearance and Habitat Loss

The Disturbance Footprint encompasses a total of 883.6 ha. As per vegetation community mapping completed for the Project, this includes 347.9 ha of remnant vegetation and 292.4 ha of regrowth vegetation. The remaining 243.3 ha of the Disturbance Footprint is in a non-remnant condition and has been heavily modified by clearing and cattle grazing.

Vegetation clearing is a direct impact that results in the loss of vegetation and associated habitat values, including habitats that support threatened or migratory species. Potential impacts resulting from clearing native vegetation can include:

- Reduced patch size of vegetation communities potentially compromising the viability of the community and associated habitat.
- Loss of habitat causing a reduction of biological diversity or loss of local populations and genotypes.
- Loss of or disturbance to microhabitat features such as tree hollows, ground timber including hollow logs, surface rocks, leaf litter and boulder piles.
- Loss of floristic diversity and the food resources this provides such as foliage, flowers, nectar, fruit and seeds.
- Fragmentation of habitats resulting in reduced dispersal opportunities for fauna.
- Destruction of abiotic features necessary to support vegetation communities and habitat types.

The extent of direct impacts to each MNES as a result of vegetation clearing under worst-case scenario are detailed in **Table 8.2**.

Vegetation clearing and construction of the Project will be staged. Although the resulting impact from clearing will be largely permanent (noting some areas to be rehabilitated), staging will allow for impacts resulting from this activity to be limited to a relatively small area within the Disturbance Footprint and wider Study Area at any one time. For some mobile fauna species, this localised impact will allow time for individuals to temporarily relocate away from disturbance. However, for species with small home ranges or reduced dispersal abilities (i.e. skinks, frogs) this may cause localised population depletion.

While the clearance of vegetation for the Project is unavoidable, it will only be completed as strictly necessary. In addition, a range of measures will be implemented to minimise the overall level of impact from clearing, as discussed in **Section 9.3.1**. It is acknowledged however that where clearing and habitat loss cannot be avoided, particularly in high constraint areas (i.e. greater glider (southern and central) and yellow-bellied glider (south-eastern) (breeding and denning habitat) and northern quoll (breeding and shelter habitat)), it is likely to result in permanent impacts to threatened biodiversity values.

Table 8.2 Direct Impacts on MNES

MNES	Likelihood of Occurrence	Habitat utilisation	Maximum direct impact area (ha)
Threatened Flora			
Cycas megacarpa	Known	Known (confirmed)	399.9
		Known (suspected)	241.6
		Total habitat	641.5
Samadera bidwillii	Known	Potential habitat	347.8
		Habitat Critical to the Survival	0.0*
Cossinia australiana	Moderate	-	8.6
Decaspermum struckoilicum	Moderate	-	2.3
Threatened Fauna			
Koala (*Phascolarctos cinereus*)	Known	Breeding, foraging and dispersal	641.6
		Climate refugia	5.3
Northern quoll (*Dasyurus hallucatus*)	Known	Denning and refuge	22.1
		Foraging and dispersal	574.8
White-throated needletail (*Hirundapus caudacutus*)	Known	Roosting and foraging	269.6
		Foraging and dispersal	370.6
Ghost bat (*Macroderma gigas*)	Low	Seasonal foraging and dispersal	883.6
Greater glider (southern and central) (*Petauroides volans*)	Known	Foraging and dispersal	207.4
		Likely/current denning	244.7
		Potential/future denning	175.8
Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)	Known	Breeding and denning	163.3
		Foraging and dispersal	158.7
Grey-headed flying-fox (*Pteropus poliocephalus*)	Low	Foraging and dispersal	277.3
Red goshawk (*Erythrotriorchis radiatus*)	Low	Marginal foraging and dispersal	633.0
Collared delma (*Delma torquata*)	Moderate	Breeding and foraging	272.8
Squatter pigeon (southern) (*Geophaps scripta scripta*)	Known	Breeding	5.9
		Foraging	1.2
		Dispersal	361.4
Migratory species			
Fork-tailed swift (*Apus pacificus*)	High	Foraging and dispersal	883.6

MNES	Likelihood of Occurrence	Habitat utilisation	Maximum direct impact area (ha)
Oriental cuckoo (*Cuculus optatus*)	Moderate	Foraging and dispersal	348.1
Black-faced monarch (*Monarcha melanopsis*)	Moderate	Foraging and marginal breeding	17.7
		Foraging and dispersal	330.7
Spectacled monarch (*Symposiachrus trivirgatus*)	Known	Foraging and dispersal	17.9
Satin flycatcher (*Myiagra cyanoleuca*)	Moderate	Foraging and dispersal	339.7
Rufous fantail (*Rhipidura rufifrons*)	Known	Foraging and dispersal	348.1

** Neoen have committed to avoiding habitat critical to the survival of quassia (Samadera bidwillii), approximately 0.1 ha.*

8.1.1.2 Habitat Fragmentation and Loss of Movement Opportunities

Clearing has the potential to dissect and disconnect vegetation communities, reducing the size of patches or potentially isolating them, which can impact on the success of seed dispersal, species recruitment and ultimately the long-term viability and persistence of a flora species or communities within the landscape. Clearing may also result in reduced fauna movement opportunities, leading to reduced species recruitment, genetic flow and ultimately affect the long-term viability and persistence of fauna populations within the landscape.

Habitat within the Disturbance Footprint (and likely the wider Study Area) has been historically subjected to low level fragmentation impacts as a result of ongoing agricultural works, including the creation of farm dams and installation of tracks, firebreaks and fences. Further vegetation clearing will be required for the construction of the Project, which may exacerbate existing fragmentation impacts.

MNES that are considered most susceptible to fragmentation impacts as a result of the construction of the Project include northern quoll (*Dasyurus hallucatus*), greater glider (southern and central) (*Petauroides volans*), yellow-bellied glider (south-eastern) (*Petaurus australis australis*), koala (*Phascolarctos cinereus*) and threatened flora including *Cycas megacarpa*. *Cycas megacarpa* may be vulnerable to fragmentation as a result of its immobile nature and seed dispersal mechanism, which does not involve a vector for movement (other than gravity). Smaller fragmented populations of less than 500 individuals are at risk of loss from genetic diversity.

The northern quoll (*Dasyurus hallucatus*) is a cryptic and nocturnal species; depending on the size and nature of the clearing, impacted areas between or within areas of suitable habitat may be no longer used due to their exposed nature and the increased risk of predation, potentially resulting in altered foraging and dispersal patterns. Although the koala (*Phascolarctos cinereus*) is considered highly mobile and is known to disperse through cleared areas, it is while making these movements that they are most susceptible to vehicle collision and attack by dogs and other predators. In contrast, the greater glider (southern and central) (*Petauroides volans*) and yellow-bellied glider (south-eastern) (*Petaurus australis australis*) are known to have low dispersal ability. Vegetation clearing may create gaps or expand existing gaps between areas of suitable habitat and potentially restrict the movement of individuals and access to required habitat resources.

Habitat fragmentation may occur within enclosed areas of the Disturbance Footprint, where patches of vegetation become encircled by linear Project infrastructure. Species with low dispersal ability, such as greater glider (southern and central) (*Petauroides volans*) and yellow-bellied glider (south-eastern) (*Petaurus australis australis*), present within enclosed areas may become cut-off or partially cut-off from the local or regional population. Individuals persisting within enclosed areas may undergo a slow population decline due to an absence of genetic diversity, usually afforded by neighboring populations.

The Project is situated on the Great Dividing Range and remnant vegetation within the Study Area provides connectivity through biodiversity corridors that facilitate north-south movement of fauna at a regional scale. Internal fauna movement is likely afforded by waterways, ridgelines and gullies. The clearance of habitat within the Disturbance Footprint may temporarily disrupt fauna movement internally, as well as to adjacent high-quality areas outside of the Study Area. Although the Project is primarily linear in nature and will have few hard dispersal barriers (i.e. fencing), clearing widths of up to 100 m for linear infrastructure (i.e. 275 kV transmission lines) and up to 165 m for turbines will reduce functional connectivity for a number of species (i.e. greater glider (southern and central) (*Petauroides volans*) and yellow-bellied glider (south-eastern) (*Petaurus australis australis*)). Siting of the Development Corridor and Disturbance Footprint has considered the location of MNES values in the landscape and the use of existing disturbed or cleared areas has been prioritised (see **Section 9.1.1**).

8.1.1.3 Fauna Injury and Mortality

Physical trauma to MNES fauna has the potential to occur during all phases of the Project, however the highest likelihood will be during construction activities that involve vegetation clearing, earthworks and trenching. Fauna may be injured or killed during construction principally through:

- Strike from moving vehicles/machinery – key issue for ground dwelling species, particularly those with poor mobility.
- Entrapment in habitat during removal – key issue during tree felling for species that use tree hollows or hollow logs for roosting and denning.
- Entrapment in trenches/holes – key issue for ground dwelling species (reptiles and small mammals), particularly those that are active at night and cannot detect trenches to avoid.

The species which are most at risk of injuries and mortality are those that are cryptic, difficult to detect (i.e. harder to be moved by spotter-catchers) and/or have poorly developed dispersal mechanisms. Larger species with defined territories and movement patterns such as the koala (*Phascolarctos cinereus*) are less likely to be at risk of direct mortality where appropriate mitigation measures are applied (i.e. spotter-catchers undertaking pre-clearance surveys).

Some mobile MNES species, such as listed birds, are likely to relocate away from areas being disturbed and may not be adversely impacted in terms of direct physical trauma unless fauna are nesting or are killed by vehicle strike. However, other species that are less mobile (i.e. ground-dwelling reptile and mammal species, or those that are nocturnal and nest or roost in trees or tree hollows during the day including arboreal mammals such as listed gliders), may find it difficult to move away from roosts or active breeding places.

Vehicle collision may result in fauna injury or mortality during all phases of the Project, but such risk is greater when high volumes of vehicle activity occur during the construction phase of the Project.

The construction of the Project infrastructure, as well as the general use of access tracks and roads across the Disturbance Footprint will result in increased vehicle movements that may cause injury or death to fauna by vehicle strike. There will be an increased level of risk from vehicle collision associated with the development and subsequent use of the access road corridor. High volumes of road traffic including light and heavy vehicles will largely be associated with the construction phase of the Project.

During the operation and maintenance phase, vehicle movements will be dramatically reduced, however some risk of collision does remain. Mammals, reptiles, amphibians and birds are all at risk of vehicle strike, particularly common species (e.g. macropods) that are tolerant of disturbance and/or those species that can utilise roads for movement pathways or as foraging habitat.

In addition, entrapment of wildlife in trenches or other excavations associated with the Project may also cause physical trauma to fauna. For example, open trenches for underground utilities, or other pits are known to be effective at trapping a wide variety of wildlife and often result in mortality. Species most likely to become trapped in pits or other excavations during construction of the Project are ground dwelling species that are capable of moving across modified areas and arboreal species which descend to the ground to disperse.

MNES that are most susceptible to fauna mortality as a result of construction of the Project include greater glider (southern and central) (*Petauroides volans*), yellow-bellied glider (south-eastern) (*Petaurus australis australis*), koala (*Phascolarctos cinereus*), northern quoll (*Dasyurus hallucatus*), squatter pigeon (southern) (*Geophaps scripta scripta*) and collared delma (*Delma torquata*). As described above, clearing and construction will be staged so only a subset of the Disturbance Footprint and overall Study Area will be impacted at one time. Mitigation measures for fauna injury and mortality are presented in **Section 9.3.2**.

8.1.1.4 Direct Impacts Associated with the Temporary Worker's Accommodation Camp

Throughout construction, a temporary worker's accommodation camp will be in operation, housing a peak work force of up to 450 people and covering a maximum area of approximately 9.8 ha. The maximum peak work force figure has increased from the original Preliminary Documentation to reflect the most conservative estimates recently shared by construction contractors consulted by Neoen as part of the ongoing procurement process for the Project. The maximum capacity of the temporary worker's accommodation camp has also been updated to reflect this maximum peak workforce figure.

The temporary works accommodation camp has been strategically designed to ensure no additional impacts to MNES (with the exception of ghost bat and fork-tailed swift, as all areas of impact are associated with these species, given their broad habitat requirements) or other ecological values by avoiding remnant and regrowth vegetation, mapped habitat for conservation significant species and also ensuring minimum setbacks from drainage lines (stream order 1) of 25 m and watercourses (stream order 2 or above) of 50 m). Further, recent revisions of the Disturbance Footprint associated with the most recent Project variation have resulted in a minor reduction (approximately 1.2 ha) to squatter pigeon (southern) dispersal habitat.

Fauna injury or mortality due to vehicle collision is already covered in the **Section 8.1.1.3** and the temporary worker's accommodation camp is unlikely to increase the overall risk substantially. The inclusion of this Project element will reduce the traffic (i.e. from daily work force commutes) on public roads including Playfield's Road, Glengowan Road and McDonalds Road. Further, the positioning of the camp in non-remnant vegetation and outside of mapped habitat for MNES will also limit the risk of vehicle/fauna interactions.

8.1.2 Indirect Impacts

The loss of vegetation and habitat, construction activities required to be undertaken to clear vegetation or complete construction as well as impacts from operation of the temporary worker's accommodation camp, can potentially result in indirect or secondary impacts to the associated fauna and flora values.
This includes:

- Increased edge effects reducing the condition of quality of remaining vegetation communities and habitat types.
- The establishment and spread of exotic species that may displace native species, native habitat resources and alter fire regimes.
- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats.
- Increased risk of contamination associated with activities such as refueling or storage of chemicals as well as effluent run-off from the sewage treatment plant/spray field associated with the temporary worker's accommodation camp.
- Temporary changes in hydrology from installation of infrastructure creating a barrier to surface flow and increasing stormwater run-off.
- Generation of dust emissions leading to excessive deposition of dust on leaves of plants suppressing photosynthesis and growth.
- Increased noise and light levels affecting foraging and breeding behaviour for some fauna species or resulting in complete avoidance and displacement from habitats.
- Periodic burst of elevated noise levels may startle and disorientate fauna species within proximity.
- Although unlikely, increased anthropogenic activity may lead to temporary increased pest levels.

It is important to note that during the construction phase these potential impacts are likely to be short-term and concentrated in specific areas before moving progressively through the Disturbance Footprint. However, it is acknowledged that some of these indirect impacts such as increased edge effects are longer term.

Further information about potential indirect impacts relating to weeds, edge effects, soil erosion and sedimentation and dust are provided in the subsequent sections.

8.1.2.1 Introduction/Exacerbation of Weeds and Pest Fauna

The introduction and/or spread of weeds is a potential indirect impact that can compromise the integrity of remaining vegetation, increase the intensity and/or frequency of fires, as well as threaten the long-term survival of threatened species. Within the Study Area, weed species are common within the cleared and regrowth areas of the site as well as sporadically throughout remnant vegetation. The weed species that pose the biggest threat to flora and vegetation values are those identified as WoNS including lantana (*Lantana camara**) and rubber vine (*Cryptostegia grandiflora**), as well as high-biomass grass species including green panic (*Megathyrsus maximus* var. *maximus**) and buffel grass (*Cenchrus ciliaris**).

High-biomass grass species can out-compete native vegetation as well as reduce the germination of native species. The high biomass of these species also increases the intensity and/or frequency of fires.

Actively removing and managing these WoNS and high-biomass grass species within the Disturbance Footprint and preventing the introduction of additional weed species may prevent indirect impacts to MNES individuals and associated habitat.

Several introduced fauna species were recorded during the field survey program including the black rat (*Rattus rattus**), cane toad (*Rhinella marina**), feral horse (*Equus caballus**), feral cat (*Felis catus**), European brown hare (*Lepus europaeus**) and feral pig (*Sus scrofa**). These species, if left unchecked, may flourish in newly disturbed areas, disperse into higher quality habitat areas and further contribute toward the degradation of fauna habitat within the Study Area.

Given the prevalence of exotic pests within the existing landscape, it is unlikely that the proposed works will result in further introductions of feral vertebrate species. However, habitat modification may facilitate larger populations of certain introduced species such as European rabbit (*Oryctolagus cuniculus**) and house mouse (*Mus musculus**) in areas where some native species will not be able to persist. Weed and pest management measures are discussed in **Section 9.3.1.3**.

8.1.2.2 Edge Effects

Edge effects in ecology are identified as any difference in environment between the edge and interior of a particular vegetation patch (Murcia 1999). Environmental characteristics which differ across edges cover many components of the environment including atmosphere (e.g. microclimate), vegetation (e.g. structure, composition, functioning), fauna and their habitat, and soil (Murcia 1999).

Edges and their effects can be created through clearing of vegetation, such as new edges created by roads. The distance the effect spreads from the edge, known as edge permeability, can be highly variable and depends upon many factors such as vulnerability of the ecosystems, degree of change in land use, intensity of this use and chance events (Murcia 1999).

The main environmental impacts to new edges created by the Project include:

- Modification of microclimate where new edges are created due to greater penetration of light and wind into the vegetation. Temperature extremes are greater, and humidity of air is generally less at the edge than in the interior of vegetation. This effect is known to increase in size if vegetation is dense or cover is high.
- Physical disturbance to vegetation at the edge. Ongoing damage to the edge of vegetation may occur due to grading and weed control of road edges and vehicle use. Similarly, unsealed tracks can facilitate an increase incidence of fire ignitions.
- Changes to soil properties including compaction of the soil, less organic matter and increased erodibility.
- Introduction of weeds and pathogens through mud and dirt which falls off vehicles.
- Changes to vegetation through the above listed impacts.

Many of these potential environmental impacts including introduction of weeds and physical disturbance to vegetation can be managed through good site practices and vehicle restrictions. Rehabilitation of areas no longer used for construction activities will further reduce potential impacts. The vine thicket communities are considered particularly sensitive to edge effects due to a dense community structure. For these communities, additional measures are recommended. Measures to manage potential edge effect impacts are provided in **Section 9.3.1.1**.

8.1.2.3 Soil Erosion and Sedimentation

Impacts associated with erosion and sedimentation include compaction of soil, loss of soil structure, nutrient degradation and increased soil salinity all of which can lead to reductions in the carrying capacity of the terrestrial environment by reducing the value of habitat.

Erosion can lead to increased sedimentation in waterways which can be damaging to their ecological health. Removal of vegetation and disturbance to the soil profile through clearing and construction activities can lead to soil erosion, which in turn can lead to increased input of sediment into waterways.

Mobilised coarse sandy-sediment tends to accumulate in areas of slow-flow and may smother bottom-dwelling organisms and their habitats. Deep permanent river pools, that are valuable habitats for aquatic fauna and refuges for wildlife during summer and drought, may become filled by coarse sediments, which may render them ineffective in relation to their ability to support aquatic and terrestrial species.

Large sediment accumulations can cause upstream flooding or deflect the flow into the adjacent stream bank or even onto adjacent land, causing further erosion and transported sediments can fill the deep permanent pools of rivers and degrade this critical refuge habitat.

The impacts from erosion in terrestrial habitats as a result of the Project would be expected to occur within areas of exposed soil, stockpile locations, or localised areas in proximity to Project infrastructure (e.g., turbines) during rainfall events. The changes to overland flow paths from erosion have the potential to have localised direct impact on terrestrial habitat. These impacts are principally associated with a loss of substrate stability around vegetation and may result in a loss of vegetation quality and cover.

Best practice soil erosion and sedimentation control will be implemented for the Project, as discussed in **Section 9.3.1.4**.

8.1.2.4 Dust Impacts

Deposition of dust, sand and soil resulting from construction may have potential impacts on vegetation if excessive levels are sustained over extended periods. When dust settles on plant foliage it can reduce the amount of light penetration on the leaf surface, block and damage stomata, and slow rates of gas exchange and water loss (Farmer 1993). Reduction in the ability to photosynthesize due to physical effects may result in reduced growth rates of vegetation and decreases in floral vigour and overall community health. These impacts are dependent on the type of vegetation, type of dust (chemical properties, grain size) and total dust load settling on the vegetation.

Dust impacts from the Project are expected to be restricted to vegetation directly adjacent to the access tracks and road where soil is exposed and can be disturbed through vehicle movement. The access road corridor will likely experience high volumes of traffic during the construction phase of the Project increasing potential impacts of dust on the surrounding roadside vegetation. The dust will be chemically inert, and as such, any potential impacts will be physical in nature, as described above. Dust generation has the potential to lead to a reduction in the health and vigour of vegetation directly adjacent to the road.

To reduce this impact, dust will be managed through the construction phase through dust suppression practices (see **Section 9.3.1.1**).

8.1.2.5 Indirect Impacts Associated with the Temporary Worker's Accommodation Camp

Although no direct impacts to MNES (with the exception of low quality habitat for fork-tailed swift (*Apus pacificus*) and ghost bat (*Macroderma gigas*) due to broad habitat requirements) are associated with the temporary worker's accommodation camp, there is potential for minor indirect impacts to occur as a result of this Project element. Given the temporary worker's accommodation camp is expected to house up to 450 people at peak construction times, light and noise spill into the adjacent environment is expected to be elevated in the immediate vicinity of the camp during these periods. The temporary worker's accommodation camp is adjacent squatter pigeon (southern) dispersal habitat and although the anticipated noise and light levels may result in temporary avoidance of this habitat by the species, it is unlikely to disrupt breeding or foraging behaviours given the buffer distance between the camp and these habitat types (approximately 100 m to breeding habitat and 850 m to foraging habitat).

Habitat for koala is mapped approximately 100 m from the camp. As the species breeds at night and relies on auditory cues to find mates during the breeding season, excessive and consistent noise has the potential to mask these cues and/or result in avoidance of nearby habitat by the species. However, given that noise is not expected to be excessively loud (i.e. construction noise; pile driving etc.) and the closest area of potential habitat is 100 m away, noise generated by the camp is unlikely to disrupt mating signals and any individuals which may occur in the area are likely to habituate to the expected level of anthropogenic noise. Further, based on the density of known records of the species and the extensive field survey effort, the population of koala present within the Study Area is likely to be very small. Vast areas of suitable habitat are present in connected habitat which would remain suitable if the noise leads to temporary avoidance of the area by the species. Given the distance from the camp to koala habitat and levels of noise anticipated, impacts are expected to be negligible.

The introduction and/or spread of weeds is a potential indirect impact relevant to the temporary worker's accommodation camp. Irrigation in disturbed areas associated with the spray field, which are already susceptible to weed invasion will provide nutrient rich water in higher than natural volumes. These areas will also experience increased exposure to sunlight and space, ideal conditions for weeds to outcompete native plants. Once established weeds can contribute to soil disturbance, loss of native plant cover and increase fuel loads for bushfire. However, this area is already cleared of native vegetation communities and potential impacts from weeds will be managed via strict biosecurity protocols as outlined in **Section 9.3.1.3**.

Given the prevalence of exotic pests within the existing landscape, it is unlikely that the proposed works will result in further introductions of feral vertebrate species. However, conditions created by human habitation may facilitate larger populations of some species. For example, house mouse (*Mus musculus**) and black rat (*Rattus rattus**) may be attracted to refuse, which may increase foraging resources for the species. This risk will be managed through the implementation of strict controls outlined in the Construction Environmental Management Plan and the Weed and Pest Management Plan.

The operation of the spray field may enhance conditions which are favourable for the establishment and or proliferation of cane toad (*Rhinella marina**). Irrigation will result in unnaturally high water volumes in the spray field. An artificial water supply may increase availability of aquatic habitat through temporary ponding after significant releases of wastewater. Lethal toxic poisoning through ingestion of the cane toad has been identified as the cause of local extinctions of northern quoll (*Dasyurus hallucatus*). This cane toad is already present within the Study Area and there is no habitat for northern quoll within approximately 3 km of the temporary worker's accommodation camp. The risk of exacerbation of cane toad populations will be managed via strict biosecurity protocols in the Weed and Pest Management Plan.

Table 9.3 in **Section 9.3.1.3** below outlines the overarching performance criteria and management actions which will be implemented to minimise the risk of introduction or proliferation of weeds/pests throughout the Project, inclusive of the temporary worker's accommodation camp.

Run-off of nutrient rich water from the sewage treatment plant and spray field into watercourses has the potential to reduce water quality and increase nutrient input which may have flow on effects to vegetation and algal growth. The temporary worker's construction camp has been designed to be set back from watercourses, however controls are still required to ensure no run-off enters these watercourses. As part of the Qld secondary approvals for the Project, a Development Permit for Material Change of Use–-Environmentally Relevant Activities (ERA) for a Sewerage Treatment Facility will be required to lawfully establish the temporary worker's accommodation camp. As part of the Development Application material, an assessment will be carried out under the *Environmental Protection Act 1994* to ensure impacts associated with the proposal are avoided and mitigated where necessary. The conditions from this Development Permit will be implemented as well as the controls developed in the Erosion and Sediment Control Plan and Construction Environmental Management Plan.

8.1.2.6 MNES Susceptible to Indirect Impacts

All MNES are susceptible to these indirect impacts to some degree; however, some are known to be more susceptible than others, or have been identified as key threatening processes for the MNES. The susceptibility of the specific MNES values identified within the Study Area to the potential indirect impacts is outlined in **Table 8.3**.

Table 8.3 MNES at Risk of Indirect Impacts Associated with the Construction Phase

Indirect Impact	Relevant MNES	Description	Frequency	Duration	Magnitude
Weed and pest incursion	Threatened flora species	Encroachment or exacerbation of exotic weed species including rubber vine and high biomass grasses could inhibit regeneration, increase fire loads and/or smother individuals within the retained areas of potential habitat.	Infrequent / periodic–- fluctuate seasonally and with land management practices or breaches in general construction protocols (weed washdowns etc.).	Temporary – outbreaks addressed via general land management obligations under State laws.	Localised, but could extend to the broader Study Area if unmanaged. Magnitude also considered low given existing condition of habitat is already impacted by weeds and pests.
	Squatter pigeon (southern)	The squatter pigeon (southern) is a predominantly ground dwelling species. The species is highly susceptible to predation from exotic predators including feral cats and foxes. However, as detailed above, feral cat population levels in the Study Area are likely to already be high and the Disturbance Footprint has been co-located with cleared areas wherever possible, that may already provide a conduit for pest movement. With the implementation of best practice weed and pest mitigation measures, it is considered unlikely the Project will lead to a notable increase in pest populations.			
	Northern quoll and ghost bat	Any potential increase in cane toad populations as a result of the Project could threaten the northern quoll and potential ghost bat populations within the Disturbance Footprint. Cane toads were recorded during the field survey and are likely to be common in the area. Increases in pest predator species such as foxes and feral cats may lead to increased competition for prey species.			

Indirect Impact	Relevant MNES	Description	Frequency	Duration	Magnitude
	Koala	Any potential increase in dingo or wild dog populations as a result of the Project could threaten the local koala population. However, as above it is considered unlikely the Project will lead to a notable increase in pest populations.			
	Collared delma	Collared delma is susceptible to weed incursion, which may displace individuals from habitat. Dwarf lantana (*Lantana montevidensis**) is noted specifically as a threat to this species in the *Approved Conservation Advice for Delmatilizeda (Collared Delma)* (DEWHA 2008b). *Lantana montevidensis** was recorded within the Study Area. With the implementation of best practice weed and pest mitigation measures, it is considered unlikely the Project will lead to a notable increase in weed populations.			
Elevated dust	Threatened flora species	Extended periods of dust deposition could threaten the health and viability of potentially present individuals. The implementation of dust management as deemed necessary and in response to conditions will limit the chances of construction dust having an adverse impact on vegetation.	Infrequent – associated with breaches in general construction protocols. Frequency is likely to be higher within the access road corridor due to higher levels of traffic during construction.	Temporary – Potential impacts rectified through active management or through natural processes such as rainfall.	Localised / low – will only effect immediate area.

Indirect Impact	Relevant MNES	Description	Frequency	Duration	Magnitude
Erosion and loss of soil structure and stability	Threatened flora species	The Disturbance Footprint has a variable terrain and includes areas of steep hills and rises. Threatened flora are known, or have the potential to occur in these areas, and will be susceptible to habitat degradation and direct impact should soils become unstable as a result of adjacent works. Potential impacts relating to erosion will be actively managed via the Project's Sediment and Erosion Control Plan minimising these risks.	Infrequent / periodic–- fluctuate seasonally and with land management practices or breaches in general construction protocols	Temporary – limited to once off incident or rectified through seasonal inundation diluting to background levels given the ephemeral nature of most waterbodies	Localised / low – will only effect immediate area.
	Greater glider (southern and central) and yellow-bellied glider (south-eastern) (*Petaurus australis australis*)	Although unlikely, erosion and alteration of riparian zones may lead to the loss of canopy vegetation. These trees may contain hollows which are necessary for the breeding of arboreal mammals such as the greater glider (southern and central). Trees may also be important for maintaining shelter and connectivity along the watercourse. As above, erosion risks will be actively managed via the Project's Sediment and Erosion Control Plan.			
Increased noise and artificial light	Nocturnal MNES	Increased lighting within or adjacent to potential habitat within the Disturbance Footprint could increase the success of predation by visual predators (including exotic pests) or could alter foraging and breeding behaviours. Construction noise during the day may disturb denning or roosting individuals and negatively affect circadian rhythms. Noise and light impacts will be managed via the Project's Construction Environmental Management Plan minimising the overall risk of adverse impacts.	Occasional – minimal night work however noise and light as a result of construction works have the potential to disrupt fauna species.	Temporary – minimal night work, significant excavation work likely required only within a portion of the Disturbance Footprint and generally limited to tower locations.	Localised – restricted to confined worksite within Disturbance Footprint.

Indirect Impact	Relevant MNES	Description	Frequency	Duration	Magnitude
Increased human activity	Northern quoll	Increased human activity levels within the Disturbance Footprint during construction may result in a greater availability of potential food resources, which may attract foraging northern quoll if not properly stored and/or disposed of. This may impact the species through foraging on unnatural food resources and increasing the contact with humans and traffic. Overall, this is considered unlikely to have a material impact on the species as appropriate management of food and waste will be part of the standard construction procedures. Northern quoll may also utilise laydown areas/construction materials for refuge opportunities increasing human interaction and the potential to be harmed or killed during construction. However, fencing of equipment storage areas should limit the opportunities for this to occur.	Infrequent – associated with breaches in general construction protocols. Primary food storage area for construction workers will be associated with specific location i.e., site office.	Temporary –Potential impacts will be indirectly monitored and managed through pest protocols, as increased food will also attract these species.	Localised – restricted to confined worksite within Disturbance Footprint.

8.2 Operation and Maintenance Phase

Impacts to flora values during the operation and maintenance phases of the Project are expected to be minimal and relate primarily to the following indirect impacts:

- Weed introduction and spread.
- Edge effects.
- Erosion and sedimentation.
- Dust impacts.

Impacts will be temporary, and it is expected that these impacts can be managed through the mitigation and management measures provided in **Section 9.0**.

Potential impacts to fauna during the operation and maintenance phase include:

- Vehicle strike.
- Mortality to birds and bats through collision with infrastructure.
- Barotrauma suffered by bats flying in close proximity to turbine blades.
- Barrier effects to avifauna from project infrastructure.
- Noise emitted from wind turbines affecting wildlife communication.

Vegetation clearing is unlikely to be repeated as part of the operation and maintenance of the Project. The exception to this is areas directly adjacent to certain infrastructure (i.e. substation) and in areas required for use throughout the life of the Project such as access tracks. In these locations, clearing works will predominantly comprise grass slashing and pruning and will be conducted as required for safe access and operation of infrastructure.

8.2.1 Vehicle Strikes

During operation, it is expected that temporary periods of increased vehicle activity, including light vehicles, large trucks and maintenance equipment will occur on the access /roads within the Disturbance Footprint. Risk of vehicle strike will be increased along the access road corridor, particularly during peak times of wildlife activity (i.e. dawn and dusk). Although the frequency of vehicle movements during operations is expected to be minor, there is some risk of vehicle strike to fauna species including medium to large mammals, woodland birds which forage on the ground and reptiles. Of the known and potentially occurring MNES, four are considered vulnerable to vehicle strike: koala (*Phascolarctos cinereus*), northern quoll (*Dasyurus hallucatus*), collared delma (*Delma torquate*) and squatter pigeon (southern) (*Geophaps scripta scripta*).

8.2.2 Infrastructure Collisions

Certain bird and bat species are known to collide with wind turbine blades, towers, nacelles, guy cable, power lines and meteorological masts resulting in injury or death. The majority of fatalities appear to result from turbine collisions (Grodsky *et al.* 2011). Drewitt & Langston (2008) identify a range of factors that influence risk of collisions with such infrastructure, including:

- Physical attributes of a wind turbine generator (i.e. turbine dimensions, lighting).
- Species-specific variables (i.e. abundance, flight behaviour, turbine avoidance capacity).
- Biophysical attributes (i.e. landscape position, topography, vegetation type).

Factors falling under the latter two points are often interrelated and generally highly spatially and temporally variable. Proximity to roost locations, migratory flight pathways and wetlands appear to be particularly important factors that influence bird and bat utilisation.

Data from Australia, Europe and North America indicate that the risk of collision is likely to be highest in any given area or landscape where species most susceptible to collision (i.e. migratory species, raptors, swifts, waterbirds, high flying microbats) most frequently occur. The consequence of mortality resulting from collision for any given species is largely influenced by the species' population size and life history traits such as longevity and fecundity which combine to determine a species' capacity to replace individuals lost.

Of the known and potentially occurring MNES, one species (the white-throated needletail) has been identified as being at very high overall risk of collision-based impacts from the Project due to a high likelihood and high consequence of collisions. Several non-listed microbat species are also at moderate to high overall risk of impacts from the Project due to the probability that they may fly at RSA height, noting the very high level of uncertainty inherently associated with any estimate relating to whether each species rarely, occasionally or regularly flies at RSA height. The full risk assessment is provided in the *Bird and Bat Utilisation Assessment* (Appendix A of the Preliminary Bird and Bat Adaptive Management Plan (Attachment G of the Preliminary Documentation)).

A potential secondary impact associated with bird and bat collisions is the increased presence of both native and exotic ground-dwelling predators who may feed on carrion. Native predator species relevant to the Project that may be attracted to the carrion include the threatened northern quoll. The increased use of cleared areas by northern quoll to forage may result in greater levels of direct predation and competition with exotic predators including the feral cat (*Felis catus**) and European fox (*Vulpes vulpes**), which is a recognised key threatening process to the species.

8.2.3 Barotrauma

Barotrauma is a phenomenon in which rapid air pressure changes cause tissue damage to air-containing structures, most notably the lungs (Baerwald *et al.* 2008). Barotrauma can also result in non-lethal injuries such as hearing impairments and other internal injuries that may result in bats succumbing to their injuries at a later time.

There is currently no published information on barotrauma in Australia. One study undertaken in Canada found that 90% of bat fatalities involved internal hemorrhaging consistent with barotrauma, and that collision with turbine blades accounted for about 50% of the fatalities (Baerwald *et al.* 2008). However, another study found that only 6% of bats collected at a wind farm in Illinois had lesions possibly consistent with barotrauma, leading to the conclusion that traumatic injury (i.e. collisions) is the major cause of bat mortality at wind farms (Rollins *et al.* 2012).

Due to the difficulty in diagnosing barotrauma unless the carcass is examined immediately after death, it is possible that cases attributed to barotrauma have been confused with traumatic injury associated with direct collisions.

Of the microbat species detected during field surveys, it is considered probable that seven species may fly at RSA, none of which are listed under the EPBC Act. In the absence of data from RSA height in the Study Area a very high level of uncertainty is inherently associated with any estimate relating to whether each species rarely, occasionally or regularly flies at RSA. However, the risk of barotrauma is relevant to all microbat individuals when flying within RSA.

8.2.4 Barrier Effects

Barrier effects can be caused by wind turbines disrupting links between feeding, roosting and/or nesting areas, or diverting flights (including migratory flights) around a wind farm. Species that pass wind farms frequently on migration appear to be of higher concern than other species (Hötker, Thomsen & Köster 2006). However, these effects on birds, possibly resulting in higher energy consumption or injuries as a result of collision, are not yet well known (Schuster, Bulling & Köppel 2015). There is currently no published information on barrier effects from wind farms in Australia.

Construction and expansion of existing roads and access tracks has the potential to cause further barrier effects. Species with limited dispersal capacity over short distances (i.e. reptiles, frogs and smaller passerines) are likely to be most susceptible to these impacts.

8.2.5 Noise Impact

Anthropogenic noise pollution can have detrimental impacts to wildlife throughout urban, rural and natural landscapes. Typical noise pollution includes a non-strike continuous but usually low decibel (dB) noise emitted from wind turbines, construction or a highway whilst acute, impulse noise is short-lasting but usually a high dB (Dooling and Popper, 2007). The severity of the noise impact to the surrounding wildlife is determined by several factors including acoustic duration and intensity of the noise source and the biology and ecology of the surrounding species (Lawrence et al. 2015).

Noise impacts can occur over an acute or chronic timescale, representing both sub-lethal and lethal impacts that have the potential to cause permanent damage; a factor that is influenced by acoustic duration, intensity, and the biology and ecology of the specific species (Lawrence et al. 2015).

The potential effects of these types of noises on wildlife may include:

- Producing significant changes in behaviour (e.g. an animal having to go further from its nesting site to find food).
- Masking signals used by animals to communicate between conspecifics or recognise biological signals to reduce the distance signals can be detected.
- Impairing detection of sounds of predators and/or prey by masking.
- Decreasing hearing sensitivity temporarily or permanently; and/or increasing stress and altering reproductive and other hormone levels (Lawrence et al., 2015).
- Directly perceiving noise as a threat resulting in anti-predatory behaviour or complete avoidance (Teff-Seker et al., 2022).

The expected operational noise emitted from the windfarm is be presented below and compared against the measured existing ambient noise level and noise impact thresholds developed for continuous noise (Dooling and Popper, 2007).

8.2.5.1 Operational Noise Prediction of Mt Hopeful Wind Farm

Operational wind farms emit sound within the infrasonic (0–20 Hz) and low frequency range between 20 and 200 Hz (Zajamsek et al., 2016). The Mt Hopeful Wind Farm Noise Impact Assessment (Sonus, 2023) was conducted for the loudest wind turbine generator model (WTG) considered for the Project at maximum hub height of 170 m (Sonus, 2023). Predicted noise levels increase with windspeed, topography and other landscape variables with noise level predictions conducted at the highest expected windspeeds of 11 m/ second (Sonus, 2023). Assessment of the noise contours from each WTG predicts noise levels of 45 dB within 0.1 km to 1 km, 40 dB between 0.5 km to 3 km and 35 dB levels predicted between 1.5 km and 5 km (Sonus, 2023). The range/ variability of each noise level threshold reflects the results from the Noise Impact Assessment as measured at nine sensitive land use sites surrounding the proposed wind farm (Sonus, 2023). The same noise assessment also returned a background night noise level of 38 dB at the same windspeeds within the area (host lot 5) (Sonus, 2023).

8.2.5.2 Expected Noise Impact to Wildlife

Noise impact thresholds were developed by Dooling and Popper (2007) based on the responses to birds and other taxa and are presented below:

a. Zone 1: Continuous noise can potentially result in hearing loss, threshold shift, masking and/or other behavioural and or/physiological effects. Laboratory evidence shows that continuous noise levels above 110 dB(A) SPL or a single blast noise over 140 dB SPL (125 dB SPL for multiple blasts) will likely result in damage.

b. Zone 2: At greater distances from the noise source, starting where the noise levels fall below 110 dB(A) continuous exposure, hearing loss and permanent threshold shift are unlikely to occur. However, continuous noise above 93 dB(A) SPL might still temporarily elevate a bird’s threshold, mask important communication signals, and possibly lead to other behavioural and/or physiological effects.

c. Zone 3: At even greater distance from the noise source, but where the spectrum level of the noise is still at or above the natural ambient noise level, masking of communication signals from the noise source will occur beyond that which already occurs from natural ambient noise. This in turn may also result in other behavioural and/or physiological effects.

d. Zone 4: Once the level of continuous noise falls below ambient noise levels in the critical frequencies for communication, masking of communication signals is no longer an issue. However, faintly heard sounds falling outside the region of the ecological target value’s vocalisations, such as the low rumble of a truck (in the case of birds), may still potentially cause other behavioural and/or physiological effects.

e. Beyond zone 4: At this boundary, the energy in continous noise at all frequencies is completely inaudible (i.e. falls below the bird’s masked threshold) to the bird and has no effects of any kind on the bird.

8.2.5.3 Potential Impact to Wildlife

Results from the noise level predictions suggest the windfarm noise emission will fall between zones 3, 4 and beyond zone 4 indicating limiting potential masking effect of wildlife communication signals and potential behavioral and/or physiological effects. However, this is dependent upon the existing ambient noise of the area that the wildlife is already subject to which was measured at 38 dB for the area (Sonus, 2023). Therefore, an ambient noise increase of 2 dB (5%) 0.5 to 3 km from the WTGs and 7 dB (15.6%) increase within 0.1 to 1 km of the WTGs can be expected. Considering this level is still below typical ambient noise thresholds of a rural area (50–55 dB), the severity of the impact to wildlife is likely to be minor (Dooling and Popper, 2007).

8.2.5.4 Anticipated Response From Wildlife

The traits of various species contribute to the sensitivity to wind turbine noise including each species' ecology, life history and physiology such as frequency hearing sensitivity and dependence on low frequency communication (Teff-Seker et al., 2022). Equally so, a species' response to noise impact varies with the majority of studies focusing on birds impacted by highway noise (Duquette, Loss and Hovick, 2021). Wildlife have been documented to modify communication in various ways to overcome anthropogenic noise masking include increasing the interval of calls, increase the volume of calls, timing calls to avoid other continuous anthropogenic noise, altering the entire frequency of calls to better suit the empty frequencies of the soundspace or, increasing just the minimum frequency of the call above the low frequency masking (Duquette, Loss and Hovick, 2021). Results from a meta-analysis on wildlife responses to anthropogenic noise infers that a range of birds, amphibians and hemipterans increase the minimum low frequency of communication as the most common adaptation however, the research also states this does not necessarily mean the species avoids the negative impact (Duquette, Loss and Hovick, 2021).

8.2.5.5 Potential Impact to Koala

Koalas produce a low frequency bellowing call typically made by a male as a mating call at approximately 27 Hz (Narayan and Williams, 2016). This falls within the same low frequency level expected from wind turbine operation (Zajamsek et al., 2016). During breeding season, males will try to establish dominance over the home range of a number of females and begin calling from spring to advertise their presence to surrounding koalas (DES, 2022).

As described in **Section 8.2.5.2**, an ambient noise increase of 2 dB (5%) 0.5 to 3 km from the WTGs and 7 dB (15.6%) increase within 0.5 km of the WTGs can be expected. The severity of the impact to the koala population is considered low as the increase is relatively minor and the overall predicted ambient noise level remains below typical noise thresholds of a rural area (50–55 dB) and other scenarios where koalas persist (Dooling and Popper, 2007). Yet, there is still some potential for the noise increase to mask the mating calls of the Mt Hopeful koala population and reduce the distance that males can communicate. Although specific research on the matter is unavailable, the anticipated response of the local population from operational noise is discussed below in consideration of the species' ecology and behavior.

8.2.5.6 Anticipated Response from Koala

Koala are solitary animals with a network of overlapping home ranges ranging from 3 to 500 ha depending on the density of the population and abundance of suitable food trees (DAWE, 2022). Considering only a single pair of female and joey koalas have been detected after an extensive survey program of the site, it can be deduced that the Mt Hopeful population is at a low to very low density. Therefore, it can be expected that the potential noise impact area (area where noise is above ambient noise of 38 dB i.e. thresholds 40 and 45 dB) would make up a small proportion of the area a male koala would traverse throughout habitat in the Study Area during the breeding season. Moreover, koalas have an acute sense of smell relied upon to detect other koalas and preferred food trees (DES, 2022). Males have a scent gland located on the chest that oozes a clear, oily, strong musky smelling liquid which they rub against tree trunks to attract females (DES, 2022). During breeding season, males will traverse the home ranges of multiple females whilst advertising a bellowing, mating call and marking tree trunks with their scent gland. This alternative form of olfactic communication would not be impacted by the windfarm noise and therefore, still allow koalas to locate one-another within the noise impacted areas of Mt Hopeful. Finally, koalas only utilise vocal calls during the breeding season typically between September and February and rely upon scent marks to locate favored foraging trees (DES, 2022). There is no known reason why the wind turbine noise would deter a koala from foraging within the noise impact areas during the non-breeding season. Therefore, the noise impact is not expected to degrade the foraging value of koala habitat surrounding WTGs.

In summary, the severity of operational noise impact to koalas and other wildlife is low as the increase from ambient noise levels is limited to 2 dB/ 5% at 0.5–3km and 7 dB/ 15% within 0.1–1km from the WTGs. Moreover, the overall predicted ambient noise level remains below typical noise thresholds of a rural area (50–55 dB) and other scenarios where koalas and other wildlife persist (Dooling and Popper, 2007). There are three factors of the Mt Hopeful koala population that contribute to its capacity to adapt to the limited expected operational noise impact of the wind turbines. These include a high dispersal range during breeding season, alternative and non-impacted olfactory communication method through scent marks and the non-reliance of audio communication for foraging. In conclusion, the noise impact is not expected to reduce the ecosystem function of nearby vegetation nor prevent communication between koalas or other wildlife.

8.3 Decommissioning and Rehabilitation Phase

The Project will be decommissioned in accordance with the Decommissioning Management Plan and in compliance with any planning conditions at the time of the decision. This plan follows the current best practice approach for removal of infrastructure including the removal of all above ground structures; the removal of all underground structures to at least 1 m below ground level with structures beneath this level to remain in situ. This approach is considered less environmentally damaging than the complete removal of all above and below ground structures from the Disturbance Footprint. Areas of disturbed land will be reinstated to the original condition prior to the construction of the Project or to the condition just prior to the commencement of the decommissioning activities.

Overall, impacts on MNES values associated with the decommissioning and rehabilitation phase are expected to be minor. However, there is some potential for impacts to occur on threatened fauna species and their habitat in both a direct and indirect capacity.

Direct impacts may include:

- Slashing and pruning of recolonised vegetation in specific locations, that may support threatened species habitat.
- Vehicle and other operational equipment strike.

Indirect impacts associated with decommissioning and rehabilitation are expected to be similar (although less severe) to construction phase impacts including:

- Elevated noise and light.
- Soil erosion and sedimentation.
- Edge effects.
- Increased dust generation as a result of increased vehicles and machinery.

9.0 Avoidance, Mitigation and Management

Neoen is committed to ensuring the Project follows the principles of ecologically sustainable development. In planning for and developing the Project, Neoen have implemented the hierarchy of management principles. These principles and the order in which they have been applied is as follows.

1. **Avoid:** locating activities to avoid direct and indirect impacts on MNES.
2. **Minimise:** minimising direct and indirect impacts where they cannot be completely avoided.
3. **Mitigate:** implementing mitigation and management measures to reduce direct, indirect and cumulative impacts.
4. **Remediate and rehabilitate:** actively remediate and rehabilitate impacted areas to promote long-term recovery.
5. **Offset (where necessary):** provide suitable offsets for activities that result in significant residual impacts to MNES even with the implementation of the above principles.

Section 9.1 below describes how impacts on MNES have and will be avoided and minimised for the Project. **Section 9.3** details the proposed mitigation and management measures, with specific mitigation measures relevant to known and potentially occurring MNES described in **Section 9.3.2** and **Appendix E** as part of the significant impact assessments.

9.1 Avoid

The avoidance of MNES values has been demonstrated through both selection of the Study Area and the design and siting of the Development Corridor. Revisions to both have occurred throughout the life of the Project as a result of community and landholder consultation, wind resource data, grid connectivity options and an understanding of on-ground constraints including MNES.

The Development Corridor size and configuration in particular has undergone several revisions and has been informed by an ecological constraints analysis, which is described in **Section 9.1.1** below.

9.1.1 Ecological Constraint Analysis

The Development Corridor shown within this report has been subject to an ecological constraint analysis. The purpose of the constraint analysis was to determine priority avoidance areas based on the presence (potential and known) of flora and fauna values with varying sensitivity levels and environmental significance including MNES status. The analysis utilised habitat mapping informed by field validated data and incorporated a traffic light system with values ranging from a very high constraint value to a limited constraint value.

A key initial input in the constraints analysis was the delineation of remnant and regrowth habitat types from non-remnant cleared areas, as well as the identification of suitability for MNES including the presence of habitat features which may be limited in the environment. Two threatened species known to the Study Area may inhabit select non-remnant areas: the squatter pigeon (southern) (*Geophaps scripta scripta*) and koala (*Phascolarctos cinereus*). However, both of these species have broad habitat requirements and the squatter pigeon (southern) is not overly sensitive to disturbance. Non-remnant areas are unlikely to be relied upon for any stage of the species lifecycle. The majority of remaining known or potentially occurring MNES species are highly unlikely to inhabit these areas due to the absence of necessary habitat features and / or ecological functionality.

Siting Project infrastructure within areas that have already been previously cleared allows for MNES values to be largely avoided in these areas. Unnecessary vegetation clearing for some Project elements such as access tracks and laydown areas has also avoided and as the areas affected are already impacted by historical clearing and edge effects, the severity of new habitat fragmentation impacts has been minimised in design.

The Development Corridor size and configuration in particular has undergone at least three significant revisions (all of which have resulted in a reduced number of turbines) to account for impacts to *Cycas megacarpa*. Known high-density areas of *Cycas megacarpa* were prioritised for avoidance during the initial design phases.

The main priority fauna value that was considered in the constraints analysis was habitat features considered unique or uncommon in the landscape (e.g. breeding and denning habitat for northern quoll (*Dasyurus hallucatus*).

This process directed infrastructure towards pre-disturbed areas, avoiding MNES values to the greatest extent possible.

9.2 Minimise

Where impacts on MNES cannot be avoided, all efforts will be made to minimise Project impacts. Vegetation clearing and the subsequent construction of the Project will occur progressively and in stages. By doing this, only a small subset of the Disturbance Footprint will be impacted at one time. Indirect impacts resulting from the construction of the Project will be localised, short-term, and actively managed as detailed below. Furthermore, clearing extents detailed in **Table 8.2** represent a worst-case scenario.

Since referral of the Project, predicted direct impacts to MNES across the Study Area have been minimised via a significant redesign of the Project, as described below in **Section 9.2.1**. Micro-siting of Project infrastructure will provide opportunities to further minimise direct impacts on MNES within the Development Corridor (see **Section 9.2.2**).

9.2.1 Design Changes

The Project originally proposed the construction, operation and decommissioning of 118 turbine generators and supporting ancillary infrastructure within a Development Corridor covering 1,973.3 ha. Influenced by a range of factors including MNES values, the Project scope and Development Corridor configuration were recently reassessed and adjusted by Neoen. This process resulted in significant changes to the Project including a decrease in the number of turbines (118 to 63) and the Development Corridor size (reduced by >400 ha). A primary benefit of these changes is the minimisation of impacts to MNES, as detailed in **Table 9.1**.

To demonstrate the nature and extent of the Project changes, the original Development Corridor (previous assessment unit for impact) and the current Disturbance Footprint (current assessment unit for impact) are shown on **Figure 9.1**.

Table 9.1 Comparison of predicted direct impacts on MNES between current Disturbance Footprint, Development Corridor and referral Development Corridor

Update latest Threatened Species or Migratory Species	Referral Development Corridor (ha) [1]	Current Development Corridor (ha)	Disturbance Footprint (ha)	Area Reduction (ha)	Area Reduction (%)
Threatened Flora					
Cycas megacarpa	1,218.4	1,013.4	641.5	576.9	47.3
Cossinia australiana	46.1	21.1	8.6	37.5	81.3
Decaspermum struckoilicum	6.2	6.3	2.3	3.9	62.9
Samadera bidwillii	1,042.1	638.9	347.8	694.1	66.4
Threatened Fauna					
Northern quoll (*Dasyurus hallucatus*) – denning/refuge and foraging/dispersal	1,456.1	929.5	596.9	859.2	59.0
Koala (*Phascolarctos cinereus*) – breeding/foraging/ dispersal and climate refugia	1,587.8	1,095.2	646.9	940.8	59.2
Collared delma (*Delma torquata*) – breeding/foraging	650.7	448.6	272.8	377.9	58.1
Red goshawk (*Erythrotriorchis radiatus*) – foraging/dispersal	1,627.4	1,092.4	633.0	994.4	61.1
Squatter pigeon (southern) (*Geophaps scripta scripta*) – breeding, foraging and dispersal	819.1	641.5	368.5	450.6	55.0
Ghost bat (*Macroderma gigas*) – seasonal foraging/dispersal only	1,974.7	1,564.6	883.6	1091.1	55.3

[1] The impact area for each species will differ from those in the referral as the new habitat rules have been applied, as per the Request for Information (RFI).

Update latest Threatened Species or Migratory Species	Referral Development Corridor (ha) [1]	Current Development Corridor (ha)	Disturbance Footprint (ha)	Area Reduction (ha)	Area Reduction (%)
White-throated needletail (*Hirundapus caudacutus*) – roosting/foraging and foraging/dispersal	1,621.5	1,096.7	640.2	981.3	60.5
Greater glider (southern and central) (*Petauroides volans*) – breeding/denning and foraging/dispersal	1,558.6	1,054	627.9	932.8	59.8
Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)	913.1	531.6	322.0	591.1	64.7
Grey-headed flying-fox (*Pteropus poliocephalus*) – foraging/dispersal	901.8	510.4	277.3	624.5	69.3
Migratory Species					
Fork-tailed swift (*Apus pacificus*) – foraging/dispersal	1,974.7	1,564.6	883.6	1,091.1	55.3
Oriental cuckoo (*Cuculus optatus*) – foraging/dispersal	1,042.1	639.2	348.1	694.2	66.6
Black-faced monarch (*Monarcha melanopsis*) – foraging/marginal breeding and foraging/dispersal	1,044.0	639.7	348.4	695.6	66.6
Satin flycatcher (*Myiagra cyanoleuca*) –foraging/dispersal	995.9	618.3	339.7	656.4	65.9
Rufous fantail (*Rhipidura rufifrons*) –foraging/dispersal	1,042.1	639.2	348.1	694	66.6
Spectacled monarch (*Symposiarchus trivirgatus*) – foraging/dispersal	101.6	40.2	17.7	83.9	82.6

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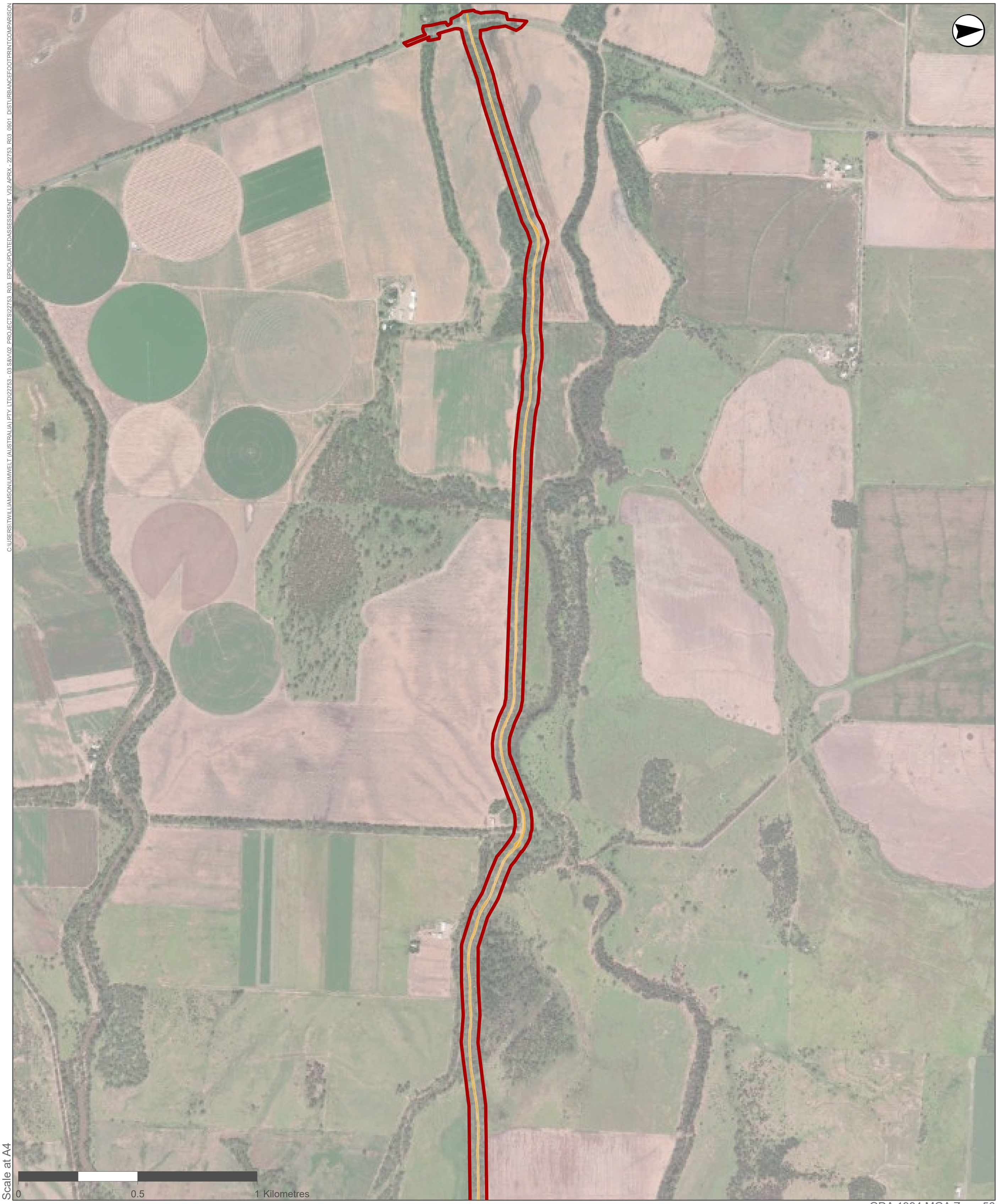


Scale at A4
1:22,500

GDA 1994 MGA Zone 56

Legend

- Watercourse
- Study Area
- State Forest
- Current Disturbance Footprint
- Referred Development Corridor

FIGURE 9.1A

Comparison of Direct Impacts – Referral Development Corridor vs Current Disturbance Footprint

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

GDA 1994 MGA Zone 56

Legend

- Watercourse
- Study Area
- State Forest
- Current Disturbance Footprint
- Referred Development Corridor

FIGURE 9.1B

Comparison of Direct Impacts – Referral Development Corridor vs Current Disturbance Footprint

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

GDA 1994 MGA Zone 56

Legend

- Watercourse
- Study Area
- State Forest
- Current Disturbance Footprint
- Referred Development Corridor

FIGURE 9.1C

Comparison of Direct Impacts – Referral Development Corridor vs Current Disturbance Footprint

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

Legend

- Watercourse
- Study Area
- State Forest
- Current Disturbance Footprint
- Referred Development Corridor

FIGURE 9.1D

Comparison of Direct Impacts – Referral Development Corridor vs Current Disturbance Footprint

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

GDA 1994 MGA Zone 56

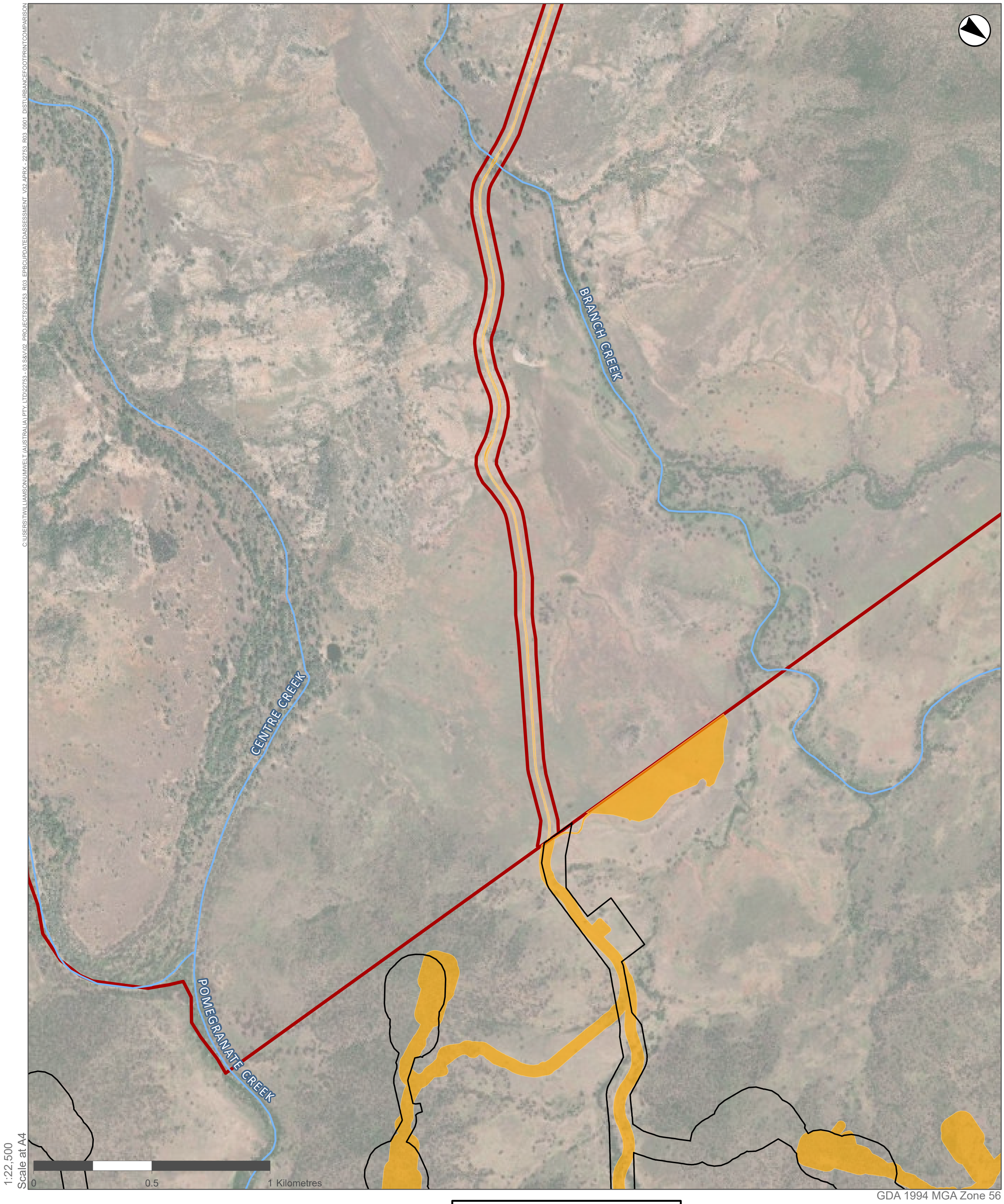
Legend

- Watercourse
- Study Area
- State Forest
- Current Disturbance Footprint
- Referred Development Corridor

FIGURE 9.1E

Comparison of Direct Impacts – Referral Development Corridor vs Current Disturbance Footprint

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



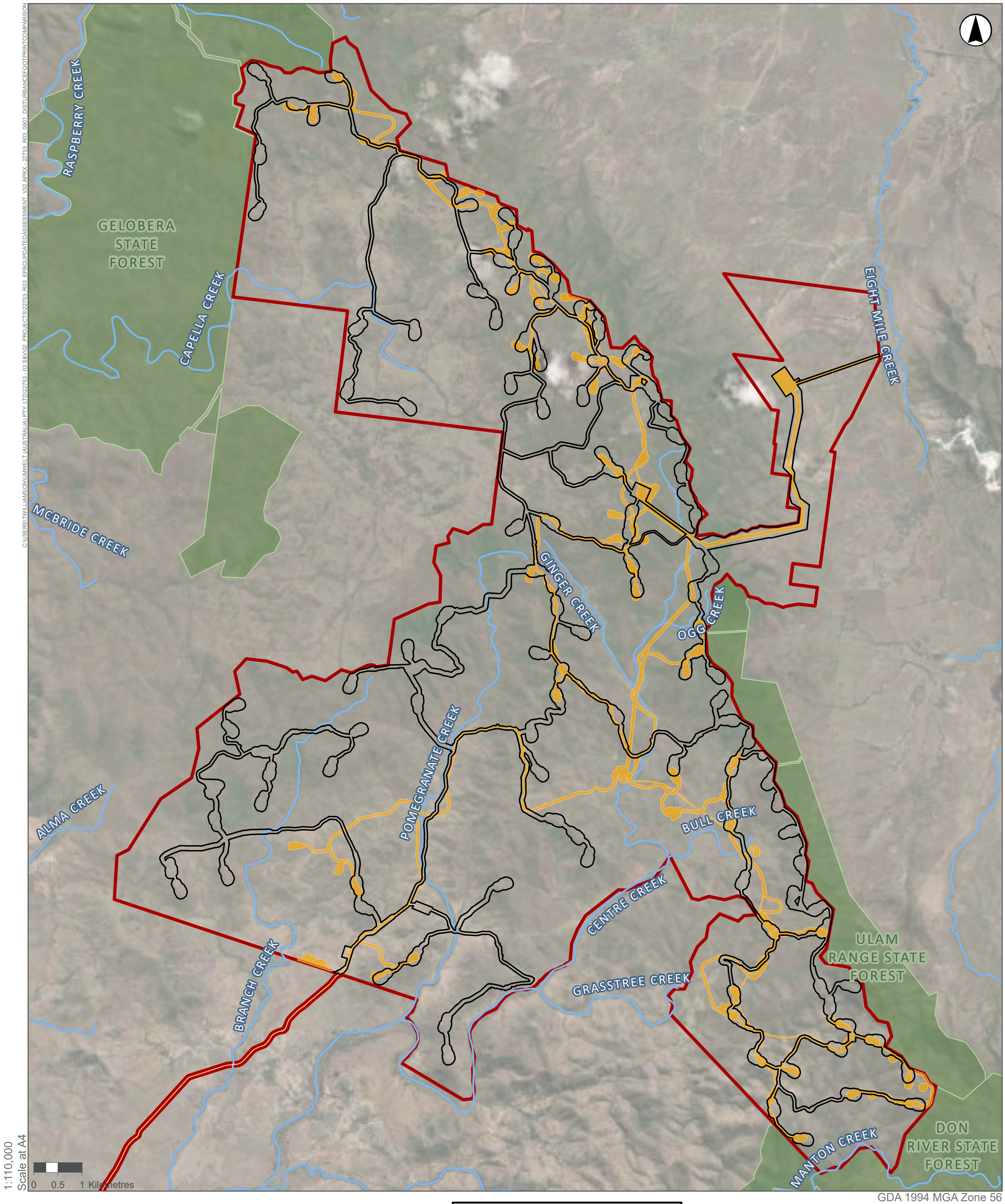
Legend

- Watercourse
- Study Area
- State Forest
- Current Disturbance Footprint
- Referred Development Corridor

FIGURE 9.1F

Comparison of Direct Impacts – Referral Development Corridor vs Current Disturbance Footprint

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Legend

- Watercourse
- Study Area
- State Forest
- Current Disturbance Footprint
- Referred Development Corridor

FIGURE 9.1G

Comparison of Direct Impacts – Referral Development Corridor vs Current Disturbance Footprint

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

9.2.2 Micro-Siting

Project infrastructure will be sited within the Development Corridor based on the location of on-ground constraints including MNES individuals and habitat. Additional field surveys specific to terrestrial ecology (as well as other types of constraints) will be conducted prior to construction, including pre-clearance surveys. This data will allow for increased accuracy and detail in mapped terrestrial ecological values within the Development Corridor including MNES habitat values. Ground-truthed ecological field data will strongly influence the final design of the Project, with the avoidance hierarchy principles in place. Future refinement of the Project will seek to avoid threatened species individuals and habitat, particularly species where significant impacts may occur.

Infrastructure micro-siting will prioritise the avoidance of MNES values not pre-approved for impact or translocation including, but not limited to, potentially occurring threatened flora. However, where an unexpected MNES find occurs, the pre-clearance surveys constraints protocol will be enacted (see **Section 9.3.2.2**).

Infrastructure micro-siting will aim to avoid or further minimise disturbance to:

- Habitat features required by MNES fauna species including hollow bearing trees and stags, trees with diameter at breast height (DBH) >30 cm, large hollow logs and complex boulder piles.
- Large reproductive-age and mature female *Cycas megacarpa* individuals.
- Breeding habitat for threatened and migratory fauna species.
- Vine thicket communities.
- Riparian zones, including avoiding placement of turbines within 50 m of waterways.

9.3 Mitigate and Manage

Throughout the life of the Project, potential impacts on MNES will be directly or indirectly managed via Project Management Plans. Extensive mitigation and management measures relevant to MNES will be captured in one or multiple of the Project management plans. Mitigation and management measures stated within Project Management Plans have been developed utilising available best practice guidance or informed by statutory or policies, where available. All mitigation and management measures relevant to MNES will be captured in one or multiple of the Project Management Plans, listed below:

- Preliminary Health, Safety and Environment Management Plan (HSE Plan) (Attachment C of the Preliminary Documentation).
- Preliminary Construction Environmental Management Plan (CEMP) (Attachment D of the Preliminary Documentation).
- Preliminary Bird and Bat Adaptive Management Plan (BBAMP) (Attachment G of the Preliminary Documentation).
- Preliminary *Cycas megacarpa* Species Management Plan (SMP) (Attachment E of the Preliminary Documentation).

- Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation).
- Preliminary Erosion and Sediment Control Plan (Attachment H of the Preliminary Documentation).
- Preliminary Decommissioning Management Plan (Attachment I of the Preliminary Documentation).
- Preliminary *Cycas megacarpa* Translocation Management Plan (Attachment J of the Preliminary Documentation).
- Preliminary Weed and Pest Management Plan.
- Preliminary Rehabilitation Management Plan.
- Preliminary Bushfire Management Plan.

Eight of the above Management Plans have been submitted as part of the Preliminary Documentation assessment as requested in the RFI (see attachment identifiers above). All plans will be finalised prior to construction commencing.

Further to these plans, general and species-specific mitigation measures have been developed and are detailed in **Section 9.3.1** and **Section 9.3.2**. Greater consideration has been given to MNES values that may be particularly sensitive to potential Project impacts including *Cycas megacarpa*, northern quoll, greater glider (southern and central), yellow-bellied glider (south-eastern) koala and collared delma.

All measures have been developed to be consistent with the S.M.A.R.T principle, ensuring they are:

- **S**pecific – prescriptive, with no uncertainty or ambiguity around their purpose or implementation.
- **M**easurable – the status (i.e. success or failure) and outcomes/results can be measured.
- **A**chievable – through the chosen method of implementation, by the responsible personnel and within the specified timeframe.
- **R**elevant – to the action/impact being controlled and to the protected matter.
- **T**ime bound – Measures were given specific and achievable timeframes for implementation in relation to specific development activities or stages.

9.3.1 General Measures

General mitigation and management measures are relevant to four broad themes including vegetation, fauna, weed and pests and other indirect impacts. All measures captured in this section will be documented in an appropriate Project management plan, which will also include objectives relevant to the theme, timing details and specific metrics to measure progress relative to the objectives. Measures are listed under their associated themes below.

9.3.1.1 Vegetation

The VMP details measures include but are not limited to:

- Site preparation must include the demarcation of areas to be cleared as well as 'no-go' zones to avoid inadvertent clearing.
- Pre-clearance surveys in areas of potential threatened flora habitat will include targeted searches for these species.
- Micro-siting of Project infrastructure will maximise the use of existing breaks in vegetation and areas of previously cleared land as much as practical.
- Micro-siting of Project infrastructure will aim to retain a vegetated buffer around the vine thicket communities up to 5 m, to limit edge effects. In cases where the final Disturbance Footprint intersects the vine thicket communities, a 5 m buffer will not be possible.
- Where watercourses intersect linear areas of the Project (i.e. access tracks and reticulation cabling) the clearing width will be reduced to 25 m or less wherever it is feasible. The full implementation of this measure is subject to final design and safe transport of Project components.
- To minimise further loss of vegetation, trees will be felled away from areas of retained vegetation where practicable. Where trees unavoidably fall into retained areas, they will be left in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna.
- Dust suppression measures will be implemented as required i.e. on high wind days during extended dry periods.

9.3.1.2 Fauna

Project mitigation and management measures related to fauna include:

- Vegetation clearing required within or directly adjacent to areas of breeding and denning habitat for northern quoll should be completed outside of the northern quoll breeding season (late July to late August). Where this cannot be committed to, a trapping and relocation program for northern quoll in these areas must be undertaken prior to vegetation clearing commencing. Potential denning sites in areas to be cleared will have entrances closed to avoid use by northern quoll prior to and during clearing. Following the completion of the trapping program, should an active den be found within the Disturbance Footprint, measures outlined in a pre-approved high-risk SMP will be implemented to ensure no impacts occur to an active breeding place. Where possible, detection dogs will be used to assist in locating northern quoll where potential denning habitat will be impacted.
- A qualified fauna-spotter will be present at all times during clearing and pre-clearance surveys. In areas of MNES habitat planned to be cleared, qualified spotter-catchers will scout the area immediately prior to the commencement of disturbance for the presence of habitat trees and other features (i.e. coarse woody debris, hollow logs, large stones and boulder piles), as well as EPBC Act listed species. This will include an inspection of terrestrial habitat features (hollows, potential dens, surface rocks and fallen logs) prior to disturbance using work platforms, inspection cameras, or other methods deemed safe and suitable. Habitat features/trees will be marked using appropriate paint or flagging tape. Located fauna (excluding koalas, see **Section 9.3.2**) will be moved to a nearby and suitable undisturbed location by the spotter-catcher. Fauna spotters will also be present during earthworks where exposed trenches and holes will be left for periods greater than 24 hours.

- Exclusion zones will be established around identified active and potentially active breeding places, such as nests, burrows, dens etc. Where there is the potential an active breeding place will be tampered with, this will only be done in accordance with an approved and appropriate (low or high risk) DES Species Management Program (SMP) as per the Nature Conservation (Animals) Regulation 2020.

- Micro-siting of Project infrastructure will aim to retain habitat trees (including hollow-bearing trees or stags, trees with DBH >30 cm, and trees containing potential animal breeding places) and terrestrial habitat features (including complex boulder piles, hollow logs). Habitat trees and features that can be avoided will be demarcated. If construction is planned to occur in proximity to a habitat tree/s to be retained, a tree protection zone (TPZ) may be established if deemed necessary by the spotter-catcher. The TPZ will be calculated using Australian Standard (AS) 4970-2009.

- Where they cannot be retained, hollow bearing trees and stags will be 'slow felled' to minimise the chances of injury or death and will be inspected after felling by a qualified fauna spotter to confirm no injured wildlife are present.

- Where they cannot be retained in situ, habitat features (i.e. ground timber including hollow logs, large stones and boulders) will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance).

- Movement within the Study Area will be via approved access tracks only with speed limits enforced. The requirement to enter and traverse the Study Area will be minimised and limited to those required for essential Project activities.

- Night works within or adjacent to areas of MNES habitat will be avoided where possible to reduce impacts from construction light and noise on MNES species (i.e. by interrupting male koala mating calls during breeding season). Where night works are required, lights will be directed to minimise light spill into adjacent habitats and the use of alternative, low-noise construction equipment considered.

- Fauna exclusion fencing will be installed around infrastructure that may pose a hazard such as the substation and laydown areas. Elsewhere, fencing will only be installed as required and will be 'fauna-friendly' (i.e. not barbed wire).

- Any open excavations will be checked for trapped fauna in the morning and at the end of the day by a suitably qualified spotter-catcher. Trench ladders, ramps, sticks, ropes and moist hessian sacks at regular intervals (or similar) will be utilised where trenches or excavations are anticipated to remain open for extended periods. This will help trapped fauna escape and/or survive until removed by a fauna spotter-catcher.

9.3.1.3 Weeds and Pests

A number of mitigation and management measures have been developed to minimise the proliferation and/or introduction of introduced weeds and pests. These measures will be managed through the implementation of three distinct management plans, one for each of three Project areas as defined in **Table 9.2** below. Each plan will define measures, objectives, performance criteria and monitoring activities required for the relevant Project area. Although measures for each Project area will be predominantly consistent, measures will be tailored to the specific threats and objectives related to each site.
The mitigation and management measures will be developed with the aim to achieve the management objectives defined in **Table 9.2** below.

The management of weeds and pests in offsets areas will be necessary to ensure the improvement or maintenance of the area for the relevant MNES and to achieve a conservation outcome. Where offset area objectives and performance criteria are related to reduction of weeds and pests, it is important to ensure that any conservation gains from weed and pest management are attributable to management requirements specific to the offset area. Establishing baseline conditions through ecological monitoring will be undertaken prior to securement, or during the first year of the offset. This will allow changes in pest and weed prevalence to be monitored and attributed to any specific offset area management measures.

Where proposed offset areas are in proximity to the Disturbance Footprint, there is the potential for observed pest reduction to be a biproduct of pest management measures implemented for the Disturbance Footprint. Baseline weed and pest monitoring of the Disturbance Footprint will provide the foundation for attributing threat reduction outcomes. Further, tailored measures in the Offset Area Management Plan will be developed once offset requirements are determined to ensure that ongoing management and monitoring is suitably designed to achieve outcomes for target MNES in consideration of the threats in the area.

Table 9.2 Project Area and Management Plans Containing Weed and Pest Measures

Project Area	Relevant Management Plan	Management Objectives
Disturbance Footprint (plus 5 m buffer)	Weed and Pest Management Plan	• Maintain (or improve) the condition of retained habitat compared against baseline condition in terms of disturbance from weeds and pests. • No introduction or proliferation of invasive weed species or pest fauna species. • Successful removal invasive weeds for all areas subject to disturbance.
Cycas megacarpa recipient sites	*Cycas megacarpa* Translocation Management Plan	• Maintain (or improve) the condition of retained habitat compared against baseline condition in terms of disturbance from weeds and pests. • No introduction or proliferation of invasive weed species or pest fauna species. • Successful removal invasive weeds for all areas subject to disturbance.
Offsets area	Offsets Area Management Plan	• Demonstrate improvement in the condition of habitat in the offset area through reduction in weeds and pests known to have a deleterious impact to the target species (i.e. reduction in cane toad population may result in a conservation gain for northern quoll).

Table 9.3 below outlines the overarching performance criteria and management actions which will be implemented to minimise the risk of introduction or proliferation of weeds/pests throughout the Project. A detailed suite of measures including timing, monitoring and reporting requirements will be provided in the Weed and Pest Management Plan, *Cycas megacarpa* Translocation Management Plan and the Offsets Area Management Plan which will require approval prior to any site disturbance commencing.

Table 9.3 Weed and Pest Management Framework

Project Phase	Applicable Area	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
Pre-construction	Disturbance Footprint (plus 5 m buffer). Offset area (to be determined). *Cycas megacarpa* recipient sites (to be determined).	Pest species presence and abundance identified within relevant Project areas	• Pre-clearance surveys will be undertaken within the applicable areas to record the presence and abundance of pest fauna. Baseline conditions will need to be established prior to construction such that impacts from the Project can be monitored throughout the Project lifecycle. • Baseline conditions will need to be established in offset areas, and *Cycas megacarpa* recipient sites to inform conservation objectives and direct recipient site preparation activities.	0–12 months prior to site disturbance during suitable seasonal conditions	Pre-clearance survey report Baseline condition assessment (documented in OAMP and CTMP)
	Disturbance Footprint (plus 5 m buffer). Offset area (to be determined). *Cycas megacarpa* recipient sites (to be determined).	Invasive weed species presence and abundance identified within relevant Project areas	• Pre-clearance surveys will be undertaken within the applicable areas to record the presence and abundance of introduced flora and those classified as Category 3 Restricted Matters and/or WoNS or species defined as weeds in the Preliminary Vegetation Management Plan (Attachment F of the Preliminary Documentation). Baseline conditions will need to be established prior to construction such that impacts from the Project can be monitored throughout the Project lifecycle.	0–12 months prior to site disturbance during suitable seasonal conditions	Pre-clearance survey report Baseline condition assessment (documented in OAMP and CTMP)
	Disturbance Footprint (plus 5 m buffer).	Successful removal of invasive weeds within all Project areas subject to disturbance	• Areas containing infestations will be treated prior to the commencement of site disturbance and any construction activities. Refer to Appendix A of the Vegetation Management Plan (Attachment F of the Preliminary Documentation) for species specific control methods. Chemical treatment adjacent to sensitive areas should be avoided, where possible. If chemical treatment is required, spot spraying methods will be undertaken.	0–12 months prior to site disturbance during suitable seasonal conditions	Pre-clearance survey report

Project Phase	Applicable Area	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
Construction, operation and maintenance, decommissioning and rehabilitation	Disturbance Footprint (plus 5 m buffer)	No increase in weed presence and abundance within the applicable areas	• Ongoing weed inspections and management will be completed within the applicable area during site disturbance (i.e. construction and *Cycas megacarpa* translocation) and operation. The weed management area shall be increased where operational maintenance activities are required to be undertaken from unformed areas until such time when weed presence in this area (if existing) can no longer be directly attributed to the Project. • Management of weeds within areas disturbed as part of Project construction (including rehabilitation areas) will continue up to two years post construction, or until weed presence in these areas can no longer be directly attributed to Project activities. Refer to Appendix A of the Vegetation Management Plan (Attachment F of the Preliminary Documentation) for species specific control methods. Chemical treatment adjacent to sensitive areas should be avoided, where possible. If chemical treatment is required, spot spraying methods will be undertaken. • Use of chemical treatment in infestation areas, to be prioritised for use in the early wet season to limit seed formation. Personnel using herbicides are to receive appropriate training prior to commencing work and hold any necessary licences required under Queensland law. Only herbicides registered for use over water will be used within 10 m of watercourses. • Site vehicles (mobile plant including light vehicles) must drive to conditions and remain on approved access tracks, to avoid mud, organic matter and weed seeds becoming attached to the vehicle. Offroad driving will be minimised to avoid contamination when driving between properties within the project site.	Throughout construction, operation and maintenance, decommissioning and rehabilitation	Construction audits (monthly) Weed and pest monitoring to compare against baseline conditions. Frequency of monitoring to be determined in the final CTMP.
	Cycas megacarpa recipient sites (to be determined)	No increase in weed presence and abundance in the immediate planting area or any other areas disturbed by the program (i.e. access tracks)		Throughout the life of the *Cycas megacarpa* Translocation Management Plan (minimum of 7 years as defined in the CTMP)	Weed and pest monitoring to compare against baseline conditions. Frequency of monitoring to be determined in final CTMP.

Project Phase	Applicable Area	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
			• A wash down area with a capture vessel will be established on or in proximity to the Project Site to ensure machinery hygiene. • Site vehicles to be washed down after working in areas where infestations are noted within applicable areas (where identified), and where weed control measures have not been implemented. • During the annual wet season light vehicles shall be maintained, washed down periodically, and kept in a clean condition. • Light vehicles and worker transport vehicles to remain on sealed roads when offsite, for example between work shifts. Further inspections will not be required when this action is implemented. • Site vehicles (mobile plant including light vehicles) and equipment is to arrive on site 'clean' of weed seeds and other organic matter. Site vehicles are to be inspected and recorded with documented evidence, via a washdown register and weed and seed certificate, prior to site mobilisation. • Personnel boots must be cleaned regularly, as well as between properties by removing excess mud / organic material. Clothing to be checked for weed seeds prior to moving between properties and offsite. • Equipment or material being brought into port facilities for direct transfer to the Project site is required to pass the quarantine inspections and protocols, as per by the Australian Quarantine and Inspection Service.		

Project Phase	Applicable Area	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
			• Material imported into the applicable areas (i.e. for use as road base etc.) must be obtained from an appropriately licensed source where the source location is deemed 'weed clean'. Evidence must be obtained from the provider prior to importation of material to the Project site. Imported fill (rocks/screenings) shall be free of contamination from mud clumps and weed seeds. • Use only native or certified weed free seeds in all rehabilitation works, including hydro mulch. No viable weed species are to be mulched or chipped in rehabilitation works. • All personnel are to be trained in the identification of key weed species during general induction and toolbox talks. Known weed species on the site are to be displayed on posters on the HSE board and any other suitable locations around the Project site.		
Construction, operation and maintenance, decommissioning and rehabilitation	Offset area (to be determined)	Overall reduction in weeds and pests known to have deleterious impacts on the target species. Detailed performance criteria to be determined in the OAMP	• Develop and implement an OAMP which specifies objectives and performance criteria, management actions, program and monitoring schedule. • Where ecological condition monitoring determines that there is an increase in weeds or pests in the offset area or that performance criteria are not being met, this will trigger the requirement for additional weed and pest control measures that will be specified in the OAMP.	The OAMP will be developed and approved prior to construction and implemented throughout the life of the EPBC Act approval	Ecological condition monitoring (weeds and pests) to compare against baseline conditions. Frequency of monitoring to be determined in OAMP, however anticipated that monitoring will be undertaken annually for the first two years and then be undertaken every five years for the remainder of the EPBC Act approval.

Project Phase	Applicable Area	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
Construction, operation and maintenance, decommissioning and rehabilitation	Disturbance Footprint (plus 5 m buffer)	No increase in pest fauna presence and abundance within the applicable areas	• Implement a species-specific control program for pest fauna in consultation with landowner(s). This is only to be implemented if incidence of any feral species has increased during construction or operation as reasonably attributable to the Project. The species-specific control program will be detailed in the Weed and Pest Management Plan. • Avoid inclusion of any water retaining voids or pits in the design where these are not otherwise required for the control of stormwater run-off erosion and sediment control measures or dams required to supply water for construction activities. Where pits and voids are required, include appropriate cover to prevent extended water retention and subsequent breeding opportunities for cane toads. • For pits and voids where long-term presence of retained water is reasonably anticipated and covering is not practicable, fencing to exclude access by cane toads will be incorporated in the design. Sediment fencing, free standing or attached to the base of other fencing material has proven to be effective. • Wash down and laydown areas will be designed to include cane toad traps where exclusion from areas of potential water retention is not practicable and where cane toad activity is locally detected. • No alteration, or refuse left exposed, which will specifically assist breeding opportunities for cane toad, red fox, feral cat, dog, house mouse or black rat on site. • To reduce the presence of pest fauna on site, all food scraps must be placed into designated waste bins, and their lids securely closed. • Train workforce in the identification of pest fauna species present in the area.	Throughout construction, operation and maintenance, decommissioning and rehabilitation	Construction audits (monthly) Compliance audits (annually for life of the EPBC Act approval) Recipient site areas (as prescribed in CTMP)

Project Phase	Applicable Area	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
	Cycas megacarpa recipient sites (to be determined)	No increase in pest fauna presence and abundance which may impact the success of the program (i.e. pigs/horses) within the applicable areas.	Implement a species-specific control program for pest fauna in consultation with landowner(s). This is only to be implemented if incidence of any feral species has increased during construction or operation as reasonably attributable to the Project. The species-specific control program will be detailed in the Weed and Pest Management Plan.	Throughout the life of the *Cycas megacarpa* Translocation Management Plan (minimum of 7 years as defined in the CTMP)	Weed and pest monitoring to compare against baseline conditions. Frequency of monitoring to be determined in the final CTMP.

9.3.1.4 Other Indirect Impacts

- To minimise soil loss, best practice erosion and sediment control measures will be implemented during construction via the Preliminary Erosion and Sediment Control Plan (Attachment H of the Preliminary Documentation):
  - Disturbed areas will be assessed and progressively rehabilitated in accordance with the Vegetation Management Plan and / or Rehabilitation Monitoring Plan.
  - Disturbed areas will be assessed and progressively rehabilitated in accordance with the Rehabilitation Monitoring Plan (to be developed in response to the State approval) and/or the Preliminary Vegetation Management Plan (Attachment F of the Preliminary Documentation).
  - Batters and embankments will be stabilised as soon as practical after construction.
- Undertake refueling and chemical storage in designated containment areas and follow emergency response procedures in the event of a spill. Containment areas will be designed and managed in accordance with relevant regulatory requirements and standards.
- Conditions of the Development Permit for Material Change of Use – Environmentally Relevant Activities (ERA) for a Sewerage Treatment Facility will be implemented to ensure no adverse impacts result from the operation of the sewage treatment plant and associated spray field (i.e. from run-off of nutrient rich water).
- Threat of wildfire caused by Project activities will be minimised through maintenance of firebreaks around ignition sources as appropriate according to the Bushfire Management Plan which will be prepared prior to construction.
- Where approved, the construction contractor may extract water from select farm dams for construction purposes. Water will only be taken where available supplies provide continuity of habitat function and quality.
- Where a watercourse crossing must be established, the crossing site will be the most direct route (i.e. 90 ± 10-degree angle to the watercourse) that maximises the use of existing vegetation breaks and minimises clearing.
- Crossings will be designed in accordance with accepted development requirements for waterway barrier works to ensure fish passage is not impeded. If this cannot be achieved a Development Application will be lodged.

9.3.2 MNES-Specific Measures

Mitigation and management measures specific to the known and potentially occurring MNES within the Study Area are detailed in **Table 9.4** below. Key threatening processes to each MNES as detailed in made/adopted National Recovery Plans, SPRAT, Threat Abatement Plans, Approved Conservation or Conservation Listing have been reviewed in order to propose meaningful mitigation and management measures that take into consideration species-specific threats. Measures proposed incorporate industry best practices, statutory or policy basis mitigation and management of MNES, or peer reviewed literature, where available. Greater consideration has been given to MNES values that may be particularly sensitive to potential Project impacts including the endangered *Cycas megacarpa*, northern quoll (*Dasyurus hallucatus*), greater glider (southern and central) (*Petauroides volans*), yellow-bellied glider (south-eastern) (*Petaurus australis australis*), koala (*Phascolarctos cinereus*) and collared delma (*Delma torquata*).

Section 9.3.2.1 provides detail regarding the Preliminary BBAMP (Attachment G of the Preliminary Documentation), which largely includes measures relevant to potential operational impacts on threatened birds and bats, as well as migratory birds.

Table 9.4 MNES-Specific Measures

Relevant MNES	Measures

Cycas megacarpa	• Pre-clearance surveys for *Cycas megacarpa* will occur across the Disturbance Footprint plus a 5 m buffer to confirm the location, extent, numbers, and age class of the population within the clearing extent, with all efforts made to avoid impacts via micro-siting to high-density areas and large reproductive-age individuals.
	• Areas proposed to be cleared will be demarcated to ensure no accidental clearing outside the approved Disturbance Footprint.
	• A pre-approved *Cycas megacarpa* SMP will be implemented through all Project phases. A preliminary SMP is provided as Attachment E of the Preliminary Documentation. This plan will provide detailed information regarding:
	  o Species information including a description to aid identification.
	  o Mitigation and management methods, including corrective actions.
	  o Vegetation clearing requirements and methods to reduce impacts to surrounding individuals and their habitat.
	  o Specific weed and pest management measures to reduce impacts on the long-term integrity of the remaining habitat and population, including high-biomass weeds.
	  o Erosion, sedimentation, and dust management requirements specific to the species.
	• A pre-approved translocation plan will be implemented for individuals that would otherwise be removed through clearing for the Project. The plan will specify pre and post monitoring requirements, translocation and propagation methods and protocols and reporting requirements and performance criteria. A preliminary *Cycas megacarpa* Translocation Management Plan is provided as Attachment J of the Preliminary Documentation. This Plan has been developed in accordance with the *National Multi-species Recovery Plan for Cycads* (Queensland Herbarium, 2007), the *Guidelines for the Translocation of Threatened Plants in Australia* (Commander *et al* 2018) and with consideration of learnings from other translocation programs for the species undertaken by Ecologica for the coal seam gas and transport sectors between 2008 and 2015.
	• This species is also considered a protected plant under the State NC Act. The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should the Project's clearing impact area (footprint inclusive of a 100 m buffer) contain high risk trigger area mapping or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the Flora Survey Guidelines – Protected Plants (DES, 2020b), and if necessary an impact management plan will be developed and implemented. If required, this will be developed in accordance with the Queensland Government Nature Conservation (Plants) Regulation 2020 – Protected Plants Assessment Guidelines (DES, 2021).

Relevant MNES	Measures
Cossinia australiana, Samadera bidwillii* and *Decaspermum struckoilicum	• Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for the respective potentially occurring threatened flora species. If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence must be recorded including number of individuals, GPS location and extent. The plants or population area including a 5 m buffer must be demarcated. The pre-clearance survey constraints protocol (see **Section 9.3.2.2**) will then be followed to ensure any potential impacts on the species are avoided or managed appropriately. • All potentially occurring threatened flora species are also considered protected plants under the State NC Act. The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should the Project's clearing impact area (footprint inclusive of a 100 m buffer) contain high risk trigger area mapping or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the guidelines (DES, 2020b), and if necessary an impact management plan will be developed and implemented (DES, 2021).
Koala **(*Phascolarctos cinereus*)**	• Pre-clearance surveys will include canopy searches for koalas. If a koala is located during pre-clearance surveys or during clearing activities: o The individual must not be forcibly relocated. o Any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition. o Allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter-catcher. o Any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer. o Requirements for koalas subject to handling to be examined and if suspected of Chlamydia infection will be taken to a predesignated veterinarian/wildlife care facility for treatment prior to release. • Clearing must be carried out in a way that ensures any koalas present have time to move out of the clearing site without human intervention. • In the unlikely event that a koala is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days. • Vehicles may cause direct mortality to koalas (DAWE, 2022). Speed limit restrictions (40 km/hr) will be enforced throughout the site to minimise potential vehicle strike risk to the species. • Nineteen 'pinch points' (excluding the access road corridor which acts as a pinch point throughout) are proposed within the Disturbance Footprint, which have been primarily designed to minimise fragmentation impacts on greater glider (southern and central) and yellow-bellied glider (south-eastern) (**Figure 9.2** and **Figure 9.3**). Pinch points describe locations of the Disturbance Footprint which are reduced in width to provide dispersal opportunities. Although pinch points have been designed primarily to facilitate movement for greater glider (southern and central) and yellow-bellied glider (south-eastern), the reduction in clearing width at these locations will also minimise fragmentation impacts to koala. Facilitating movement for koala and connecting habitat aims to adhere to the planning and design principles of the Koala Sensitive Design Guideline (DES, 2022).

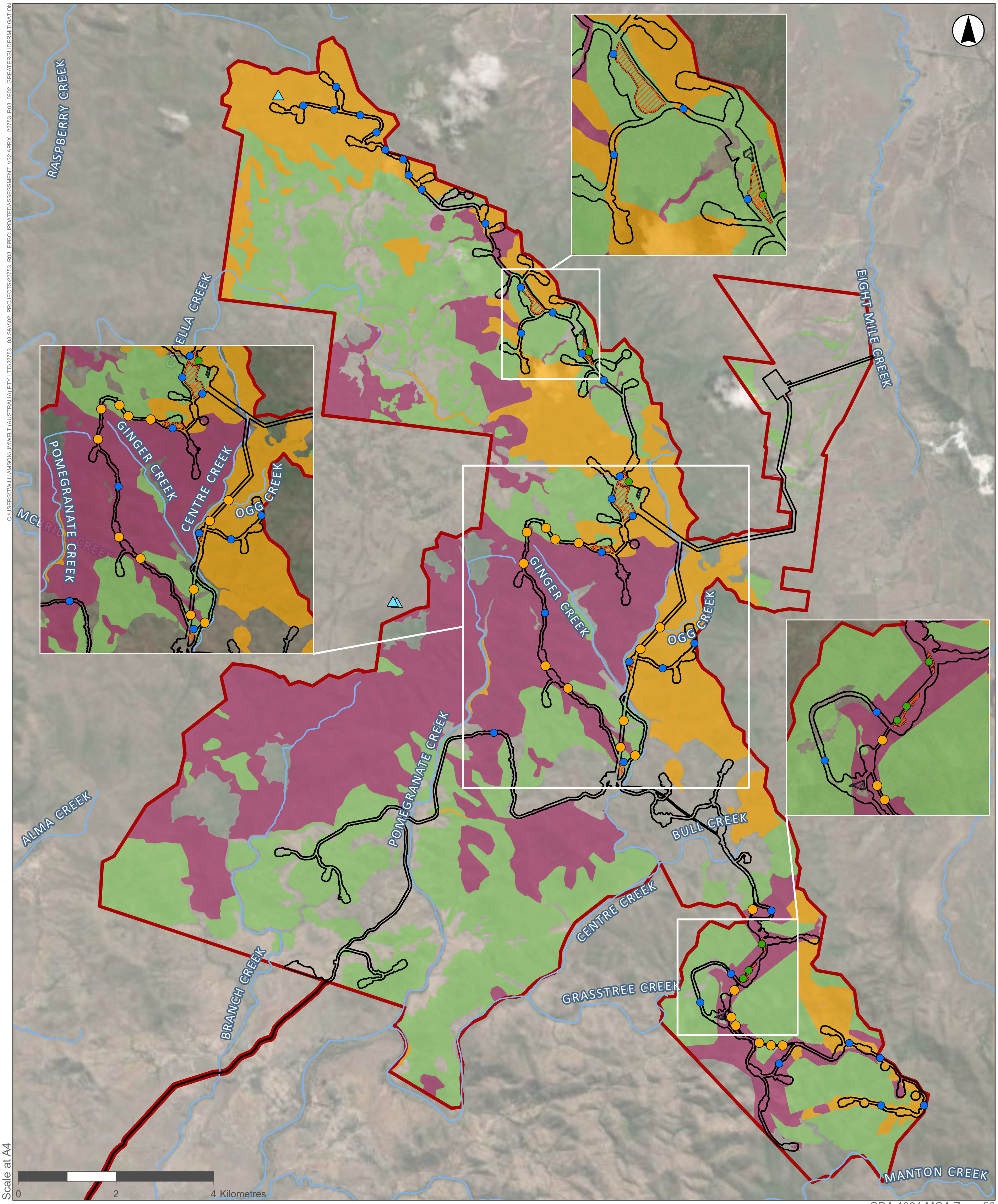
Relevant MNES	Measures
	• Habitat degradation by invasion of weeds has the potential to increase impacts associated with land clearing (DAWE, 2022). A Weed and Pest Management Plan will be implemented to ensure no introduction or proliferation of invasive weed species or pest fauna species. This includes for lantana and rubber vine, which are known habitat degrading species of the koala and have been identified as occurring on site.
Threatened Gliders: Greater glider (southern and central) **(*Petauroides volans*) and yellow-bellied glider (south-eastern) (*Petaurus australis australis*)**	• Construction and clearing of vegetation will be staged to allow for continued wildlife movement outside the immediate danger of the construction site. • Where clearing is proposed for areas of greater glider (southern and central) and/or yellow-bellied glider (south-eastern) denning habitat, pre-clearance surveys must include canopy searches and inspections of suitably sized hollows (>8 cm diameter). Where inspection of hollows cannot be safely undertaken prior to felling, the hollow-bearing tree will be slow felled to minimise the likelihood of injury or death and will be inspected by a qualified fauna spotter to confirm presence or absence of greater glider (southern and central) or yellow-bellied glider (south-eastern). If an individual is found to be present, it will be inspected for injury and if healthy, relocated to an adjacent area of mapped breeding and denning habitat after dusk. If the individual is injured it will be transported to a local wildlife carer and rehabilitated prior to releasing in a suitable area adjacent to the location in which it was found. • Every effort will be made to retain suitable hollow bearing trees (those containing hollows >8 cm diameter) within areas identified as denning habitat including *Eucalyptus moluccana* woodlands. The retention of trees >30 cm DBH on patch edges will be prioritised next in areas of potential greater glider (southern and central) and yellow-bellied glider (south-eastern) habitat. Trees to be retained within the Disturbance Footprint must be clearly demarcated and avoided. If deemed necessary, a TPZ may be established. • Increasing evidence of glider use of glide poles is emerging in Australian literature (Goldingay & Taylor, 2009; Goldingay, et. al., 2010; Soanes et. al, 2017; Goldingay, et. al., 2018; Taylor & Rohweder, 2020) and ongoing in-field studies (Brendan Taylor, Southern Cross University) that demonstrate glide poles as a tool to mitigate linear infrastructure impacts. Glide poles are proposed to be installed at 38 locations within the Disturbance Footprint to provide movement opportunities between areas of suitable habitat in the landscape (**Figure 9.2** and **Figure 9.3**). The proposed glide pole locations represent areas important for dispersal and where ongoing connectivity is required to avoid isolation of patches and retention of possible high use areas (i.e. riparian corridors and *Eucalyptus moluccana* woodlands). Glide pole specifications and locations will be finalised during the detailed design phase of the Project. To identify the effectiveness and utilisation of glide poles, a monitoring program will be developed. • Nineteen 'pinch points' (excluding the access road corridor which is acts as a pinch point throughout) are proposed within the Disturbance Footprint associated with areas of greater glider (southern and central) and / or yellow-bellied glider (south-eastern) modelled habitat to maintain movement opportunities and minimise fragmentation impacts on the species (**Figure 9.2** and **Figure 9.3**). Pinch points describe locations of the Disturbance Footprint which are reduced in width to the extent that individuals can easily disperse across (i.e. based on usual volplane distances, the clearing will have a width no greater than 1.2 times the average canopy height at that location). Pinch points locations will be minimised during the detailed design phase of the Project. Pinch points have been proposed along sections of the Disturbance Footprint which form an enclosed area, thereby allowing threatened gliders to move between nearby habitat patches.

Relevant MNES	Measures
	• In areas of habitat where greater gliders (southern and central) or yellow-bellied glider (south-eastern) are known to occur (i.e. the far northern Study Area), cleared suitable hollows (>8 cm diameter) will be replaced at a 1:2 ratio with a suitable nest box, to be installed in adjacent suitable habitat (i.e. two nest boxes for every hollow removed). A nest box is considered suitable if it is a design known to be used by the greater glider. • No barbed wire fencing will be installed as part of the Project within the Study Area unless strictly necessary (i.e. substation). • In the unlikely event that a greater glider (southern and central) or yellow-bellied glider (south-eastern) is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.
Red goshawk **(*Erythrotriorchis radiatus*)**	• Pre-clearance nest surveys will be undertaken for red goshawk within the Disturbance Footprint. Searches will be undertaken during fauna spotter catcher pre-clearance surveys whereby suitably qualified fauna spotter catchers will actively search for red goshawk nests. Where a potential nest is identified, clearance activities within the area will cease and a suitably qualified ecologist will undertake an investigation to determine the species that the nest belongs to. If the nest does not belong to a red goshawk, or any other threatened or migratory fauna species, clearance activities will continue as planned in accordance with the Project management plans. In the event that a red goshawk nest is identified within the Study Area DCCEEW will be notified within 10 business days. A review of the current mitigation measures outlined in the BBAMP and recommendation of additional actions will be made where necessary. • As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single red goshawk death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revise. • Other operational measures relevant to red goshawk are detailed in the Preliminary BBAMP.
White-throated needletail (*Hirundapus caudacutus*)	• As detailed in the BBAMP the single death of a white-throated needletail will be a reportable incident to DES/DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to this species are detailed in the BBAMP.
Squatter pigeon (southern) **(*Geophaps scripta scripta*)**	• Where clearing is proposed for areas of squatter pigeon (southern) breeding, foraging or dispersal habitat, pre-clearance surveys must include flushing to encourage the movement of individuals out of the clearing area. • As squatter pigeon (southern) nests on the ground and is at high risk of direct mortality, nests should be identified and clearly demarcated by a spotter-catcher during pre-clearance surveys. If the spotter-catcher determines a nest to be active, it will be managed in accordance with an approved High-risk SMP. • To reduce vehicle or plant collision or crushing of nests, all vehicles and pedestrians will remain within designated access tracks in squatter pigeon breeding habitat.

Relevant MNES	Measures
	• To minimise the chances of a collision, in known squatter pigeon (southern) occurrence areas speed limits (in private areas) will be reduced to 40 km/hr or less and signage will be installed that indicates subspecies' presence. Signage will also be installed within the public access road corridor. • The construction contractor will not conduct water extraction activities at any location that provide suitable resources for squatter pigeon (southern) (i.e. suitable watercourses and reservoirs mapped on **Figure 7.13**). • As outlined in the Preliminary BBAMP, a single squatter pigeon (southern) death resulting from potential wind turbine collision will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to squatter pigeon (southern) are detailed in the Preliminary BBAMP.
Grey-headed flying-fox **(*Pteropus poliocephalus*)**	• In the event that a flying-fox congregation is identified within the Disturbance Footprint, an exclusion zone will be established. A suitably qualified person will refer to the *Interim Policy for Determining When a Flying-fox Congregation is Regarding as flying-fox Roost under Section 88C of the Nature Conservation Act 1992* (DES, 2021) to determine if the congregation could be considered a roost. If determined that the congregation constitutes a roost, impacts to the flying-fox congregation will be managed in accordance with the *Code of practice – Ecologically Sustainable Management of Flying-fox Roosts* (DES, 2020). • As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single grey-headed flying-fox death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to the grey-headed flying-fox are detailed in the Preliminary BBAMP.
Ghost bat **(*Macroderma gigas*)**	• Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads. • As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single ghost bat death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to ghost bat are detailed in the Preliminary BBAMP.
Northern quoll **(*Dasyurus hallucatus*)**	• Micro-siting of Project infrastructure will aim to retain potential denning habitat features including large hollow logs and large boulders piles. Habitat features that can be avoided will be demarcated. Where they cannot be retained in situ, features will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance).

Relevant MNES	Measures
	• Vegetation clearing required within or directly adjacent to areas of breeding and denning habitat should be completed outside of the northern quoll breeding season (late July to late August). Where this cannot be committed to, a trapping and relocation program for northern quoll in these areas must be undertaken prior to vegetation clearing commencing. Potential denning sites in areas to be cleared will have entrances closed to avoid use by northern quoll prior to and during clearing. Where possible, detection dogs will be used to assist in locating northern quoll where potential denning habitat will be impacted. • Following the completion of the trapping program, should an active den be found within the Disturbance Footprint, measures outlined in a pre-approved high-risk SMP will be implemented to ensure no impacts occur to an active breeding place. This may include blocking access to dens once vacated to ensure they are not re-utilised during construction. Inappropriate fire regimes is a known threat to the species (DoE, 2016). To avoid degradation of habitat from fire as a result of the Project, a Bushfire Management Plan will be prepared in consultation with Queensland Fire and Emergency Services (QFES). • Nineteen 'pinch points' are proposed within mapped habitat for the northern quoll, which have been primarily designed to minimise fragmentation impacts on greater glider (southern and central) and yellow-bellied glider (south-eastern) (**Figure 9.2** and **Figure 9.3**). Pinch points describe locations of the Disturbance Footprint which are reduced in width to provide dispersal opportunities. Although pinch points have been designed primarily to facilitate movement for greater glider (southern and central) and yellow-bellied glider (south-eastern), the reduction in clearing width at these locations will also mitigate impacts to dispersal for northern quoll, for which mapped habitat coincides with pinch points. • Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads. • Carcass surveys will be conducted by a suitably qualified ecologist to detect and remove carrion in operational areas that may attract northern quolls. The Preliminary BBAMP (Attachment G of the Preliminary Documentation) will include a carcass survey protocol and include details such as survey frequency and timing. • Construction areas that may inadvertently provide potential denning opportunities through stockpiling of materials will have fauna exclusion fencing installed around the perimeter. • In the unlikely event that a northern quoll is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.

Relevant MNES	Measures
Collared delma (*Delma torquata*)	• Micro-siting of Project infrastructure will aim to retain terrestrial habitat features including large stones, boulders and coarse woody debris. Habitat features that can be avoided will be demarcated. Where they cannot be retained in situ, features will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance). • Where clearing is proposed for areas of potential collared delma habitat, pre-clearance surveys must include active searches targeting areas with common surface rocks. Collared delma is thought to be sedentary with one study finding that individuals occupy a small (<20 m) home range (Porter 1998). Should an individual or eggs of the species be located, relocation of captured individuals will occur at least 200 m from the Disturbance Footprint within habitat that is considered the same or better quality based on the availability of microhabitat features. • In the unlikely event that a collared delma is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days. • The Weed and Pest Management Plan will be implemented to ensure no introduction or proliferation of invasive weed species or pest fauna species. This includes for lantana, which is a known habitat degrading species of the collared delma.
Migratory birds	• As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the single death of a white-throated needletail, fork-tailed swift, oriental cuckoo, black-faced monarch, satin flycatcher, rufous fantail or spectacled monarch will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to migratory birds are detailed in the Preliminary BBAMP.



GDA 1994 MGA Zone 56

Legend

- Proposed 8m Glide Poles
- Proposed 15m Glide Poles
- Pinch Points
- Greater Glider (Southern and Central) Record (Umwelt)
- Disturbance Footprint
- Study Area
- Potential Supplementary Offset Areas
- Enclosed Areas without Poles (Additional Impact Areas)

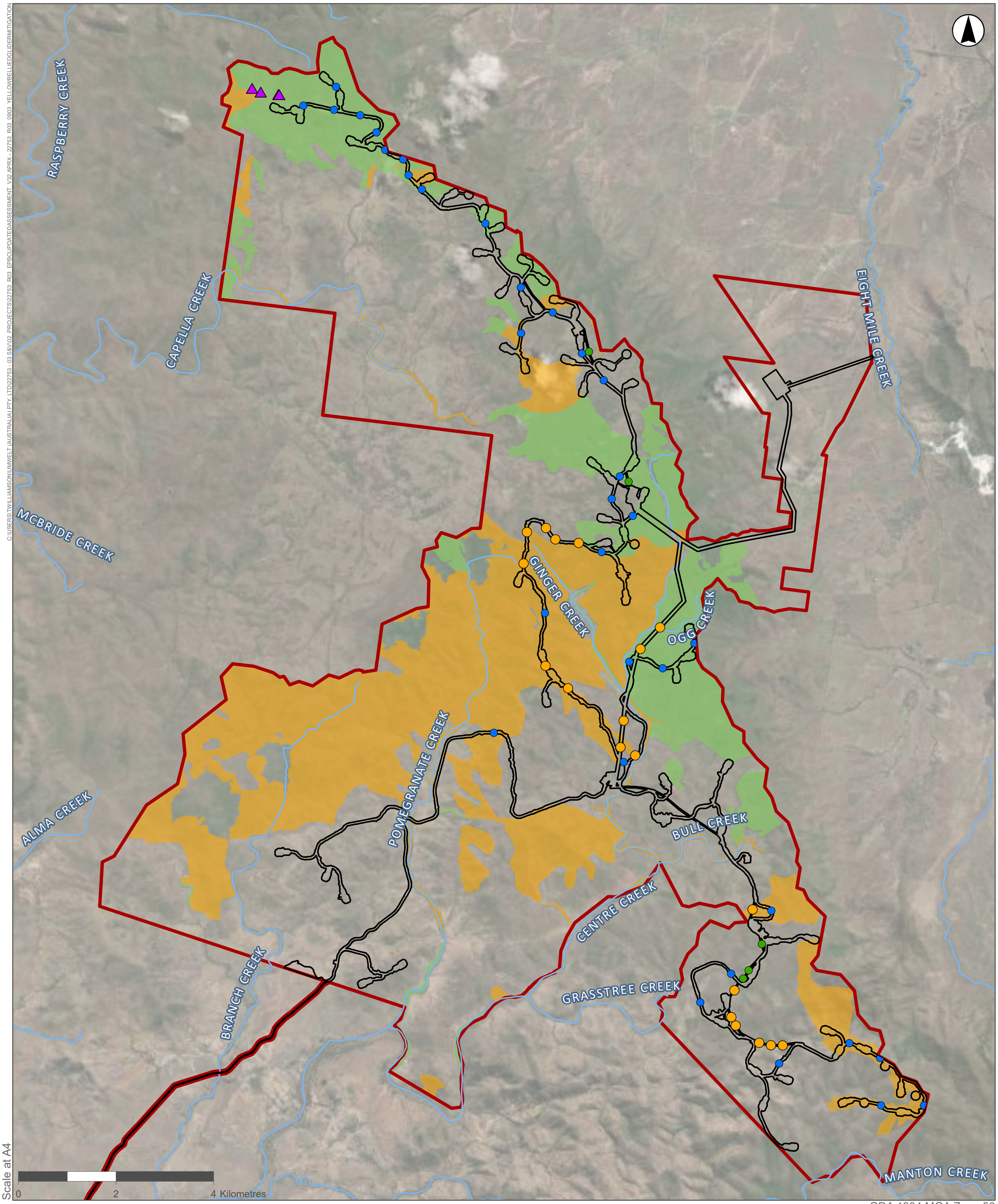
Greater Glider (Southern and Central) Habitat

- Foraging and dispersal
- Likely / current denning
- Potential future / denning

FIGURE 9.2

GREATER GLIDER MITIGATION AND POTENTIAL SUPPLEMENTARY OFFSET AREAS

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Proposed 8m Glide Poles
- Proposed 15m Glide Poles
- Pinch Points
- Yellow-bellied Glider (south-eastern) Record (Umwelt)
- Disturbance Footprint
- Study Area

Potential Yellow-bellied Glider Habitat

- Breeding and denning
- Foraging and dispersal

FIGURE 9.3

YELLOW-BELLIED GLIDER MITIGATION MEASURES

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

9.3.2.1 Bird and Bat Adaptive Management Plan

Monitoring and management actions relating to MNES birds and bats will be undertaken in accordance with a pre-approved BBAMP. The strategy of the BBAMP is to monitor and mitigate the potential impacts of turbine strike on birds and bats via trigger based, adaptive management. The implementation of a trigger will be the primary mechanism for monitoring and managing impacts on the white-throated needletail (*Hirundapus caudacutus*).

Pre- and post-commissioning monitoring of bird and bat activity (including flight behaviours) is a key requirement of the plan. The monitoring results will inform a risk profile for each turbine. This strategy leads to direct and tailored management actions, applied at the appropriate locations and times.

Pre-commissioning bird utilisation surveys completed within the Study Area to date have confirmed the use of the airspace above the Study Area by the white-throated needletail (*Hirundapus caudacutus*). To ensure a conservative and risk adverse approach is adopted at the outset of post-commissioning monitoring, all turbine locations are considered high risk for the white-throated needletail (*Hirundapus caudacutus*).
The Preliminary BBAMP is provided as Attachment G of the Preliminary Documentation.

9.3.2.2 Pre-clearance Surveys Constraints Protocol

This section defines an adaptive management response which is to be engaged if unexpected MNES finds are observed during pre-clearance surveys or any other surveys undertaken prior to construction. As the process for managing threatened reptiles and mammals located during pre-clearance survey is defined in **Table 9.4** and for threatened or migratory birds is defined in Attachment G of the Preliminary Documentation, this protocol relates specifically to threatened flora with a moderate likelihood of occurrence. Whilst the occurrence of new MNES is considered highly unlikely, the intent of this protocol is to ensure the appropriate adaptive management response is implemented and adverse impacts mitigated should they be discovered.

The trigger to undertake the pre-clearance surveys constraints protocol is the observation of one or more individual of a flora species listed as threatened under the EPBC Act within the Disturbance Footprint during future surveys or construction. If either are to be found, the constraints protocol below will then be followed.

STEP 1: Halt construction/clearing activities in the area (i.e. adjacent areas within the Disturbance Footprint where suitable habitat is present – to be determined by a suitably qualified ecologist).

STEP 2: Undertake investigation into potential impacts on the species. This should include:

- Updating of habitat mapping.
- Updating of Significant Impact Assessment.
- Determination of avoidance and mitigation strategies.

STEP 3: Communicate outcomes with DCCEEW and determine next steps.

9.4 Rehabilitate

As described in **Section 2.0**, the Disturbance Footprint includes a number of linear sections associated with access tracks and supporting ancillary infrastructure such as communication and power cable lines. Linear sections of the Disturbance Footprint vary in width but in some locations span approximately 100 m; these widths have been deemed necessary for the safe transport and installation of turbine infrastructure. Excluding established access tracks and fire safety Asset Protection Zones, which at all times will need to remain free of vegetation, previously cleared areas will be reclaimed and rehabilitated. Further to this, all areas of temporary ancillary infrastructure will also be subject to rehabilitation efforts including:

- Laydown areas.
- Concrete batching plants.
- Construction compound.
- Temporary worker’s accommodation camp.

With current design details, it is estimated approximately 20% of the total Disturbance Footprint (i.e. the area that will be cleared for the Project) may be able to be rehabilitated following construction. This equates to approximately 180 ha of native vegetation being rehabilitated.

Rehabilitation will include the planting of native species known to the region, consistent with the characteristics of surrounding retained vegetation. Rehabilitation will also involve continuous monitoring and management, including erosion prevention, management of weed species and protection and enhancement of impacted water sources to achieve a condition of the historic vegetation at the rehabilitation site.

It should be noted that during decommissioning, only hardstand areas, access tracks and swept paths would require pruning or clearing to remove infrastructure from the site. Further rehabilitation works will be undertaken as part of the decommissioning phase after infrastructure has been removed. The overall objective of these rehabilitation activities would be to return the site to pre-construction conditions, however specific rehabilitation outcomes will be developed in consultation with the landowners prior to the decommissioning process.

9.4.1 Rehabilitation for the Restoration of Habitat of Listed Species and Communities

In locations where the integrity of infrastructure will not be compromised, opportunities to create supplementary habitat for MNES species such as the greater glider (southern and central) (*Petauroides volans*), yellow-bellied glider (south-eastern) (*Petaurus australis australis*), koala (*Phascolarctos cinereus*) and squatter pigeon (southern) (*Geophaps scripta scripta*) will be investigated. For example, in addition to native grasses and shrubs which will provide ground cover for dispersing koalas (*Phascolarctos cinereus*) and squatter pigeons (southern) (*Geophaps scripta scripta*), suitable tree species with potential to form hollows in the future will also be planted as appropriate (e.g. *Corymbia citriodora* and/or *Eucalyptus moluccana*).

Rehabilitation criteria are provided in Sections 5 and 6 in Attachment F – Preliminary Vegetation Management Plan. Additionally, a Weed and Pest Management Plan and Rehabilitation Management Plan will be developed and finalised prior to construction commencement.

Where threatened fauna species habitat has been cleared for Project activities, rehabilitation will aim to restore habitat to a similar vegetation composition as the original area, i.e. to a condition where the targeted threatened species could utilise the area[2]. As such, management measures will target habitat values required for relevant species and monitoring will ensure the required species-specific outcomes have been achieved.

To ensure that rehabilitation achieves the habitat suitability and condition requirements, both self-sustaining and active rehabilitation actions are required during progressive rehabilitation and after decommissioning of the Project. A summary of the rehabilitation criteria for areas where threatened fauna species habitat would be cleared include:

- Undertaking condition benchmark assessments during pre-clearance surveys of the Disturbance Footprint prior to disturbance (where it intersects mapped threatened species habitat). This will inform the rehabilitation requirements. The rehabilitation will not be certified until minimum habitat values have met the required benchmark.
- Monitoring of rehabilitation to ensure progression to the pre-defined benchmark condition. This includes monitoring the development of long-term habitat values such canopy tree growth, including for tree species which may bear hollows in the future.
- Monitoring of seedling growth and establishment until the benchmark conditions are met. If plantings are not developing appropriately, watering programs and re-seeding efforts will be implemented, which may include soil management.
- Monitoring and active management to restrict weed growth/establishment, clearing established weeds as necessary until the benchmark conditions are met.
- Monitoring to prevent and manage pest establishment or disturbance, including from cattle, European foxes, pigs etc.

Examples of how rehabilitation actions may benefit MNES are provided below:

- Re-establishing appropriate ground and midstory cover to facilitate safe dispersal opportunities in the short-term (relevant to koala, squatter pigeon (southern), northern quoll and collared delma).
- Providing and protecting groundcover (and therefore food sources and dispersal opportunities for squatter pigeon (southern)) from erosion and sedimentation.
- Ensuring weeds are not established (which is a high risk in the early stages of re-vegetation) beyond the historical condition of the site to provide suitable squatter pigeon (southern) and koala dispersal habitat without prevention of movement.

[2] It is noted that some slow developing microhabitat features relevant for the target species ecological requirements (i.e. medium hollows for greater glider (southern and central) and yellow-bellied glider (south-eastern) denning habitat) are unlikely to develop during the Project lifespan. However, it is expected that habitat will meet a condition where it can be used for foraging and dispersal at a minimum, for any MNES species for which habitat has been mapped in that location.

- Improving and maintaining the condition of water sources and associated riparian vegetation impacted by the Project back to historical condition. This will support access for the squatter pigeon (southern) to the permanent water sources this species is known to depend on.
- Re-establishing other relevant vegetation strata to provide improved habitat condition and function in the longer term (relevant to squatter pigeon (southern), collared delma, koala, greater glider (southern and central) and yellow-bellied glider (south-eastern)).

9.4.1.1 Progressive Rehabilitation for Squatter Pigeon (Southern)

One of the intentional benefits of progressive rehabilitation is to restore dispersal habitat for the squatter pigeon (southern), and therefore minimise the Project impacts in relation to loss/degradation of habitat for this species.

Progressive rehabilitation aims to re-establish a native ground cover that aligns with the pre-disturbed vegetation where possible. Initial rehabilitation works will be completed within 3 months of the construction phase and aims to re-establish vegetation communities (including grasslands, woodlands and forests) that provide dispersal habitat for the squatter pigeon (southern).

Natural regeneration of plant species is expected from seed in the soil seed bank and/or from vegetation sources in surrounding areas to match the historical vegetation of the rehabilitation site where possible. The squatter pigeon (southern) is known to utilise and disperse through grasslands and highly modified environments and has specific ground cover requirements (DCCEEW 2023b). Re-establishing the ground layer will provide improved dispersal opportunities in the short-term (DCCEEW 2023b). Ground cover is expected to be re-established and be self-sustaining within five months to two years after completion of temporary works (Ladouceur, E. and Mayfield 2017; Baskerville, L, Spain, CS, Nuske, S, Gagen 2023). Within 6 months after the beginning of rehabilitation, grass species will start to mature and seedlings of canopy species will begin to emerge (Ladouceur, E. and Mayfield 2017; Baskerville, L, Spain, CS, Nuske, S, Gagen 2023). Therefore, within this timeframe, progressive rehabilitation efforts will provide dispersal habitat for the squatter pigeon (southern). Eucalypts and other canopy species (where relevant) will regenerate more substantially in the longer term (~10 years) and provide further protection for the species and improved understory development (Ladouceur, E. and Mayfield 2017; Baskerville, L, Spain, CS, Nuske, S, Gagen 2023).

Refer to **Section 9.4.1** for examples of how rehabilitation actions may benefit squatter pigeon (southern).

9.4.2 Procedures and Contingency Measures to Achieve Rehabilitation Acceptance Criteria

No direct impacts are proposed to occur outside of the Disturbance Footprint as a result of rehabilitation activities, which will be restricted to the Disturbance Footprint. To achieve this, final clearing extents within the Disturbance Footprint and no-go areas will be demarcated with flagging tape, signs and/or fencing.

Effective management and monitoring of rehabilitation activities will ensure no indirect impacts occur to retained habitat. Some key management and monitoring efforts to prevent indirect impacts to retained habitat are provided below:

- The Erosion and Sediment Control Plan (ESCP) (Attachment H) will apply to rehabilitation works. The methods outlined in this plan will ensure that indirect impacts from dust, erosion and sediment will not impact retained habitat.

- A Weed and Pest Management Plan will be developed for the Project and will apply to rehabilitation works. The Plan will include mitigation measures and corrective actions for pests and weeds to avoid indirect impacts to retained habitat.

- Material imported into the Study Area (i.e. for use as road base) will be obtained from an appropriately licensed source where the source location is deemed 'weed clean'. Evidence must be obtained from the provider prior to importation of material to the Project site. Imported fill (rocks/screenings) shall be free of contamination from mud clumps and weed seeds.

- Use only native or certified weed free seeds in all rehabilitation works, including hydro mulch. No viable weed species are to be mulched or chipped in rehabilitation works.

Where threatened fauna species habitat has been cleared for Project activities, rehabilitation will aim to restore habitat to its original condition. A summary of the rehabilitation processes that will be undertaken to restore habitat values for MNES are as follows:

- Natural regeneration will be utilised as first preference, as this reduces risk of weeds and will align with the historic vegetation to develop into habitat for MNES. Where natural regeneration is insufficient, direct seeding and watering programs will be undertaken as required. Local seed sources form surrounding areas or weed-free suppliers from the local region will be used preferentially.

- In areas where the Disturbance Footprint is adjacent to sensitive areas, including retained fauna habitat, revegetation is to occur through natural regeneration and through assisted planting to create a vegetated buffer between the Disturbance Footprint and sensitive areas. The vegetation within these areas will consist of native species analogous to adjacent vegetation community.

- Recreation of micro-habitat features in the Disturbance Footprint as per the benchmark conditions identified during pre-clearance surveys. This includes establishment of nest boxes and spreading of hollow logs, large-woody debris rock piles and leaf litter mats.

10.0 Significant Impact Assessment

The potential significance of Project-related impacts was assessed for 20 MNES values, including three that are considered to have a low likelihood of occurrence within the Study Area (but may be subject to operational impacts at some point during the life of the Project).

Assessments have been undertaken in accordance with *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (Department of the Environment 2013). The precautionary principle has been applied when deciding whether or not the Project is likely to have a significant impact on a value.

The full significant impact assessments, relevant criteria and supporting documents are detailed in **Appendix E**. Findings of these assessments determined potential significant impacts on the following six MNES may occur as a result of the Project:

- *Cycas megacarpa.*
- Northern quoll (*Dasyurus hallucatus*).
- Koala (*Phascolarctos cinereus*).
- Greater glider (southern and central) (*Petauroides volans*).
- Yellow-bellied glider (south-eastern) (*Petaurus australis australis*).
- Collared delma (*Delma torquata*).

To mitigate residual impacts on these species as a result of the Project, offsets under the EPBC Act may be required. Based on this finding, an Offset Management Strategy (Attachment K of the Preliminary Documentation) has been developed for the Project.

10.1 Supplementary Offsets

Where areas of the suitable habitat for MNES species becomes enclosed by Project infrastructure, populations of species with low dispersal ability within the enclosed area may become vulnerable to loss of genetic diversity, resulting in population decline (Coleman et al. 2018). MNES species most at risk of decline from fragmentation from enclosed areas are glider species including greater glider (southern and central) and yellow-bellied glider (south-eastern). Remaining MNES species known or with a moderate likelihood of occurrence have dispersal capabilities such that an access road or electrical reticulation line is unlikely to prevent movement between suitable habitat patches. This is with the exception of the collared delma which is thought to be sedentary and occupy a very small home range (<20 m^2).

The Project proposes mitigation measures to reduce the impact to threatened glider species due to fragmentation by Project infrastructure including the use of pinch points and the installation of glide poles to provide habitat connectivity to surrounding areas. Pinch points will reduce the width of linear infrastructure areas (roads and electrical reticulation lines) at key locations to the extent that individuals can disperse (i.e. based on usual volplane distances, the clearing will have a width no greater than 1.2 times the average canopy height at that location). At some locations, pinch points are proposed along enclosed sections of the Disturbance Footprint, thereby allowing threatened gliders to move in and out of the enclosed area, into neighbouring habitat.

The use of glide poles has been documented in yellow-bellied glider (*Petaurus australis*) on the Pacific Highway at Halfway Creek, north-east New South Wales (Taylor & Rohweder 2020) and as such is known to be an effective mitigation measure and hence supplementary offsets are not required. Greater glider (southern and central) has been identified using glide poles, however, it is not yet known if the species actually glides between them or between the woodland and the glide poles, therefore the effectiveness of glide poles as a mitigation measure for this species of glider is not yet known (Dalton 2017). The efficacy of glide poles established within the Disturbance Footprint will be investigated following clearing for the Project and installation of the poles. A glide pole monitoring survey will also be undertaken to determine the level of use of glide poles by greater glider (southern and central).

The success of mitigation measures aimed to support the movement of greater glider (southern and central) will determine if enclosed areas with glide poles are suitable for the long-term persistence of any local population. If these measures are unsuccessful in providing movement opportunities the habitat for the species occurring within enclosed areas may require offsetting via supplementary offsets.

The extent of habitat for greater glider (southern and central) occurring within enclosed areas is provided in **Table 10.1** below. These areas, along with greater glider (southern and central) mitigation measures and mapped habitat are provided in **Figure 9.3**.

Table 10.1 Enclosed Areas Potentially Requiring Supplementary Offsets

Habitat Utilisation for Greater Glider (southern and central)	Habitat Utilisation for Greater Glider (southern and central)
Likely or current denning habitat	4.1 ha
Potential or future denning habitat	2.3 ha
Foraging or dispersal habitat	34.4 ha
Total	**40.8 ha**

11.0 Conclusion

This updated MNES Assessment was developed to support the Preliminary Documentation of the Project and respond to RFI items relevant to the habitat and impact assessment of MNES.

Using a combination of desktop information, field-validated data and extrapolated field survey results, the potential presence and extent of MNES values within the Study Area was determined. The assessment focused on a total of 20 MNES, including 17 threatened and or migratory species considered known to occur, or determined to have a moderate or high likelihood of occurring within the Study Area (see **Section 7.0** and **Appendix C**). In response to the RFI, habitat modelling was undertaken for an additional three species considered to have a low likelihood of occurrence.

MNES known to occur include:

- *Cycas megacarpa.*
- *Samadera bidwillii.*
- Koala *(Phascolarctos cinereus*).
- Greater glider (southern and central) (*Petauroides volans*).
- Yellow-bellied glider (south-eastern) (*Petaurus australis australis*).
- Northern quoll (*Dasyurus hallucatus*).
- Squatter pigeon (southern) (*Geophaps scripta scripta*).
- White-throated needletail (*Hirundapus caudacutus*).
- Rufous fantail (*Rhipidura rufifrons*).
- Spectacled monarch (*Symposiarchus trivirgatus*).

MNES with a high likelihood of occurrence include:

- Fork-tailed swift (*Apus pacificus*).

MNES with a moderate likelihood of occurrence include:

- *Cossinia australiana.*
- *Decaspermum struckoilicum.*
- Collared delma (*Delma torquata*).
- Black-faced monarch (*Monarcha melanopsis*).
- Oriental cuckoo (*Cuculus optatus*).
- Satin flycatcher (*Myiagra cyanoleuca*).

Potential impacts as a result of the Project on relevant MNES and biodiversity more broadly were determined (**Section 8.0**). Numerous sources of both direct and indirect impact were identified, with the greatest risk to MNES considered likely to occur during the construction phase as a result of vegetation clearing and associated habitat loss. Other potential impacts identified include wind turbine collision-based impacts (including direct collision, barotrauma and barrier effects), exacerbation of biosecurity risks and disturbance from indirect impacts such as noise, light and dust.

The Project has employed avoidance measures as part of the existing Development Corridor design and will continue to consider ecological constraints as the Disturbance Footprint is sited and refined. Where avoidance is not possible, the Project will be governed by a suite of management plans to ensure minimisation, mitigation and management of potential impacts. During all phases of the Project, one or several management plans will be actively implemented and outline procedures to limit and reduce impacts on MNES.

With consideration of Project mitigation measures, significant impact assessments were undertaken for the 20 relevant MNES in accordance with *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (Department of the Environment 2013) (**Appendix E**).

As detailed in **Section 10.0**, the precautionary principle was applied in the assessment of significant impacts. The findings of the assessment indicate that the Project may result in a significant impact on six MNES:

- *Cycas megacarpa.*
- Greater glider (southern and central) (*Petauroides volans*).
- Northern quoll (*Dasyurus hallucatus*).
- Yellow-bellied glider (south-eastern) (*Petaurus australis australis*).
- Koala (*Phascolarctos cinereus*).
- Collared delma (*Delma torquata*)

To mitigate residual impacts on these species as a result of the Project, offsets under the EPBC Act may be required. An Offset Management Strategy has been developed for the Project and is provided in Attachment K of the Preliminary Documentation.

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APPENDIX A

Protected Matters Search Tool Report

Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 17-Apr-2023

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	45
Listed Migratory Species:	17

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	7
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In buffer area only
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community likely to occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In buffer area only
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat may occur within area	In feature area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat known to occur within area	In feature area
MAMMAL			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chalinolobus dwyeri			
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area	In feature area
Dasyurus hallucatus			
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area
Macroderma gigas			
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Nyctophilus corbeni			
Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In feature area
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat likely to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area	In feature area
PLANT			
Arthraxon hispidus			
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area	In feature area
Bosistoa transversa			
Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bulbophyllum globuliforme Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Cossinia australiana Cossinia [3066]	Endangered	Species or species habitat likely to occur within area	In feature area
Cupaniopsis shirleyana Wedge-leaf Tuckeroo [3205]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Cycas megacarpa [55794]	Endangered	Species or species habitat known to occur within area	In feature area
Cycas ophiolitica [55797]	Endangered	Species or species habitat may occur within area	In feature area
Decaspermum struckoilicum Struck Oil Myrtle [78796]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat may occur within area	In feature area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus raveretiana Black Ironbox [16344]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Leichhardtia brevifolia listed as Marsdenia brevifolia [91893]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Samadera bidwillii Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Solanum dissectum [75720]	Endangered	Species or species habitat known to occur within area	In feature area
Solanum johnsonianum [84820]	Endangered	Species or species habitat known to occur within area	In feature area
REPTILE			
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area	In feature area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area	In feature area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area	In feature area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area	In feature area
Hemiaspis damelii Grey Snake [1179]	Endangered	Species or species habitat likely to occur within area	In feature area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius leschenaultii			
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus			
Osprey [952]		Species or species habitat likely to occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata			
Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans			
Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Charadrius leschenaultii			
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area	In feature area
Haliaeetus leucogaster			
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat likely to occur within area overfly marine area	In feature area
Merops ornatus			
Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Monarcha melanopsis			
Black-faced Monarch [609]		Species or species habitat likely to occur within area overfly marine area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca			
Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus			
Osprey [952]		Species or species habitat likely to occur within area	In feature area
Rhipidura rufifrons			
Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus			
Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area	In feature area
Reptile			
Crocodylus porosus			
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area

Extra Information

State and Territory Reserves

[Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Bouldercombe Gorge	Resources Reserve	QLD	In feature area
Mount Hopeful	Conservation Park	QLD	In buffer area only

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Mount Hopeful Wind Farm	2021/9137		Assessment	In feature area
Controlled action				
Blackwater to Gladstone Gas Pipeline Project	2011/6034	Controlled Action	Completed	In buffer area only
Construct and operate 447km high pressure gas transmission pipeline	2009/4976	Controlled Action	Post-Approval	In buffer area only
install & operate gas pipeline	2005/2059	Controlled Action	Post-Approval	In buffer area only
Smoky Creek Solar Photovoltaic Farm	2021/9030	Controlled Action	Further Information Request	In buffer area only
ZeroGen Integrated Gasification Combined Cycle Power Plant and CO2 Capture, Transport and Storage	2009/5195	Controlled Action	Completed	In buffer area only
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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APPENDIX B

Field Survey Program – Species List

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Flora				
Acanthaceae	blue trumpet	*Brunoniella australis*	-	Least Concern
Amaranthaceae	-	*Achyranthes aspera*	-	Least Concern
Amaranthaceae	hairy joyweed	*Alternanthera nana*	-	Least Concern
Amaranthaceae	-	*Gomphrena sp.*	-	Least Concern
Anacardiaceae	-	*Euroschinus falcatus* var. *falcatus*	-	Least Concern
Anacardiaceae	Burdekin plum	*Pleiogynium timorense*	-	Least Concern
Apocynaceae	-	*Alyxia ruscifolia*	-	Least Concern
Apocynaceae	red-head cottonbush	*Asclepias curassavica**	-	-
Apocynaceae	rubber vine	*Cryptostegia grandiflora***	-	-
Apocynaceae	balloon cottonbush	*Gomphocarpus physocarpus**	-	-
Araliaceae	celery wood	*Polyscias elegans*	-	Least Concern
Araliaceae	umbrella tree	*Schefflera actinophylla*	-	Least Concern
Arecaceae	-	*Livistona decora*	-	Least Concern
Asteraceae	-	*Ageratum conyzoides* subsp. *conyzoides**	-	-
Asteraceae	-	*Apowollastonia spilanthoides*	-	Least Concern
Asteraceae	-	*Bidens pilosa* var. *pilosa**	-	-
Asteraceae	-	*Cassinia laevis*	-	Least Concern
Asteraceae	spear thistle	*Cirsium vulgare**	-	-
Asteraceae	-	*Emilia sonchifolia**	-	-
Asteraceae	-	*Erigeron bonariensis**	-	-
Asteraceae	-	*Ozothamnus cassinioides*	-	Least Concern
Asteraceae	parthenium	*Parthenium hysterophorus***	-	-
Asteraceae	applebush	*Pterocaulon sphacelatum*	-	Least Concern
Asteraceae	common sowthistle	*Sonchus oleraceus**	-	-

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Asteraceae	-	*Sonchus* sp.*	-	-
Asteraceae	-	*Vittadinia cuneata*	-	Least Concern
Bignoniaceae	-	*Pandorea jasminoides*	-	Least Concern
Cactaceae	-	*Opuntia stricta***	-	-
Cactaceae	velvety tree pear	*Opuntia tomentosa***	-	-
Capparaceae	-	*Capparis canescens*	-	Least Concern
Capparaceae	-	*Capparis loranthifolia* var. *loranthifolia*	-	Least Concern
Capparaceae	-	*Capparis* sp.	-	Least Concern
Casuarinaceae	-	*Allocasuarina littoralis*	-	Least Concern
Casuarinaceae	-	*Allocasuarina torulosa*	-	Least Concern
Casuarinaceae	-	*Casuarina cunninghamiana* subsp. *cunninghamiana*	-	Least Concern
Celastraceae	broad-leaved boxwood	*Denhamia celastroides*	-	Least Concern
Celastraceae	-	*Denhamia cunninghamii*	-	Least Concern
Celastraceae	-	*Denhamia disperma*	-	Least Concern
Chenopodiaceae	-	*Einadia nutans*	-	Least Concern
Chenopodiaceae	-	*Enchylaena tomentosa*	-	Least Concern
Combretaceae	-	*Terminalia* sp.	-	Least Concern
Cycadaceae	-	*Cycas megacarpa*	Endangered	Endangered
Cycadaceae	western nutgrass	*Cyperus bifax*	-	Least Concern
Cycadaceae	-	*Cyperus gracilis*	-	Least Concern
Cyperaceae	common fringe-rush	*Fimbristylis dichotoma*	-	Least Concern
Cyperaceae	-	*Gahnia aspera*	-	Least Concern
Cyperaceae	-	*Lepidosperma* sp.	-	Least Concern
Cyperaceae	-	*Scleria brownii*	-	Least Concern
Ebenaceae	scaly ebony	*Diospyros geminata*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Euphorbiaceae	soft acalypha	*Acalypha eremorum*	-	Least Concern
Euphorbiaceae	macaranga	*Macaranga tanarius*	-	Least Concern
Euphorbiaceae	white kamala	*Mallotus discolor*	-	Least Concern
Euphorbiaceae	-	*Mallotus mollissimus*	-	Least Concern
Euphorbiaceae	red kamala	*Mallotus philippensis*	-	Least Concern
Euphorbiaceae	-	*Phyllanthus virgatus*	-	Least Concern
Fabaceae	-	*Desmodium gunnii*	-	Least Concern
Fabaceae	-	*Desmodium macrocarpum*	-	Least Concern
Fabaceae	-	*Desmodium rhytidophyllum*	-	Least Concern
Fabaceae	slender tick trefoil	*Desmodium varians*	-	Least Concern
Fabaceae	-	*Erythrina vespertilio* subsp. *vespertilio*	-	Least Concern
Fabaceae	flemingia	*Flemingia parviflora*	-	Least Concern
Fabaceae	-	*Galactia tenuiflora*	-	Least Concern
Fabaceae	-	*Glycine cyrtoloba*	-	Least Concern
Fabaceae	-	*Glycine* sp.	-	Least Concern
Fabaceae	woolly glycine	*Glycine tomentella*	-	Least Concern
Fabaceae	-	*Hardenbergia violacea*	-	Least Concern
Fabaceae	-	*Indigofera pratensis*	-	Least Concern
Fabaceae	-	*Jacksonia scoparia*	-	Least Concern
Fabaceae	siratro	*Macroptilium atropurpureum**	-	-
Fabaceae	-	*Stylosanthes scabra**	-	-
Goodeniaceae	-	*Goodenia glabra*	-	Least Concern
Goodeniaceae	-	*Goodenia rotundifolia*	-	Least Concern
Hemerocallidaceae	-	*Dianella caerulea*	-	Least Concern
Hemerocallidaceae	-	*Dianella revoluta*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Hemerocallidaceae	-	*Geitonoplesium cymosum forma album*	-	Least Concern
Juncaceae	-	*Juncus usitatus*	-	Least Concern
Juncaceae	-	*Juncus radula*	-	Least Concern
Lamiaceae	-	*Colieus australis*	-	Least Concern
Lauraceae	-	*Cryptocarya triplinervis* var. *triplinervis*	-	Least Concern
Laxmanniaceae	-	*Eustrephus latifolius subforma fimbriatus*	-	Least Concern
Laxmanniaceae	-	*Lomandra confertifolia* subsp. *pallida*	-	Least Concern
Laxmanniaceae	-	*Lomandra hystrix*	-	Least Concern
Laxmanniaceae	-	*Lomandra longifolia*	-	Least Concern
Laxmanniaceae	-	*Lomandra multiflora* subsp. *multiflora*	-	Least Concern
Lecythidaceae	cockatoo apple	*Planchonia careya*	-	Least Concern
Leguminosae	glycine pea	*Glycine tabacina*	-	Least Concern
Loganiaceae	strychnine tree	*Strychnos psilosperma*	-	Least Concern
Malvaceae	-	*Hibiscus heterophyllus*	-	Least Concern
Malvaceae	-	*Malvastrum americanum* var. *americanum**	-	-
Malvaceae	spinyhead sida	*Sida acuta*	-	-
Malvaceae	-	*Sida cordifolia**	-	-
Malvaceae	spiked sida	*Sida hackettiana*	-	Least Concern
Marsileaceae	common nardoo	*Marsilea drummondii*	-	Least Concern
Meliaceae	ivory mahogany	*Dysoxylum gaudichaudianum*	-	Least Concern
Meliaceae	white cedar	*Melia azedarach*	-	Least Concern
Meliaceae	native honeysuckle	*Turraea pubescens*	-	Least Concern
Mimosaceae	pretty wattle	*Acacia decora*	-	Least Concern
Mimosaceae	-	*Acacia disparrima* subsp. *disparrima*	-	Least Concern
Mimosaceae	scaly bark	*Acacia fasciculifera*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Mimosaceae	lightwood	*Acacia implexa*	-	Least Concern
Mimosaceae	-	*Acacia leiocalyx* subsp. *leiocalyx*	-	Least Concern
Mimosaceae	-	*Acacia penninervis* var. *penninervis*	-	Least Concern
Mimosaceae	Doolan	*Acacia salicina*	-	Least Concern
Mimosaceae	-	*Acacia* sp.	-	Least Concern
Mimosaceae	red lancewood	*Archidendropsis basaltica*	-	Least Concern
Mimosaceae	-	*Vachellia bidwillii*	-	Least Concern
Moraceae	creek sandpaper fig	*Ficus coronata*	-	Least Concern
Moraceae	-	*Ficus obliqua*	-	Least Concern
Moraceae	-	*Ficus opposita*	-	Least Concern
Moraceae	-	*Ficus racemosa* var. *racemosa*	-	Least Concern
Moraceae	-	*Ficus rubiginosa forma glabrescens*	-	Least Concern
Moraceae	-	*Ficus virens* var. *virens*	-	Least Concern
Myrsinaceae	-	*Myrsine variabilis*	-	Least Concern
Myrtaceae	rough-barked apple	*Angophora floribunda*	-	Least Concern
Myrtaceae	spotted gum	*Corymbia citriodora* subsp. *citriodora*	-	Least Concern
Myrtaceae	-	*Corymbia clarksoniana*	-	Least Concern
Myrtaceae	-	*Corymbia dallachiana*	-	Least Concern
Myrtaceae	variable-barked bloodwood	*Corymbia erythrophloia*	-	Least Concern
Myrtaceae	pink bloodwood	*Corymbia intermedia*	-	Least Concern
Myrtaceae	-	*Corymbia* sp.	-	Least Concern
Myrtaceae	Moreton Bay ash	*Corymbia tessellaris*	-	Least Concern
Myrtaceae	-	*Corymbia trachyphloia* subsp. *trachyphloia*	-	Least Concern
Myrtaceae	-	*Eucalyptus acmenoides*	-	Least Concern
Myrtaceae	coolabah	*Eucalyptus coolabah*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Myrtaceae	narrow-leaved red ironbark	*Eucalyptus crebra*	-	Least Concern
Myrtaceae	Queensland peppermint	*Eucalyptus exserta*	-	Least Concern
Myrtaceae	-	*Eucalyptus melanophloia* subsp. *melanophloia*	-	Least Concern
Myrtaceae	gum-topped box	*Eucalyptus moluccana*	-	Least Concern
Myrtaceae	poplar box	*Eucalyptus populnea*	-	Least Concern
Myrtaceae	-	*Eucalyptus portuensis*	-	Least Concern
Myrtaceae	-	*Eucalyptus tereticornis* subsp. *tereticornis*	-	Least Concern
Myrtaceae	brush box	*Lophostemon confertus*	-	Least Concern
Myrtaceae	swamp box	*Lophostemon suaveolens*	-	Least Concern
Myrtaceae	-	*Melaleuca bracteata*	-	Least Concern
Myrtaceae	-	*Melaleuca fluviatilis*	-	Least Concern
Myrtaceae	broad-leaved tea-tree	*Melaleuca leucadendra*	-	Least Concern
Myrtaceae	snow-in summer	*Melaleuca linariifolia*	-	Least Concern
Myrtaceae	-	*Melaleuca viminalis*	-	Least Concern
Myrtaceae	Weeping lilly pilly	*Waterhousea floribunda*		Least Concern
Oleaceae	northern olive	*Chionanthus ramiflorus*	-	Least Concern
Oleaceae	-	*Jasminum didymum* subsp. *didymum*	-	Least Concern
Oleaceae	-	*Jasminum simplicifolium* subsp. *australiense*	-	Least Concern
Orchidaceae	-	*Cymbidium canaliculatum*	-	Least Concern
Oxalidaceae	creeping wood sorrel	*Oxalis corniculata**	-	-
Passifloraceae	-	*Passiflora foetida**	-	-
Passifloraceae	white passionflower	*Passiflora subpeltata**	-	-
Phyllanthaceae	-	*Breynia oblongifolia*	-	Least Concern
Phyllanthaceae	-	*Bridelia leichhardtii*	-	Least Concern
Phyllanthaceae	-	*Glochidion lobocarpum*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Pittosporaceae	-	*Bursaria incana*	-	Least Concern
Pittosporaceae	-	*Pittosporum spinescens*	-	Least Concern
Poaceae	cockatoo grass	*Alloteropsis semialata*	-	Least Concern
Poaceae	-	*Amphibromus* sp.	-	Least Concern
Poaceae	-	*Aristida calycina* var. *calycina*	-	Least Concern
Poaceae	feathertop wiregrass	*Aristida latifolia*	-	Least Concern
Poaceae	white speargrass	*Aristida leptopoda*	-	Least Concern
Poaceae	-	*Aristida* sp.	-	Least Concern
Poaceae	reedgrass	*Arundinella nepalensis*	-	Least Concern
Poaceae	-	*Bothriochloa bladhii* subsp. *bladhii*	-	Least Concern
Poaceae	-	*Bothriochloa decipiens* var. *decipiens*	-	Least Concern
Poaceae	desert bluegrass	*Bothriochloa ewartiana*	-	Least Concern
Poaceae	-	*Bothriochloa pertusa**	-	-
Poaceae	-	*Cenchrus* sp.*	-	-
Poaceae	rhodes grass	*Chloris gayana**	-	-
Poaceae	-	*Chrysopogon fallax*	-	Least Concern
Poaceae	lemon grass	*Cymbopogon ambiguus*	-	Least Concern
Poaceae	silky oilgrass	*Cymbopogon bombycinus*	-	Least Concern
Poaceae	barbed-wire grass	*Cymbopogon refractus*	-	Least Concern
Poaceae	-	*Dichanthium sericeum* subsp. *sericeum*	-	Least Concern
Poaceae	leafy nineawn	*Enneapogon polyphyllus*	-	Least Concern
Poaceae	-	*Eriachne mucronata*	-	Least Concern
Poaceae	spring grass	*Eriochloa crebra*	-	Least Concern
Poaceae	black speargrass	*Heteropogon contortus*	-	Least Concern
Poaceae	-	*Hyparrhenia rufa* subsp. *rufa**	-	-

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Poaceae	blady grass	*Imperata cylindrica*	-	Least Concern
Poaceae	-	*Megathyrsus maximus* var. *maximus**	-	-
Poaceae	red natal grass	*Melinis repens**	-	-
Poaceae	-	*Panicum decompositum* var. *decompositum*	-	Least Concern
Poaceae	hairy panic	*Panicum effusum*	-	Least Concern
Poaceae	-	*Panicum simile*	-	Least Concern
Poaceae	-	*Sporobolus creber*	-	Least Concern
Poaceae	kangaroo grass	*Themeda triandra*	-	Least Concern
Poaceae	sabi grass	*Urochloa mosambicensis**	-	-
Pteridaceae	-	*Adiantum atroviride*	-	Least Concern
Putranjivaceae	grey boxwood	*Drypetes deplanchei*	-	Least Concern
Rhamnaceae	soap tree	*Alphitonia excelsa*	-	Least Concern
Rhamnaceae	supplejack	*Ventilago viminalis*	-	Least Concern
Rubiaceae	-	*Psydrax lamprophylla forma lamprophylla*	-	Least Concern
Rubiaceae	-	*Psydrax odorata*	-	Least Concern
Rubiaceae	-	*Psydrax oleifolia*	-	Least Concern
Rubiaceae	-	*Spermacoce brachystema*	-	Least Concern
Rutaceae	-	*Acronychia laevis* var. *leucocarpa*	-	Least Concern
Rutaceae	crow's ash	*Flindersia australis*	-	Least Concern
Rutaceae	brush wilga	*Geijera salicifolia*	-	Least Concern
Santalaceae	native cherry	*Exocarpos cupressiformis*	-	Least Concern
Santalaceae	-	*Exocarpos latifolius*	-	Least Concern
Santalaceae	-	*Santalum lanceolatum* var. *venosum*	-	Least Concern
Sapindaceae	-	*Alectryon subdentatus*	-	Least Concern
Sapindaceae	Coogera	*Arytera divaricata*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Sapindaceae	tuckeroo	*Cupaniopsis anacardioides*	-	Least Concern
Sapindaceae	-	*Dodonaea lanceolata* var. *lanceolata*	-	Least Concern
Sapindaceae	-	*Harpullia pendula*	-	Least Concern
Scrophulariaceae	winter apple	*Eremophila debilis*	-	Least Concern
Simaroubaceae	quassia	*Samadera bidwillii*	Vulnerable	Vulnerable
Smilacaceae	barbed-wire vine	*Smilax australis*	-	Least Concern
Solanaceae	potato bush	*Solanum ellipticum*	-	Least Concern
Solanaceae	Brazilian nightshade	*Solanum seaforthianum**	-	-
Sparrmanniaceae	dysentery plant	*Grewia latifolia*	-	Least Concern
Sparrmanniaceae	-	*Grewia retusifolia*	-	Least Concern
Sterculiaceae	broad-leaved bottle tree	*Brachychiton australis*	-	Least Concern
Sterculiaceae	little kurrajong	*Brachychiton bidwillii*	-	Least Concern
Sterculiaceae	-	*Brachychiton populneus* subsp. *populneus*	-	Least Concern
Ulmaceae	-	*Trema tomentosa* var. *tomentosa*	-	Least Concern
Verbenaceae	-	*Glandularia aristigera**	-	-
Verbenaceae	lantana	*Lantana camara***	-	-
Verbenaceae	creeping lantana	*Lantana montevidensis*	-	
Xanthorrhoeaceae	-	*Xanthorrhoea johnsonii*	-	Least Concern
Zamiaceae	-	*Macrozamia douglasii*	-	Least Concern
Zamiaceae	-	*Macrozamia macleayi*	-	Least Concern
Fauna				
Amphibians				
Bufonidae	cane toad	*Rhinella marina**	-	-
Hylidae	common green treefrog	*Litoria caerulea*	-	Least Concern
Hylidae	broad palmed rocketfrog	*Litoria latopalmata*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Hylidae	striped rocketfrog	*Litoria nasuta*	-	Least Concern
Limnodynastidae	scarlet sided pobblebonk	*Limnodynastes terraereginae*	-	Least Concern
Limnodynastidae	ornate burrowing frog	*Platyplectrum ornatum*	-	Least Concern
Birds				
Acanthizidae	yellow-rumped thornbill	*Acanthiza chrysorrhoa*	-	Least Concern
Acanthizidae	white-throated gerygone	*Gerygone olivacea*	-	Least Concern
Acanthizidae	fairy gerygone	*Gerygone palpebrosa*	-	Least Concern
Acanthizidae	white-browed scrubwren	*Sericornis frontalis*	-	Least Concern
Acanthizidae	weebill	*Smicrornis brevirostris*	-	Least Concern
Accipitridae	collared sparrowhawk	*Accipiter cirrocephalus*	-	Least Concern
Accipitridae	brown goshawk	*Accipiter fasciatus*	-	Least Concern
Accipitridae	grey goshawk	*Accipiter novaehollandiae*	-	Least Concern
Accipitridae	wedge-tailed eagle	*Aquila audax*	-	Least Concern
Accipitridae	pacific baza	*Aviceda subcristata*	-	Least Concern
Accipitridae	whistling kite	*Haliastur sphenurus*	-	Least Concern
Accipitridae	black kite	*Milvus migrans*	-	Least Concern
Aegothelidae	Australian owlet-nightjar	*Aegotheles cristatus*	-	Least Concern
Anatidae	pacific black duck	*Anas superciliosa*	-	Least Concern
Anatidae	Australian wood duck	*Chenonetta jubata*	-	Least Concern
Apodidae	white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable
Ardeidae	white-necked heron	*Ardea pacifica*	-	Least Concern
Ardeidae	white-faced heron	*Egretta novaehollandiae*	-	Least Concern
Artamidae	black-faced woodswallow	*Artamus cinereus*	-	Least Concern
Artamidae	dusky woodswallow	*Artamus cyanopterus*	-	Least Concern
Artamidae	white-breasted woodswallow	*Artamus leucorynchus*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Artamidae	pied butcherbird	*Cracticus nigrogularis*	-	Least Concern
Artamidae	grey butcherbird	*Cracticus torquatus*	-	Least Concern
Artamidae	Australian magpie	*Gymnorhina tibicen*	-	Least Concern
Artamidae	pied currawong	*Strepera graculina*	-	Least Concern
Burhinidae	bush stone-curlew	*Burhinus grallarius*	-	Least Concern
Cacatuidae	sulphur-crested cockatoo	*Cacatua galerita*	-	Least Concern
Cacatuidae	little corella	*Cacatua sanguinea*	-	Least Concern
Cacatuidae	red-tailed black-cockatoo	*Calyptorhynchus banksii*	-	Least Concern
Cacatuidae	yellow-tailed black-cockatoo	*Calyptorhynchus funereus*	-	Least Concern
Cacatuidae	glossy black-cockatoo	*Calyptorhynchus lathami*	-	Vulnerable
Cacatuidae	galah	*Eolophus roseicapilla*	-	Least Concern
Cacatuidae	cockatiel	*Nymphicus hollandicus*	-	Least Concern
Campephagidae	ground cuckoo-shrike	*Coracina maxima*	-	Least Concern
Campephagidae	black-faced cuckoo-shrike	*Coracina novaehollandiae*	-	Least Concern
Campephagidae	white-bellied cuckoo-shrike	*Coracina papuensis*	-	Least Concern
Campephagidae	cicadabird	*Coracina tenuirostris*	-	Least Concern
Campephagidae	varied triller	*Lalage leucomela*	-	Least Concern
Casuariidae	emu	*Dromaius novaehollandiae*	-	Least Concern
Charadriidae	masked lapwing	*Vanellus miles*	-	Least Concern
Climacteridae	white-browed treecreeper	*Climacteris affinis*	-	Least Concern
Climacteridae	white-throated treecreeper	*Cormobates leucophaea*	-	Least Concern
Columbidae	emerald dove	*Chalcophaps indica*	-	Least Concern
Columbidae	peaceful dove	*Geopelia striata*	-	Least Concern
Columbidae	squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
Columbidae	wonga pigeon	*Leucosarcia melanoleuca*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Columbidae	topknot pigeon	*Lopholaimus antarcticus*	-	Least Concern
Columbidae	brown cuckoo-dove	*Macropygia amboinensis*	-	Least Concern
Columbidae	crested pigeon	*Ocyphaps lophotes*	-	Least Concern
Columbidae	common bronzewing	*Phaps chalcoptera*	-	Least Concern
Columbidae	rose-crowned fruit-dove	*Ptilinopus regina*	-	Least Concern
Coraciidae	dollarbird	*Eurystomus orientalis*	-	Least Concern
Corcoracidae	white-winged chough	*Corcorax melanorhamphos*	-	Least Concern
Corcoracidae	apostlebird	*Struthidea cinerea*	-	Least Concern
Corvidae	Torresian crow	*Corvus orru*	-	Least Concern
Cuculidae	fan-tailed cuckoo	*Cacomantis flabelliformis*	-	Least Concern
Cuculidae	pallid cuckoo	*Cacomantis pallidus*	-	Least Concern
Cuculidae	pheasant coucal	*Centropus phasianinus*	-	Least Concern
Cuculidae	Horsfield's bronze-cuckoo	*Chalcites basalis*	-	Least Concern
Cuculidae	eastern koel	*Eudynamys orientalis*	-	Least Concern
Cuculidae	channel-billed cuckoo	*Scythrops novaehollandiae*	-	Least Concern
Dicruridae	spangled drongo	*Dicrurus bracteatus*	-	Least Concern
Dicruridae	willie wagtail	*Rhipidura leucophrys*	-	Least Concern
Estrildidae	plum-headed finch	*Neochmia modesta*	-	Least Concern
Estrildidae	red-browed finch	*Neochmia temporalis*	-	Least Concern
Estrildidae	double-barred finch	*Taeniopygia bichenovii*	-	Least Concern
Estrildidae	zebra finch	*Taeniopygia guttata*	-	Least Concern
Eurostopodidae	white-throated nightjar	*Eurostopodus mystacalis*	-	Least Concern
Falconidae	brown falcon	*Falco berigora*	-	Least Concern
Falconidae	nankeen kestrel	*Falco cenchroides*	-	Least Concern
Falconidae	peregrine falcon	*Falco peregrinus*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Gruidae	brolga	*Antigone rubicunda*	-	Least Concern
Halcyonidae	blue-winged kookaburra	*Dacelo leachii*	-	Least Concern
Halcyonidae	laughing kookaburra	*Dacelo novaeguineae*	-	Least Concern
Halcyonidae	forest kingfisher	*Todiramphus macleayii*	-	Least Concern
Hirundinidae	welcome swallow	*Hirundo neoxena*	-	Least Concern
Hirundinidae	tree martin	*Petrochelidon nigricans*	-	Least Concern
Maluridae	red-winged fairy-wren	*Malurus elegans*	-	Least Concern
Maluridae	red-backed fairy-wren	*Malurus melanocephalus*	-	Least Concern
Megaluridae	brown songlark	*Cincloramphus cruralis*	-	Least Concern
Megaluridae	rufous songlark	*Cincloramphus mathewsi*	-	Least Concern
Megapodiidae	Australian brush-turkey	*Alectura lathami*	-	Least Concern
Meliphagidae	blue-faced honeyeater	*Entomyzon cyanotis*	-	Least Concern
Meliphagidae	brown honeyeater	*Lichmera indistincta*	-	Least Concern
Meliphagidae	noisy miner	*Manorina melanocephala*	-	Least Concern
Meliphagidae	Lewin's honeyeater	*Meliphaga lewinii*	-	Least Concern
Meliphagidae	white-throated honeyeater	*Melithreptus albogularis*	-	Least Concern
Meliphagidae	black-chinned honeyeater	*Melithreptus gularis*	-	Least Concern
Meliphagidae	scarlet honeyeater	*Myzomela sanguinolenta*	-	Least Concern
Meliphagidae	white-eared honeyeater	*Nesoptilotis leucotis*	-	Least Concern
Meliphagidae	little friarbird	*Philemon citreogularis*	-	Least Concern
Meliphagidae	noisy friarbird	*Philemon corniculatus*	-	Least Concern
Meropidae	rainbow bee-eater	*Merops ornatus*	-	Least Concern
Monarchidae	magpie-lark	*Grallina cyanoleuca*	-	Least Concern
Monarchidae	leaden flycatcher	*Myiagra rubecula*	-	Least Concern
Monarchidae	broad-billed flycatcher	*Myiagra ruficollis*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Monarchidae	spectacled monarch	*Symposiachrus trivirgatus*	Migratory	Special Least Concern
Motacillidae	Australasian pipit	*Anthus novaeseelandiae*	-	Least Concern
Nectariniidae	mistletoebird	*Dicaeum hirundinaceum*	-	Least Concern
Neosittidae	varied sittella	*Daphoenositta chrysoptera*	-	Least Concern
Oriolidae	olive-backed oriole	*Oriolus sagittatus*	-	Least Concern
Oriolidae	Australasian figbird	*Sphecotheres vieilloti*	-	Least Concern
Otididae	Australian bustard	*Ardeotis australis*	-	Least Concern
Pachycephalidae	grey shrike-thrush	*Colluricincla harmonica*	-	Least Concern
Pachycephalidae	little shrike-thrush	*Colluricincla megarhyncha*	-	Least Concern
Pachycephalidae	golden whistler	*Pachycephala pectoralis*	-	Least Concern
Pachycephalidae	rufous whistler	*Pachycephala rufiventris*	-	Least Concern
Pardalotidae	striated pardalote	*Pardalotus striatus*	-	Least Concern
Pelecanidae	Australian pelican	*Pelecanus conspicillatus*	-	Least Concern
Petroicidae	eastern yellow robin	*Eopsaltria australis*	-	Least Concern
Petroicidae	red-capped robin	*Petroica goodenovii*	-	Least Concern
Petroicidae	rose robin	*Petroica rosea*	-	Least Concern
Phasianidae	brown quail	*Coturnix ypsilophora*	-	Least Concern
Podargidae	tawny frogmouth	*Podargus strigoides*	-	Least Concern
Podicipedidae	Australasian grebe	*Tachybaptus novaehollandiae*	-	Least Concern
Pomatostomidae	grey-crowned babbler	*Pomatostomus temporalis*	-	Least Concern
Psittacidae	Australian king-parrot	*Alisterus scapularis*	-	Least Concern
Psittacidae	red-winged parrot	*Aprosmictus erythropterus*	-	Least Concern
Psittacidae	budgerigar	*Melopsittacus undulatus*	-	Least Concern
Psittacidae	little lorikeet	*Parvipsitta pusilla*	-	Least Concern
Psittacidae	scaly-breasted lorikeet	*Trichoglossus chlorolepidotus*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Psittaculidae	pale-headed rosella	*Platycercus adscitus*	-	Least Concern
Psittaculidae	rainbow lorikeet	*Trichoglossus moluccanus*	-	Least Concern
Psophodidae	spotted quail-thrush	*Cinclosoma punctatum*	-	Least Concern
Ptilonorhynchidae	green catbird	*Ailuroedus crassirostris*	-	Least Concern
Ptilonorhynchidae	spotted bowerbird	*Ptilonorhynchus maculatus*	-	Least Concern
Rhipiduridae	grey fantail	*Rhipidura albiscapa*	-	Least Concern
Rhipiduridae	rufous fantail	*Rhipidura rufifrons*	Migratory	Special Least Concern
Strigidae	southern boobook	*Ninox boobook*	-	Least Concern
Strigidae	barking owl	*Ninox connivens*	-	Least Concern
Threskiornithidae	straw-necked ibis	*Threskiornis spinicollis*	-	Least Concern
Turnicidae	painted button-quail	*Turnix varius*	-	Least Concern
Tytonidae	eastern barn owl	*Tyto delicatula*	-	Least Concern
Zosteropidae	silvereye	*Zosterops lateralis*	-	Least Concern
Mammals				
Canidae	dingo	*Canis familiaris dingo*	-	-
Dasyuridae	northern quoll	*Dasyurus hallucatus*	Endangered	Least Concern
Emballonuridae	yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	-	Least Concern
Emballonuridae	Troughton's sheathtail bat	*Taphozous troughtoni*	-	Least Concern
Equidae	wild horse	*Equus caballus**	-	-
Felidae	cat	*Felis catus**	-	-
Leporidae	European brown hare	*Lepus europaeus**	-	-
Macropodidae	black-striped wallaby	*Macropus dorsalis*	-	Least Concern
Macropodidae	eastern grey kangaroo	*Macropus giganteus*	-	Least Concern
Macropodidae	whiptail wallaby	*Macropus parryi*	-	Least Concern
Macropodidae	Herbert's rock-wallaby	*Petrogale herberti*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Macropodidae	unadorned rock-wallaby	*Petrogale inornata*	-	Least Concern
Macropodidae	swamp wallaby	*Wallabia bicolor*	-	Least Concern
Miniopteridae	little bent-wing bat	*Miniopterus australis*	-	Least Concern
Miniopteridae	eastern bent-wing bat	*Miniopterus orianae*	-	Least Concern
Molossidae	northern freetail bat	*Chaerephon jobensis*	-	Least Concern
Molossidae	northern free-tailed bat	*Ozimops lumsdenae*	-	Least Concern
Molossidae	eastern free-tailed bat	*Ozimops ridei*	-	Least Concern
Molossidae	bristle-faced free-tailed bat	*Setirostris eleryi*	-	Least Concern
Muridae	black rat	*Rattus rattus**	-	-
Petauridae	yellow-bellied glider (south-eastern)	*Petaurus australis australis*	Vulnerable	Vulnerable
Petauridae	sugar glider	*Petaurus breviceps*	-	Least Concern
Petauridae	squirrel glider	*Petaurus norfolcensis*	-	Least Concern
Phalangeridae	common brushtail possum	*Trichosurus vulpecula*	-	Least Concern
Phascolarctidae	Koala	*Phascolarctos cinereus*	Endangered	Endangered
Potoroidae	rufous bettong	*Aepyprymnus rufescens*	-	Least Concern
Pseudocheiridae	greater glider (southern and central)	*Petauroides volans*	Vulnerable	Vulnerable
Pteropodidae	black flying-fox	*Pteropus alecto*	-	Least Concern
Pteropodidae	little red flying-fox	*Pteropus scapulatus*	-	-
Rhinolophidae	eastern horseshoe bat	*Rhinolophus megaphyllus*	-	Least Concern
Suidae	pig	*Sus scrofa**	-	-
Tachyglossidae	short-beaked echidna	*Tachyglossus aculeatus*	-	Special Least Concern
Vespertilionidae	Gould's wattled bat	*Chalinolobus gouldii*	-	Least Concern
Vespertilionidae	chocolate wattled bat	*Chalinolobus morio*	-	Least Concern
Vespertilionidae	hoary wattled bat	*Chalinolobus nigrogriseus*	-	Least Concern
Vespertilionidae	little pied bat	*Chalinolobus picatus*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Act Status	NC Act Status
Vespertilionidae	inland broad-nosed bat	*Scotorepens balstoni*	-	Least Concern
Vespertilionidae	little broad-nosed bat	*Scotorepens greyii*	-	Least Concern
Vespertilionidae	south-eastern broad-nosed bat	*Scotorepens orion*		Least Concern
Vespertilionidae	northern broad-nosed bat	*Scotorepens sanborni*	-	Least Concern
Reptiles				
Agamidae	eastern bearded dragon	*Pogona barbata*	-	Least Concern
Colubridae	freshwater snake	*Tropidonophis mairii*	-	Least Concern
Colubridae	green tree snake	*Dendrelaphis punctulatus*	-	Least Concern
Diplodactylidae	wood gecko	*Diplodactylus vittatus*	-	Least Concern
Diplodactylidae	robust velvet gecko	*Nebulifera robusta*	-	Least Concern
Diplodactylidae	ocellated velvet gecko	*Oedura monilis*	-	Least Concern
Diplodactylidae	southern spotted velvet gecko	*Oedura tryoni*	-	Least Concern
Elapidae	eastern small-eyed snake	*Cryptophis nigrescens*	-	Least Concern
Gekkonidae	Bynoe's gecko	*Heteronotia binoei*	-	Least Concern
Pygopodidae	Burton's legless lizard	*Lialis burtonis*	-	Least Concern
Scincidae	open-litter rainbow skink	*Carlia pectoralis*	-	Least Concern
Scincidae	orange-flanked rainbow skink	*Carlia rubigo*	-	Least Concern
Scincidae	tree-base litter-skink	*Lygisaurus foliorum*	-	Least Concern
Scincidae	eastern blue-tongued lizard	*Tiliqua scincoides*	-	Least Concern
Scincidae	eastern mulch slider	*Lerista fragilis*	-	Least Concern
Varanidae	sand monitor	*Varanus gouldii*	-	Least Concern
Varanidae	black-tailed monitor	*Varanus tristis*	-	Least Concern
Varanidae	lace monitor	*Varanus varius*	-	Least Concern

Notes:

* *Introduced.*

** *Weed of National Significance.*

APPENDIX C

Likelihood of Occurrence Assessment

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Threatened Ecological Communities					
Brigalow (*Acacia harpophylla* dominant and codominant)		Endangered	-	The TEC is characterised by the presence of brigalow which is usually dominant in the tree layer or co-dominant with other species such as belah (*Casuarina cristata*), *Acacia* spp. or *Eucalyptus* spp. The structure of the vegetation ranges from open forest to open woodland. The following Qld REs form part of, or align with this TEC: RE 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.11.14, 11.12.21.	**Unlikely** – No REs that align with this TEC were recorded within the Study Area.
Coolibah – Black Box Woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions		Endangered	-	The TEC is associated with floodplains and drainage areas of the Darling Riverine Plains and Brigalow Belt South IBRA bioregions. This community is represented by eucalypt woodland where coolabah (*Eucalyptus coolabah* subsp. *coolabah*) and/or black box (*Eucalyptus largiflorens*) are the dominant canopy species. The understorey tends to be grassy. The following Qld REs form part of, or align with this TEC: RE 11.3.3, 11.3.15, 11.3.16, 11.3.28, 11.3.37.	**Unlikely** – No REs that align with this TEC were recorded within the Study Area.
Poplar Box Grassy Woodland on Alluvial Plains		Endangered	-	The TEC occurs on alluvial soils and is typically a grassy woodland with a canopy dominated by poplar box (*Eucalyptus populnea*) with an understorey of mostly grasses and herbs. The following Qld REs correspond to this TEC: 11.3.2, 11.3.17, 11.4.7, 11.4.12, 12.3.10.	**Unlikely** – No REs that align with this TEC were recorded within the Study Area.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Weeping Myall Woodlands		Endangered	-	The TEC occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Qld. This community is an open woodland to woodland in which weeping myall (*Acacia pendula*) trees are the sole or dominant overstorey species. The following Qld REs correspond to this TEC: 11.3.2, 11.3.28.	**Unlikely** – No REs that align with this TEC were recorded within the Study Area.
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions		Endangered	-	The TEC occurs within the Brigalow Belt Bioregions in Queensland, New South Wales, the Northern Territory and Western Australia. This community is a form of seasonal sub-tropical rainforest that occurs in areas that experience seasonally dry periods with vegetation that is characterized by trees with microphyll sized leaves and emergent bottle trees (*Brachychiton* spp.). The following Qld REs correspond to this TEC: 12.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, 11.11.18.	**Unlikely** – No REs that align with this TEC were recorded within the Study Area.
Threatened Flora					
hairy-joint grass	*Arthraxon hispidus*	Vulnerable	Vulnerable	The species occurs in Qld and NSW. In Qld it occurs as far north as Port Douglas, and west to disjunct occurrences around mound springs in Carnarvon National Park. However, most occurrences occur south of Noosa. It occurs in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps.	**Low** – No records of this species occur within the desktop search extent and habitat in the Study Area is marginal.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
three-leaved bosistoa	*Bosistoa transversa*	Vulnerable	Least Concern	The species grows in wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude. It is associated with *Argyrodrendon trifoliolatum*, *Syzygium hodgkinsoniae*, *Endiandra pubens*, *Dendrocnide phoinphylla*, *Amena ingens*, *Diploglottis australis* and *Diospyros mabacea*.	**Low** – No records of this species occur within the desktop search extent and habitat in the Study Area is marginal.
-	*Bulbophyllum globuliforme*	Vulnerable	Near Threatened	The species occurs in the McPherson Range of north-east NSW, south-east Qld and in the Calliope Range Inland from Gladstone. The species grows only on hoop pines (*Araucaria cunninghamii*), colonising the upper mature branches in upland rainforest.	**Low** – No records of this species occur within the desktop search extent and no hoop pines were recorded in the Study Area during surveys.
ooline	*Cadellia pentastylis*	Vulnerable	Vulnerable	The species occurs in NSW and Qld. In Qld, it occurs from the southern border to the Canarvon Range and Callide Valley, south-west of Rockhampton. Cadellia grows in dry rainforest, semi evergreen vine thickets and sclerophyll ecological communities, often locally dominant or as an emergent.	**Low** – The closest records occur > 30 km from the Study Area and generally occur to the west of the Study Area.
-	*Cossinia australiana*	Endangered	Endangered	The species is known from fragmented relict patches of Araucarian vineforests or vine thickets on fertile soils in central and southern Qld. It is distributed from Rockhampton in the north Kingaroy in the south-west.	**Moderate** – Vine thicket communities within the Study Area (RE 11.11.5a and RE 11.12.4) may provide suitable habitat for the species. An ALA record from 2001 is centered within 500 m of the Study Area. However details of the record indicate a spatial uncertainty of 25 km which suggests the record is actually located some distance from the Study Area.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
wedge-leaf tuckeroo	*Cupaniopsis shirleyana*	Vulnerable	Vulnerable	The species occurs in south-east Qld between Brisbane and Curtis Island. It occurs in dry rainforest and scrubby urbanised areas on moderate to very steep slopes, screeslope gullies and rocky stream channels at elevations of 60 to 550 m asl.	**Low** – No records of this species occur in the vicinity of the Study Area. The closest record occurs approximately 45 km east at Targinnie. Some suitable vine thicket habitat occurs within the Study Area.
-	*Cycas megacarpa*	Endangered	Endangered	The species is endemic to south-east Qld and its range extends from Woolooga in the south to Bouldercombe in the north. It occurs in spotted gum (*Eucalyptus citriodora*) and narrow-leaved ironbark (*Eucalyptus crebra*) woodland and open forest with a grassy understorey. It has also been recorded on rainforest margins. The species usually grows on hill tops and steep slopes. It is found on varying topsoils; commonly sandy loams or shallow clay loams which are often stony. It occurs at altitudes of 40–600 m asl.	**Known** – In addition to the presence of previous records within and adjacent to the Study Area, this species was frequently recorded in the Study Area during field surveys.
Marlborough blue	*Cycas ophiolitica*	Endangered	Endangered	The species is endemic to Qld and occurs between Marlborough and Rockhampton in central-eastern Qld. It inhabits eucalypt open forest and woodland communities with a grassy understorey. It occurs on hill tops or steep slopes, at altitudes of 80–620 m asl. It grows on shallow, stony, red clay loams or sandy soils.	**Low** – No records of this species occur within the desktop search extent. While suitable habit exists within the Study Area, extensive targeted surveys did not identify this species.
Mount Morgan myrtle	*Decaspermum struckoilicum*	Endangered	Endangered	The species is only known from two populations in Qld, both about 8 km east of Mount Morgan, in the area known as Struck Oil. It occurs in semi-evergreen vine thicket on brown or reddish soil. The northern population comprises only 1 plant, where the northern population possibly comprises 17. Both populations occur in remnant vegetation.	**Moderate** – The two known populations of this species occur approximately 15 km north-west of the Study Area. Remnant semi-evergreen vine thicket communities (11.11.5a and 11.12.4) within the Study Area provide suitable habitat for the species.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
king blue-grass	*Dichanthium queenslandicum*	Endangered	Vulnerable	This species occurs near Dalby north to about 90 km north of Hughenden and west as far as Clermont. The main concentration of populations in central Queensland in the Emerald region. It is found in Gemini Peaks NP north-east of Clermont and Alpinia NP near Rolleston.	**Low** – No records of this species occur within the desktop search extent and habitat in the Study Area is marginal.
-	*Dichanthium setosum*	Vulnerable	-	The species occurs in Qld and NSW. In Qld it occurs in the Leichardt, Morton, North Kennedy and Port Curtis regions. It occurs in the Mistake Range, in Main Range National Park and possibly Glen Rock National Park. It occurs on heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil.	**Low** – No records of this species occur within the desktop search extent and habitat in the Study Area is marginal.
black ironbox	*Eucalyptus raveretiana*	Vulnerable		The species usually grows along watercourses, to a lesser extent river flats or open woodland at 0–300 m asl in sub-tropical climates. Soil varies from sand to heavy clays. The species does not occur in pure stands, but is co-dominant with species including *Melaleuca leucadendra*, *M. fluviatilis*, *Eucalyptus tereticornis*, *Corymbia tessellaris*, and occasionally in semi evergreen vine thicket.	**Low** – The species has been recorded from the broader region. Extensive surveys did not record this conspicuous species.
-	*Marsdenia brevifolia*	Vulnerable	Vulnerable	The species occurs in north and central Qld where it is known from localities near Townsville, Springsure and north of Rockhampton. North of Rockhampton, it grows on serpentine rock outcrops or crumbly black soil derived from serpentine in eucalypt woodland, often with broad-leaf ironbark (*Eucalyptus fibrosa*) and *Corymbia xanthope*. At Hidden Valley near Paluma, plants grow in woodland on granite soils and on Magnetic Island the species occurs in open forest on acid agglomerate soils.	**Low** – No records of this species are known from the desktop search extent, with the closest records occurring north of Rockhampton and habitat within the Study Area is considered marginal.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
quassia	*Samadera bidwillii*	Vulnerable	Vulnerable	The species is endemic to Qld and is currently known in several locations between Scawfell Island near Mackay, and Goomboorian, north of Gympie. It occurs in lowland rainforest or on rainforest margins, but it can be found in other forest types such as open forest and woodland up to 510 m altitude.	**Known** – Within the Development Corridor, this species was recorded in RE 11.11.3. The population occurred as a small shrub, from 0.3 – 0.7 m tall. It occurred across approximately 0.03 ha of moderately steep, rocky terrain.
-	*Solanum dissectum*	Endangered	Endangered	The species is endemic to Qld and found within a region bounded by the towns of Blackwater to Bauhinia to Thangool to Dululu, which is centred about 150 km west of Gladstone. It is restricted to very small, localised areas where populations exist. It is found in open forest and woodland habitats where brigalow (*Acacia harpophylla*) and/or lapunyah (*Eucalyptus thozetiana*) characterise the dominant vegetation types on solodic soils.	**Low** – No suitable habitat occurs within the Study Area.
-	*Solanum johnsonianum*	Endangered	Endangered	The species is endemic to Qld and found in a region bounded by the town of Rolleston to Theodore to Biloela to Dululu, which is centred about 160 km west of Gladstone. It may be found in very small, localised areas on heavy cracking clays soils where brigalow (*Acacia harpophylla*) dominates or co-dominates. Other associated species include lapunyah (*Eucalyptus thozetiana*) and an understorey of wilga (*Geijera parviflora*).	**Low** – No suitable habitat occurs within the Study Area.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Threatened Fauna					
Birds					
curlew sandpiper	*Calidris ferruginea*	Critically Endangered, Migratory	Endangered	The species mainly occurs on intertidal mudflats in sheltered coastal areas such as estuaries, bays, inlets and lagoons, and around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded less often inland, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand, occurring in both fresh and brackish waters.	**Unlikely** – No proximal records for this species exist, and the inland location of the Study Area is unlikely to provide suitable habitat.
greater sand plover	*Charadrius leschenaultii*	Vulnerable, Migratory	Vulnerable	The species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt-marshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast.	**Low** – Suitable habitat does not occur within the Study Area. Records for this species occur within the wider Project region though are further east towards the coast.
Coxen's fig-parrot	*Cyclopsitta diophthalma coxeni*	Endangered	Endangered	The species occurs in rainforest habitats including subtropical, dry, littoral and vine forest types. Within these habitats, the species is likely to favour alluvial areas that support figs and other trees with fleshy fruits. The species has also been recorded in sub-littoral mixed scrub; corridors of riparian vegetation in woodland, open woodland or other types of cleared habitat; and isolated stands of fig or other trees on urban, agricultural or cleared land.	**Low** – The Study Area is located north of the historic range of the species. The Study Area may provide suitable habitat within vine forest and riparian woodland habitats.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
red goshawk	*Erythrotriorchis radiatus*	Vulnerable	Endangered	The species occurs in coastal and sub-coastal tall open forests and woodlands. Red goshawks typically breed in trees >20 m tall (range 18.5–40.5 m) with an open limb and canopy structure. Nests are located above 20 m in tall trees (>30 m) that are usually within groups of the tallest trees (>25 m) in a given region. The species prefers areas with a mosaic of vegetation types, permanent water (within 1 km) and abundant small birds. Associated with gorge and escarpment country in partially cleared country in eastern Qld. In eastern Australia, populations seem to move from inland nest sites to coastal plains in winter, thus occupying home ranges of 50–220 km^2.	**Low** –The species was recently reported to be extinct in the region (Briggs & Noske 2021), and no records occur within the wider area surrounding the Study Area. Due to the lack of permanent water and the location of the Study Area in the region, no potential breeding habitat is identified. Habitat within the Study Area may be marginally suitable for foraging and dispersal.
grey falcon	*Falco hypoleucos*	Vulnerable	Vulnerable	Occupies woodlands, shrublands, and grasslands of arid to semi-arid landscapes often in association with watercourses. Occasionally found in coastal woodlands. Uses nests of other birds of prey usually in tall eucalypts near water.	**Low –** Records of this species are rare within the Project region as this species rarely occupies coastal woodland. Limited habitat for this species exists within the Study Area.
squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable	The species occurs in open, dry woodland with a grassy understorey in proximity to permanent water. Prefers areas of sandy soil with sparser cover of low grasses; and less common on heavier soils with dense grass cover.	**Known** – This species was recorded frequently within and adjacent to the Study Area, commonly along tracks in proximity to water sources.
painted honeyeater	*Grantiella picta*	Vulnerable	Vulnerable	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box (*Eucalyptus largiflorens*) and river red gum (*E. camaldulensis*), box-ironbark-yellow gum woodlands, *Acacia*-dominated woodlands, *Melaleuca*, *Casuarina* or *Callitris* woodlands, and trees on farmland or in gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes.	**Low** – Some suitable habitat for this species may exist within eucalypt woodland in the Study Area, however, there are no records proximal to the Project.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable	The species is found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial, though it roosts in tree hollows and the foliage canopy. It forages for insects aerially, flying anywhere between "cloud level" and "ground level", often forming mixed feeding flocks with other species. The species roosts in tall trees at night, mainly in forests.	**Known** – This species was recorded commonly during field surveys, often flocking in high numbers above ridges and peaks within and adjacent to the Study Area.
star finch (eastern, southern)	*Neochmia ruficauda ruficauda*	Endangered	Endangered	The species inhabits tall grass and reed beds associated with swamps and watercourses. It may also be found in grassy woodlands, open forests and mangroves. The condition of preferred habitat varies according to season, grazing pressure and fire.	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.
eastern curlew	*Numenius madagascariensis*	Critically Endangered, Migratory	Endangered	The species occurs in sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. They are often recorded among saltmarsh and on mudflats fringed by mangroves, sometimes within the mangroves. They are also found in coastal saltworks and sewage farms.	**Unlikely** – No proximal records for this species exist, and the inland location of the Study Area is unlikely to provide suitable habitat.
southern black-throated finch	*Poephila cincta cincta*	Endangered	Endangered	The species inhabits grassy, open woodlands and forests, typically dominated by *Eucalyptus* spp. including narrow-leaved ironbark (*E. crebra*), river red gum (*E. camaldulensis*) and silver-leaved ironbark (*E. melanophloia*), *Corymbia* spp. and *Melaleuca* spp, and occasionally in tussock grasslands or other habitats often along or near watercourses, or in the vicinity of water.	**Low** – This location of the Study Area is outside of this species current known distribution. Some available tussock grasslands may be present but it is unlikely that they would exist in a large enough patch to support this species.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
diamond firetail	*Stagonopleura guttata*	Vulnerable	Vulnerable	This species is distributed from south-east Queensland to Eyre peninsula, South Australia and to approximately 300 km inland from coastal regions. The species utilizes eucalypt, acacia and casuarina woodlands, open forests and other lightly timbered environments. The species prefers habitat with a low tree density, few large logs, low litter cover and high grass cover for foraging, roosting and breeding.	**Low** – Some suitable habitat for this species may exist within eucalypt woodlands within the Study Area, however, there are no records proximal to the Project.
Australian painted-snipe	*Rostratula australis*	Endangered	Vulnerable	The species occurs in shallow freshwater wetlands or saltmarshes, including inundated grasslands, dams and bore drains, generally with good cover of grasses or low scrub.	**Low** – Suitable habitat for this species is unlikely to occur within the Study Area. Records for this species occur within the wider Project region but are found on low lying marsh and swamp land which is not present within the Study Area.
black-breasted button-quail	*Turnix melanogaster*	Vulnerable	Vulnerable	The species is restricted to rainforests and forests, mostly in areas with 770–1200 mm rainfall per annum. They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest. They may also be found in low, dense acacia thickets and, in littoral areas, in vegetation behind sand dunes.	**Low** – Some suitable habitat for this species may exist within vine forest in the Study Area, however, there are no records proximal to the Project.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Mammals					
large-eared pied bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable	In south-east Qld, the species has primarily been recorded from higher altitude moist tall open forest adjacent to rainforest. Most records are from canopied habitat, although narrow connecting riparian strips in otherwise cleared habitat are sometimes quite heavily used. Rainforest and moist eucalypt forest habitats on rhyolite, trachyte and basalt at high elevation are important roosting habitat for the species.	**Low** – Some suitable habitat for this species may exist within vine forest in the Study Area, however, there are no records proximal to the Project.
northern quoll	*Dasyurus hallucatus*	Endangered	-	The species occupies a diversity of habitats including rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. The species is also known to occupy non-rocky lowland habitats such as beach scrub communities in central Qld. The species generally encompasses some form of rocky area for denning purposes, with surrounding vegetated habitats used for foraging and dispersal. Rocky habitats are usually of high relief, often rugged and dissected.	**Known** – This species was recorded twice on camera traps in the central-east portion of the Study Area from riparian *Melaleuca* woodland adjacent to remnant eucalypt woodland.
ghost bat	*Macroderma gigas*	Vulnerable	Endangered	The species occurs throughout a wide range of habitats from rainforest, monsoon and vine scrub to open woodlands in arid areas. These habitats are used for foraging, while roost habitat is more specific. Ghost bats move between a number of roosts seasonally or as dictated by weather conditions and/or foraging opportunities, as such they require a range of roost sites. Roost sites can include caves, rock crevices and disused mine adits.	**Low** – The species is known historically from the Rockhampton region, however, no records occur in the wider area surrounding the Study Area. Habitat assessments completed during the field survey program did not identify any suitable roosting habitat including caves or abandoned mines. However, habitat within the Study Area may be suitable for foraging and dispersal.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Corben's long-eared bat	*Nyctophilus corbeni*	Vulnerable	Vulnerable	The species inhabits a range of inland dry forest habitats including river red gum (*Eucalyptus camaldulensis*), mallee, brigalow (*Acacia harpophylla*) and other arid and semi-arid habitats; in southern Qld it is more common in box, ironbark and cypress pine forests on sandy soils. The species is most abundant in vegetation with a distinct canopy and a dense, cluttered shrub layer, and in large, continuous remnants. Roosts solitarily in tree hollows, crevices, and under loose bark (particularly on dead bull oak (*Allocasuarina luehmannii*) or belah (*Casuarina cristata*).	**Unlikely** – Suitable habitat is not present within the Study Area, and the Study Area is located north of the known range of the species.
greater glider (southern and central)	*Petauroides volans*	Vulnerable	Vulnerable	The species is largely restricted to eucalypt forests and woodlands; it is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows.	**Known** – This species was recorded within gum-topped box (*Eucalyptus moluccana*) woodland during nocturnal surveys within and adjacent to the Study Area.
koala (combined populations of Qld, NSW and the ACT)	*Phascolarctos cinereus*	Endangered	Endangered	The species inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by eucalypt species. The species is limited by habitat (restricted to below 800 m asl (asl)), temperature and, at the western and northern ends of the range, leaf moisture.	**Known** – An adult female with a joey was recorded within RE 11.11.3 within the Disturbance Footprint. This species was occupying *Eucalyptus crebra* at the time of the observation.
grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	-	The species occurs in rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. The grey-headed flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of Melaleuca, mangroves and riparian vegetation.	**Low** – There are no records proximal to the Study Area. Foraging habitat has been identified in the Study Area and includes any vegetation community (remnant or regrowth) which contains important winter/spring flowering species.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
				Grey-headed flying-foxes commute daily to foraging areas, usually within 15 km of the day roost site. They are capable of nightly flights of up to 50 km from their roost to different feeding areas as food resources change. At most times of the year there is a complete exodus from the colony site at dusk.	The Project occurs within 40 km of known camps within the Study Area. The western extent of the access road corridor occurs within 10 km of a known camp.
yellow-bellied glider (south-eastern)	*Petaurus australis australis*	Vulnerable	Vulnerable	The species occurs in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests. Abundance is highly dependent on habitat suitability, which is in turn determined by forest age and floristics. The subspecies shows a preference for large patches of mature old growth forest that provide suitable trees for foraging and shelter.	**Known** – Species was recorded on four occasions during the field survey program while completing spotlighting surveys in *Eucalyptus moluccana* woodlands in the north of the Study Area.
Reptiles					
collared delma	*Delma torquata*	Vulnerable	Vulnerable	The species normally inhabits eucalypt-dominated woodlands and open-forests in the following land zones: alluvium, undulating country on fine-grained sedimentary rocks, and sandstone ranges. The presence of rocks, logs, coarse woody debris and leaf litter are essential characteristics of the species' microhabitat.	**Moderate**– Eucalypt-dominated woodlands and open-forests on alluvium occur within the Study Area and may provide suitable habitat for the species. An ALA record from 1989 is centered within the southern Study Area. However, details of the record indicate it has a spatial inaccuracy of 100 km and is associated with the location 'Archer'. Record is thus considered unreliable.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
ornamental snake	*Denisonia maculata*	Vulnerable	Vulnerable	The species inhabits lower-lying subtropical areas with deep-cracking clay soils and adjacent slightly elevated ground of clayey and sandy loams. The species is also found in vegetation of woodland and shrub land, including brigalow (*Acacia harpophylla*), riverside woodland and open forest, particularly on natural levees.	**Low** – This species has been historically recorded in the region, however, suitable habitat for this species does not exist within the Study Area.
yakka skink	*Egernia rugosa*	Vulnerable	Vulnerable	The species occurs in a variety of drier forests and woodlands, usually on well-drained, gritty soils, including poplar box (*Eucalyptus populnea*) on alluvial soils, white cyprus pine (*Callitris glaucophylla*) on sands, bull oak (*Allocasuarina luehmannii*), brigalow (*Acacia harpophylla*), bendee (*A. catenulata*) and mulga (*A. aneura*). The species inhabits burrows, abandoned rabbit warrens, and hollow logs or in deep rock crevices.	**Low**– Suitable eucalypt woodland habitat is present within the Study Area; however, this species has not been recorded in the search extent.
southern snapping turtle	*Elseya albagula*	Critically Endangered	Endangered	The species is only found in the Burnett, Fitzroy, Raglan and Mary river drainages of south-east Qld. It prefers permanent flowing water habitats where there are suitable shelters and refuges.	**Low** – This species has been recorded from creeks in the wider region. The Study Area lacks suitable watercourses to support this species.
Dunmall's snake	*Furina dunmalli*	Vulnerable	Vulnerable	The species has been found in a broad range of habitats, including forests and woodlands on black alluvial cracking clay/ clay loams dominated by including brigalow (*Acacia harpophylla*) and other *Acacia* spp., *Callitris* spp. or bull oak (*Allocasuarina luehmannii*), and various spotted gum (*Corymbia citriodora*), ironbark (*Eucalyptus crebra* and *E. melanophloia*) and white cyprus pine (*Callitris glaucophylla*) open forest and woodland associations on sandstone derived soils.	**Low** – The species is not known from the search extent. Eucalypt woodland and forest may provide suitable habitat for the species.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
grey snake	*Hemiaspis damelii*	Endangered	Endangered	The species is known to occur in brigalow (*Acacia harpophylla)* and belah (*Casuarina cristata*) woodlands on heavy, dark brown to black cracking clay soils, particularly in association with water bodies and flood plain environments. It is also known to occur in *Dichanthium sericeum* and/or *Astrebla spp.* grassland on alluvial plains with cracking clay soils. *Hemiaspis damelii* shelters beneath logs, rocks and soil cracks.	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.
Fitzroy river turtle	*Rheodytes leukops*	Vulnerable	Vulnerable	The species is a benthic feeder that occurs in flowing rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. Preferred areas have high water clarity and are often associated with ribbonweed (*Vallisneria* sp.) beds. Commonly associated riparian vegetation includes forest red gum (*Eucalyptus tereticornis*), river she-oak (*Casuarina cunninghamiana*), weeping bottlebrush (*Melaleuca viminalis*) and snow-in summer (*M. linariifolia*).	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.
Migratory Fauna					
Marine Birds					
fork-tailed swift	*Apus pacificus*	Migratory	Special Least Concern	The species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	**High** – Likely to occur overhead throughout the Study Area, as this species frequently visits the region on migration and utilises updrafts from hills and ridges to maintain flight.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Marine Species					
salt-water crocodile	*Crocodylus porosus*	Migratory	Special Least Concern	The species mostly occurs in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast. It usually inhabits the estuarine reaches of rivers. In Qld, the species is usually restricted to coastal waterways and floodplain wetlands. Floating rafts of vegetation provide important nesting habitat.	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.
Terrestrial Species					
oriental cuckoo	*Cuculus optatus*	Migratory	Special Least Concern	The species uses a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and often along edges of forests, or ecotones between forest types.	**Moderate** – This species has been recorded within 25 km north of the Study Area and some suitable habitat may exist on site, such as open eucalypt forest and woodland.
black-faced monarch	*Monarcha melanopsis*	Migratory	Special Least Concern	The species is a wet forest specialist, occurring mainly in rainforests and riparian vegetation. In wet sclerophyll forest, the species mostly frequents sheltered gullies and slopes with a dense understorey of ferns and/or shrubs. They forage from trees and shrubs or by taking insect prey from the air (sallying).	**Moderate** – This species has been recorded within 25 km of the Study Area and some suitable habitat, such as riparian woodland, exists on site.
spectacled monarch	*Symposiachrus trivirgatus*	Migratory	Special Least Concern	The species occurs in thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	**Known** – This species was recorded twice during field surveys within the Study Area, once from vine thicket and once from eucalypt woodland.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
yellow wagtail	*Motacilla flava*	Migratory	Special Least Concern	Habitat requirements for the species are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves.	**Unlikely** – Suitable habitat for this species does not exist within the Study Area. The closest record of this species to the Study Area has been identified approximately 70 km to the west of the access road corridor.
satin flycatcher	*Myiagra cyanoleuca*	Migratory	Special Least Concern	The species inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	**Moderate** – This species has been historically recorded approximately 7 km north of the western extent of the access road corridor and within 15 km of the wind farm area. Suitable habitat for this species exists within the Study Area in the form of vegetated gullies.
rufous fantail	*Rhipidura rufifrons*	Migratory	Special Least Concern	In east and south-east Australia, the species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts; usually with a dense shrubby understorey often including ferns.	**Known** – This species was recorded three times during field surveys within the Study Area, once from vine thicket and twice from eucalypt woodland.
Wetlands Species					
common sandpiper	*Actitis hypoleucos*	Migratory	Special Least Concern	The species utilises a wide range of coastal wetlands and some inland wetlands with varying levels of salinity. The species is mostly found around muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present. Records from the region occur along the coast away from the site.

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
sharp-tailed sandpiper	*Calidris acuminata*	Migratory	Special Least Concern	The species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland. They also occur in salt works and sewage farms.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present. Records from the region occur along the coast away from the site.
pectoral sandpiper	*Calidris melanotos*	Migratory	Special Least Concern	The species prefers shallow fresh to saline wetlands. It is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present. Records from the region occur along the coast away from the site.
Latham's snipe	*Gallinago hardwickii*	Migratory	Special Least Concern	In Australia, the species occurs in permanent and ephemeral wetlands up to 2000 m asl. They usually inhabit open, freshwater wetlands with low, dense vegetation such as swamps, flooded grasslands or heathlands, around bogs and other water bodies.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present.
osprey	*Pandion haliaetus*	Migratory	Special Least Concern	In east and south-east Australia, the species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts; usually with a dense shrubby understorey often including ferns.	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.

APPENDIX D

Habitat Quality Assessment

Impact/ Offset	Matter	Assessment Unit	Average of Site condition score /3	Average of Site context score/3	Average of Species stocking rate score /4	Average of HQS/10	Matter proportion (%)	Area weighted Site condition score /3	Area weighted Site context score/3	Area weighted Species stocking rate score /4	Area weighted HQS
Impact	Collared delma Breeding and Foraging	Regrowth	2.308	1.647	2.400	6.355	0.218	0.502	0.358	0.522	1.382
Impact	Collared delma Breeding and Foraging	Remnant	1.682	1.882	2.560	6.124	0.782	1.316	1.473	2.003	4.792
Impact	Yellow-bellied glider Breeding and Denning	All	2.275	1.793	2.571	6.639	1.000	2.275	1.793	2.571	6.639
Impact	Yellow-bellied glider Foraging and Dispersal	All	1.765	1.714	1.952	5.432	1.000	1.765	1.714	1.952	5.432
Impact	Koala Breeding, Foraging and Dispersal	Regrowth	2.0625	1.950893	2.71428571	6.727679	0.460253	0.949273	0.897905	1.249259	3.096437
Impact	Koala Breeding, Foraging and Dispersal	Remnant	2.3325	1.979464	2.94285714	7.254821	0.539747	1.258959	1.068409	1.588397	3.915765
Impact	Northern quoll Foraging and Dispersal	Regrowth	1.932	2.092	2.457	6.481	0.455	0.878	0.951	1.118	2.947
Impact	Northern quoll Foraging and Dispersal	Remnant	1.916	1.884	2.260	6.060	0.545	1.045	1.027	1.232	3.304

Impact/ Offset	Matter	Assessment Unit	Average of Site condition score /3	Average of Site context score/3	Average of Species stocking rate score /4	Average of HQS/10	Matter proportion (%)	Area weighted Site condition score /3	Area weighted Site context score/3	Area weighted Species stocking rate score /4	Area weighted HQS
Impact	Greater glider Foraging and Dispersal	All	1.913	1.495	1.893	5.300	1.000	1.913	1.495	1.893	5.300
Impact	Greater Glider Likely / Current Denning	All	2.165	2.031	2.698	6.894	1.000	2.165	2.031	2.698	6.894
Impact	Greater glider Potential / Future Denning	All	1.719	2.082	2.071	5.873	1.000	1.719	2.082	2.071	5.873
Impact	Koala Climate Refugia	All	1.865	2.071429	2.85714286	6.793571	1	1.865	2.071429	2.857143	6.793571
Impact	Northern quoll Denning and Refuge	All	1.275	1.618	2.143	5.036	1.000	1.275	1.618	2.143	5.036
Impact	*Cycas megacarpa*	Non-remnant	1.397	2.489	2.238	7.124	0.194	1.020	0.123	1.628	3.803
Impact	*Cycas megacarpa*	Remnant	2.028	2.232	3.238	7.498	0.503	0.635	0.716	0.983	2.354
Impact	*Cycas megacarpa*	Regrowth	2.093	2.361	3.238	7.691	0.303	0.271	0.482	0.627	1.391
Offset	Collared delma Breeding and Foraging	Regrowth	1.832	2.406	2.187	6.424	0.236	0.432	0.567	0.515	1.514

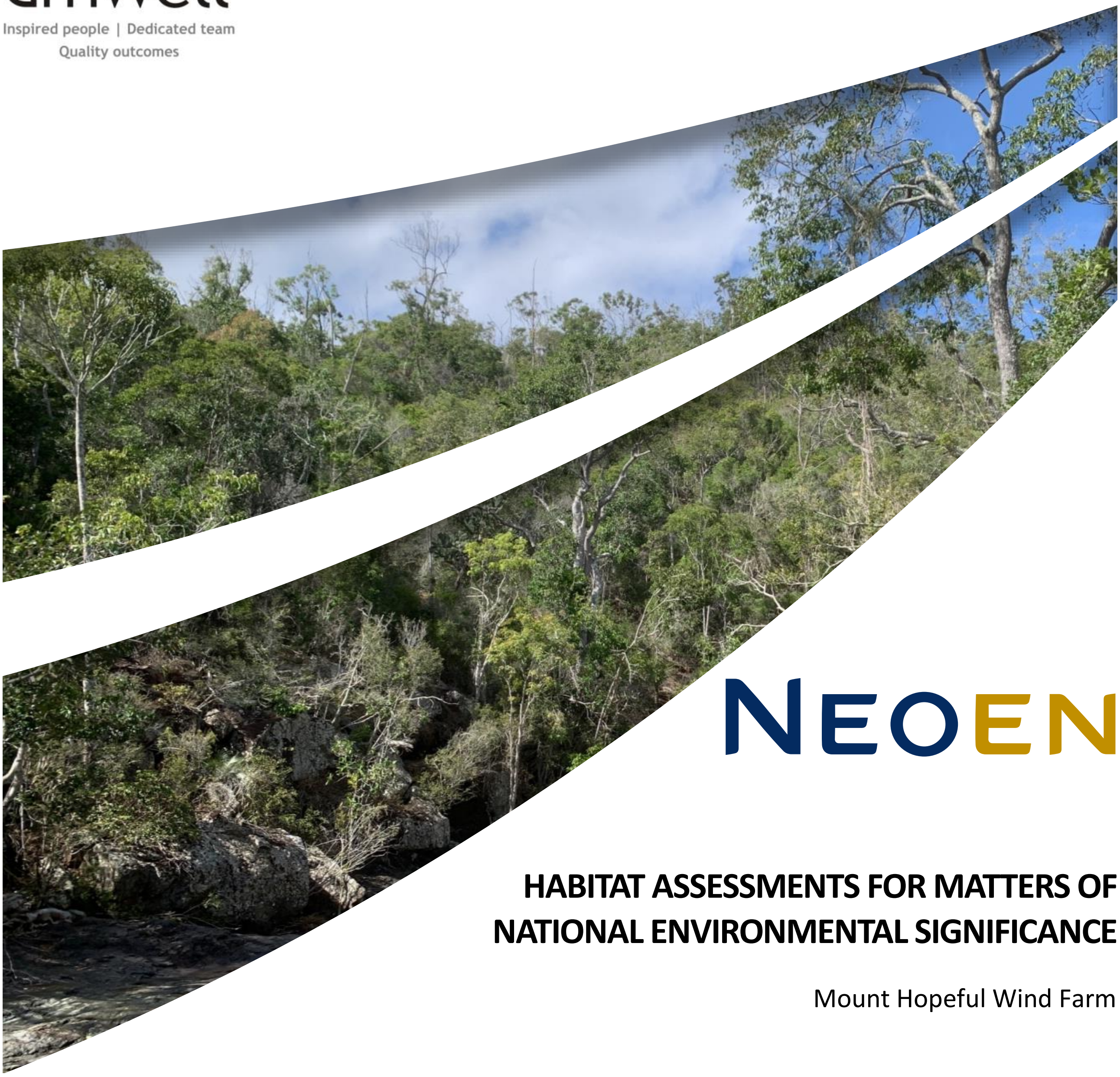
Impact/ Offset	Matter	Assessment Unit	Average of Site condition score /3	Average of Site context score/3	Average of Species stocking rate score /4	Average of HQS/10	Matter proportion (%)	Area weighted Site condition score /3	Area weighted Site context score/3	Area weighted Species stocking rate score /4	Area weighted HQS
Offset	Collared delma Breeding and Foraging	Remnant	2.056	2.323	2.374	6.754	0.660	1.357	1.533	1.567	4.456
Offset	Koala Breeding, Foraging and Dispersal	Emerging	1.68	2.102679	2.14285714	5.925536	0.185993	0.312469	0.391084	0.398557	1.102111
Offset	Koala Climate Refugia	Regrowth	2.0175	1.982143	2.85714286	6.856786	0.256173	0.516829	0.507771	0.731923	1.756523
Offset	Koala Climate Refugia	Remnant	1.970625	2.045759	2.92857143	6.944955	0.743827	1.465804	1.521691	2.178351	5.165845
Offset	Northern quoll Denning and Refuge	Regrowth	2.026	2.330	2.857	7.213	0.159	0.322	0.370	0.454	1.146
Offset	Northern quoll Denning and Refuge	Remnant	1.951	2.148	2.438	6.537	0.841	1.641	1.807	2.051	5.499
Offset	Northern quoll Foraging and Dispersal	Emerging	1.403	1.705	1.381	4.489	0.119	0.167	0.204	0.165	0.536
Offset	Yellow-bellied glider Breeding and Denning	All	2.142	2.013	2.286	6.440	0.811	1.736	1.632	1.853	5.220
Offset	Yellow-bellied glider Foraging and Dispersal	All	1.977	2.047	1.976	6.000	0.640	1.266	1.310	1.265	3.841

Impact/ Offset	Matter	Assessment Unit	Average of Site condition score /3	Average of Site context score/3	Average of Species stocking rate score /4	Average of HQS/10	Matter proportion (%)	Area weighted Site condition score /3	Area weighted Site context score/3	Area weighted Species stocking rate score /4	Area weighted HQS
Offset	Koala Breeding, Foraging and Dispersal	Remnant	2.263269	2.049107	2.68131868	6.993695	0.499653	1.13085	1.023843	1.33973	3.494423
Offset	Koala Breeding, Foraging and Dispersal	Regrowth	1.980714	2.02551	2.72108844	6.727313	0.314353	0.622644	0.636726	0.855383	2.114753
Offset	Northern quoll Foraging and Dispersal	Remnant	1.967	2.144	2.200	6.311	0.567	1.115	1.216	1.248	3.579
Offset	Northern quoll Foraging and Dispersal	Regrowth	1.795	1.925	2.229	5.948	0.314	0.563	0.604	0.699	1.865
Offset	Yellow-bellied glider Breeding and Denning	Emerging Regrowth	1.869	1.882	1.286	5.036	0.167	0.312	0.314	0.214	0.840
Offset	Yellow-bellied glider Breeding and Denning	Remnant	1.920	1.607	1.286	4.813	0.023	0.044	0.036	0.029	0.109
Offset	Yellow-bellied glider Foraging and Dispersal	Emerging Regrowth	1.886	1.680	1.286	4.852	0.300	0.567	0.505	0.386	1.457
Offset	Yellow-bellied glider Foraging and Dispersal	Remnant	1.667	1.955	1.571	5.194	0.059	0.099	0.116	0.093	0.309

Impact/ Offset	Matter	Assessment Unit	Average of Site condition score /3	Average of Site context score/3	Average of Species stocking rate score /4	Average of HQS/10	Matter proportion (%)	Area weighted Site condition score /3	Area weighted Site context score/3	Area weighted Species stocking rate score /4	Area weighted HQS
Offset	Greater Glider Likely / Current Denning	All	2.213	2.244	2.960	7.416	1.000	2.213	2.244	2.960	7.416
Offset	Greater glider Potential / Future Denning	All	2.060	2.133	2.622	6.815	1.000	2.060	2.133	2.622	6.815
Offset	Greater glider Foraging and Dispersal	All	1.833	1.964	1.495	5.291	0.880	1.613	1.728	1.315	4.656
Offset	Greater glider Foraging and Dispersal	Emerging	1.853	1.714	2.143	5.710	0.120	0.222	0.206	0.257	0.685
Offset	Collared delma Breeding and Foraging	Emerging	1.686	2.292	1.783	5.761	0.104	0.176	0.239	0.186	0.602
Offset	*Cycas megacarpa*	Remnant	2.137	2.285	2.857	7.279	0.520	1.111	1.189	1.486	3.786
Offset	*Cycas megacarpa*	Non-remnant	1.572	2.674	2.857	7.103	0.184	0.289	0.491	0.524	1.304
Offset	*Cycas megacarpa*	Regrowth	1.860	2.348	2.857	7.065	0.296	0.551	0.696	0.846	2.093

APPENDIX E

Detailed Habitat Assessments and Significant Impact Assessments



HABITAT ASSESSMENTS FOR MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Mount Hopeful Wind Farm

FINAL

March 2024

HABITAT ASSESSMENTS FOR MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Mount Hopeful Wind Farm

FINAL

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Neoen Australia Pty Ltd

Project Director:	David Gatfield
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Report No.	22753/R03/Appendix E
Date:	March 2024

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Sebastian Knight	15 December 2022	David Gatfield	16 December 2022
V2	Sebastian Knight	22 December 2022	David Gatfield	22 December 2022
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V5	Sebastian Knight	24 May 2023	Sebastian Knight	24 May 2023
V6	Sebastian Knight	24 August 2023	David Gatfield	24 August 2023
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V8	Sebastian Knight	21 November 2023	David Gatfield	21 November 2023
V9	David Gatfield	5 March 2024	David Gatfield	5 March 2024

Table of Contents

Figures

Photos

Tables

1.0 Endangered Species

1.1 Endangered Flora

1.1.1 *Cycas megacarpa*

1.1.1.1 Description and Status Under the EPBC Act

Cycas megacarpa is a trunked cycad growing to 5 metres (m) tall, with the trunk being 8–14 centimetres (cm) in diameter. The leaves are 70–110 cm long, with 120–170 leaflets. New growth is green, densely hairy with orange-brown hairs that later fall off. The seeds are ovoid, green becoming yellowish, pinkish or purplish as they mature, 38–50 millimetres (mm) long, 35–45 mm diameter.

Cycas megacarpa is listed Endangered under the EPBC Act.

1.1.1.2 Distribution and Habitat Requirements

Cycas megacarpa is endemic to south-east Queensland, found from as far south as Woolooga to Bouldercombe in the north. It is found in woodland, open woodland and open forests dominated by narrow-leaved ironbark (*Eucalyptus crebra*) and lemon-scented gum (*Corymbia citriodora*) as well as red bloodwood (*Corymbia erythrophloia*), silver-leaved ironbark (*Eucalyptus melanophloia*) and brush box (*Lophostemon confertus*), often in conjunction with a grassy understory. It occurs at altitudes of 40–680 m, typically on undulating, hilly terrain either on gentle to steep slopes or hill crests (Queensland Herbarium, 2007). The soils are generally well drained, shallow, often stony, sandy loam to clay loam in texture and derived from sandstones, fine grained sediments and acid and basic volcanic rocks (Queensland Herbarium, 2007).

This species has been recorded in several Regional Ecosystems (REs) that are considered suitable habitat for *Cycas megacarpa*. According to the Queensland Herbarium (2007), the REs that *Cycas megacarpa* have been recorded in include:

- Brigalow Belt Bioregion: REs 11.3.25, 11.3.26, 11.11.3, 11.11.15, 11.12.1, 11.12.6.
- South East Queensland Bioregion: REs 12.1.3, 12.5.5, 12.11.2, 12.11.6, 12.11.7, 12.12.3, 12.12.4, 12.12.5, 12.12.7, 12.12.9, 12.12.11, 12.12.12, 12.12.16, 12.12.23, 12.12.27.

It is noted that the majority of published information available on *Cycas megacarpa* has come from the National Recovery Plan (Queensland Herbarium, 2007), which is now 15 years old. Since the National Recovery Plan was published, several field surveys have been conducted for proposed developments within Queensland and have recorded the presence of *Cycas megacarpa*.

1.1.1.3 Occurrence, Populations and Metapopulations within the Broader Region

Based on records held at the Queensland Herbarium, 46 known populations of *Cycas megacarpa* are documented, with an estimated minimum area of occupancy of 2,527 ha and a projected total number of individuals greater than 372,964 across the species range (Queensland Herbarium, 2007).

Of the 46 known populations, 20 populations are known to occur in reserve tenures, consisting of:

- National Parks (4 populations).
- State Forests (12 populations).
- Roadside Reserves (3 populations).
- Forest Reserve (1 population).

The remaining 26 populations occur in freehold, vacant crown land, grazing homestead or unknown tenure types. Population sizes range from <10–>1,000. As reported by the Queensland Herbarium (2007), seven of these populations are identified as being important populations considered to be viable in the long term (outlined in **Table 1.1, Figure 1.1**). Based on two surveyed populations of *Cycas megacarpa*, between 3,500–4,500 plants are considered to constitute a minimum viable population for the species (Queensland Herbarium, 2007).

There are several known populations that occur within proximity to the Study Area including:

- Population 5 (Dee Range) with an estimated population of 5,600 individuals.
- Population 6 (Mount McCamley) with an estimated population of 28 individuals.
- Population 7,8,9 (Don River State Forest) with an estimated population of 115,200 individuals.

A study by James *et al.* (2018), which looked at the distribution and genetic structure of *C. megacarpa*, identified evidence of considerable historic gene flow among populations across its entire range, and showed little differentiation across the entire species. Genetic clustering was shown to occur within a 36 km radius, consistent with the hypothesis that *C. megacarpa* existed as a set of three linked metapopulations, historically linked by gene flow. However, due to ongoing increasing population isolation, this may continue to reduce the species' viability. Based on this evidence it can be concluded that *C. megacarpa* can be considered one population, with the most genetic similarity within a 36 km radius.

Genetic analysis for other projects noted that the Boulder Creek population appears to link the populations to the north, south and east of it genetically. Further to this it was noted that in the northern region, where the Mount Hopeful population in part lies (Dee Range), individuals were genetically similar to each other when within a 16.8 km radius.

Decreasing genetic diversity was not found to occur even within smaller populations, potentially due to the persistence of adult cycads through multiple generations, allowing rare alleles to remain within the population over a longer period of time and potentially passed on to successive generations. This, and dispersal and cross pollination between adjacent populations, may maintain the genetic diversity of small populations (James *et al.,* 2018).

The Mount Hopeful population intersects Population 5 in the northern section and is likely to be a part of the locally known populations (Populations 7 to 9). As such there is the potential for the local population to be in excess of 160,000 individuals. Noting that the study by James *et al.* 2018 identified three distinct metapopulations with Mount Hopeful located between the northern and Callide/Calliope metapopulations.

Table 1.1 *Cycas megacarpa* Known Important Populations

Population	Tenure Type	Projected Occupancy of Population (ha)	Projected Number of Plants in Population	Approximate Number Plants per ha	Approximate Distance from Study Area Population[1]
Population Eight (Biloela)	State Forest Reserve	800	115,200	144	20 km south-east
Population Nineteen (Kroombit)	State Forest Reserve	c.250	76,750	307	49 km south-east
Population Thirty (Wonbah)	State Forest Reserve	c. 20	Thousands (not defined within the SPRAT profile for the species)	N/A	146 km south-east
Population Two (Bouldercombe)	Not available	c. 100	Thousands (not defined within the SPRAT profile for the species)	N/A	16 km north
Population Three (Mt Morgan)	Freehold Title	>850	159,800	188	19 km north-west
Population Five (Dee Range)	Freehold Title & Road Reserve	c. 100	5,600	56	5 km north
Population Fourteen (Biloela)	Freehold Title & Road Reserve	>200	14,400	72	58 km south

[1] *Approximate location obtained from ALA records.*

A population's viability in the long term is based on evidence of replacement by age structure and population size (Queensland Herbarium, 2007). A population with a progression of size classes, with fewer, large (old) individuals down to many juveniles can be considered as adequately replacing itself (Queensland Herbarium, 2007). Healthy populations of *Cycas megacarpa* are known to have a range of individuals from large adults (5–8 m in height) through to seedlings. Reference surveys completed in large and small populations of *Cycas megacarpa* (Queensland Herbarium, 2007) determined that between 40% (small population) and 80% (large population) were juveniles and between 11% (small population) and 14% (large population) were of reproductive age (>1 m tall).

The number of individuals of *Cycas megacarpa* recorded within the Study Area based on data interpolation was 141,392 individuals across an area of 16,975.8 ha. The development class distribution of the population within the Study Area mirrors the overall proportions of a regional study of *Cycas megacarpa* across all surveyed populations identified in *Conservation Genetics and Demographic Analysis of the Endangered Cycad Species Cycas megacarpa and the Impacts of Past Habitat Fragmentation* (James et al. 2018). **Table 1.2** below displays the number of *Cycas megacarpa* individuals in each development class taken from James *et al.,* (2018) to the Study Area.

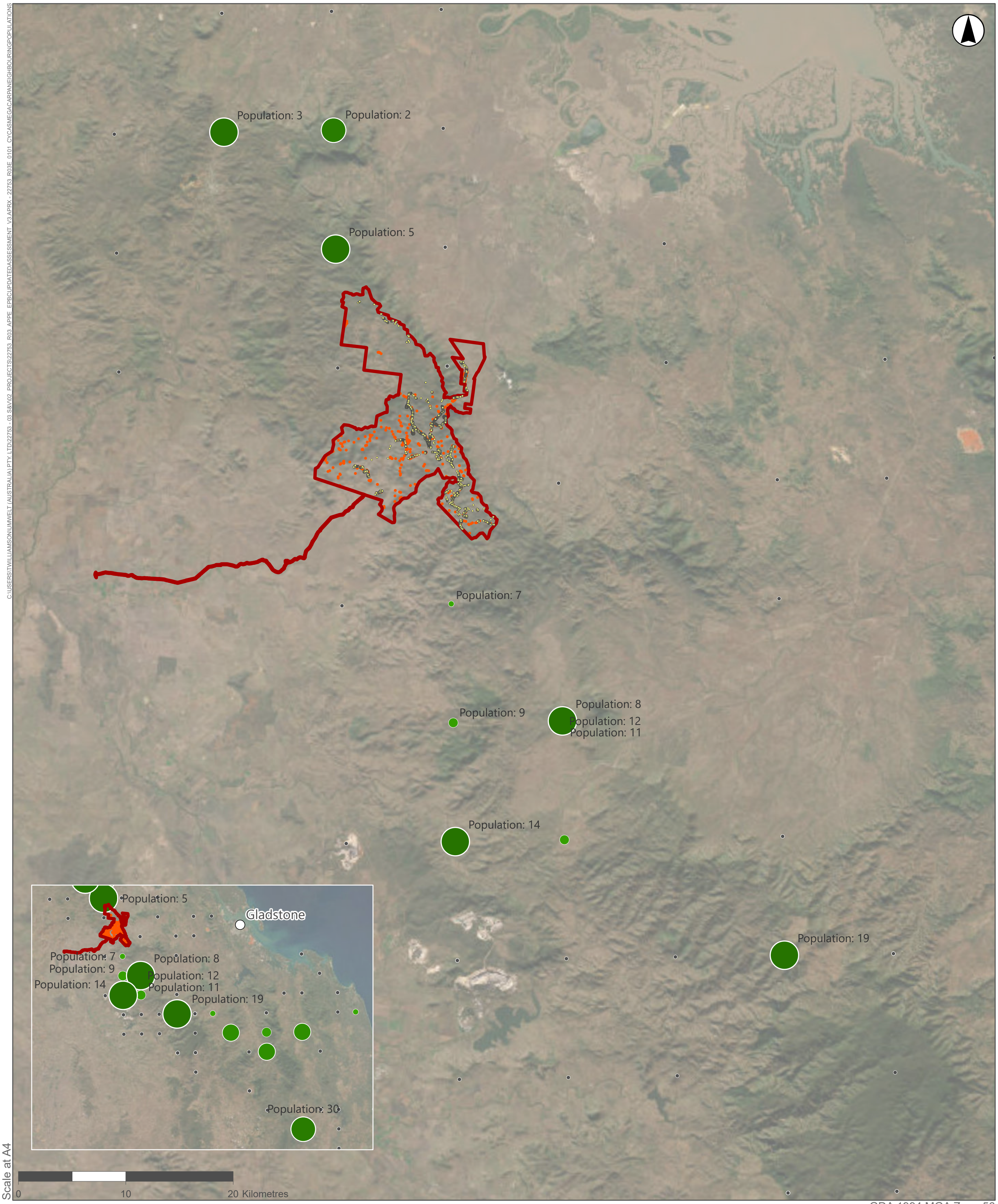
It should be noted that the Development Classes utilised during the field surveys were defined differently to James *et al.,* (2018). To provide an accurate comparison to James *et al.,* (2018), Umwelt's development classes have been aligned to James *et al.,* (2018) where possible in **Table 1.2**. This shows a range of individuals from large adults through to seedlings, with a large number of reproductive age adults (> 1 m), which is required to maintain a viable population.

Table 1.2 Number of *Cycas megacarpa* individuals in each development class from James *et al.,* (2018) and across the Study Area

Development Class	James et al., (2018) Individual Numbers	James et al., (2018) Percentage in Population	Study Area Individual Numbers	Study Area Percentage in Population
Seedlings (≤ 0.49 m, non trunked)	Approximately 450	16%	262	21%
Juveniles (≥ 0.5 m, not trunked; ≤0.49 m, trunked)	Approximately 900	33%	368	30%
Sub adults (<1 m, trunked)	Approximately 550	20%	-[1]	-[1]
Adults (≥ 1 m, trunked)	Approximately 500	18%	572[2]	47%
Total	**2,668 Individuals**	**-**	**1,202 Individuals**	**-**

[1]Juvenile and sub adults have been different classifications for the Umwelt surveys, as a result these have been captured as 'Juveniles' to compare to James et al., (2018).

[2]Adults have been separated into adult and large adults for the Umwelt surveys. Adults and large adults have been captured as 'Adults' to compare to James et al., (2018). The data collected during the Umwelt surveys shows that a larger proportion of 'Adults' were identified within the Study Area. Further work will need to be done to characterise population in line with James et al., (2018).



GDA 1994 MGA Zone 56

Legend

Study Area
Cycas megacarpa Records (Umwelt)
Cycas megacarpa Records (Ausecology)
***Cycas megacarpa* Record (ALA) (+/- 2km)**
Unknown
≤10
>10≤50
>10≤150
>50≤150
>150≤300
>500≤3500
>3500

FIGURE 1.1

CYCAS MEGACARPA
NEIGHBOURING POPULATIONS

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.1.1.4 Threats

The National Multi-species Recovery Plan for the cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis (Queensland Herbarium 2007) lists the following threats as relevant to *Cycas megacarpa*:

- Destruction due to land clearing, including for development for housing, road building, mining and permitted land clearing.
- Legal harvesting and commercial salvage.
- Illegal harvesting, whole plants and seed.
- Loss of genetic variation and insect pollinators, particularly relevant for small populations.
- Land management practices, including:
  - Fire.
  - Timber harvesting.

Two additional threats that are not directly included within the 'Threats Section' within *The National Multi-species Recovery Plan for the cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis* (Queensland Herbarium 2007) are noted for *Cycas megacarpa*.

The beetle, *Lilioceris nigripes* and the lycaenid butterfly, *Theclinesthes onycha* are known to predate on cycads. Little is known about their roles, evidence suggests that impacts to new foliage from these species can be devastating. Feral pigs (*Sus scrofa*) can also cause damage to *Cycas megacarpa* individuals and habitat. There is evidence of feral pigs (*Sus scrofa*) foraging on rhizomes, bulbs and tubers from *Macrozamia spp.* and as such other members of the Cycadaceae family may provide a foraging resource for feral pigs (Choquenot, Mcllr & Korn 1996).

1.1.1.5 Occurrence and Potential Habitat within the Study Area

Cycas megacarpa was recorded in a range of habitats within the Study Area including remnant, regrowth and cleared vegetation. Habitats within the Study Area which were recorded to support the species include:

- Eucalypt woodland to open woodland on steep slopes or undulating terrain, dominated by *Corymbia citriodora*, *Eucalyptus crebra*, *Eucalyptus acmenoides* and *Eucalyptus moluccana.*
- Woodlands on alluvium, dominated by *Melaleuca fluviatilis*, *Corymbia tessellaris* and *Eucalyptus tereticornis.*
- Semi-evergreen vine thicket and microphyll vine forest.
- Non remnant or cleared pasture.

From August to September 2023, pre-clearance surveys were conducted to determine actual counts of *Cycas megacarpa* within the Disturbance Footprint, to inform final design planning and translocation requirements. Based on the pre-clearance surveys completed to date, a total of 10,179 individuals are present within the Disturbance Footprint. While 10,179 individuals are known to occur within the Disturbance Footprint, the final impact to individuals is still to be confirmed, with detailed design ongoing. Avoidance and mitigation measures, such as micrositing of Project infrastructure, reduction in clearing widths of some Project tracks and retention of individuals under 33 kilovolt (kV) and 275 kV reticulation will contribute to a reduction in the number of *Cycas megacarpa* individuals impacted, as well as the final Project design. With regards to the final Project design, there are several options the Project is considering to reduce impacts to *Cycas megacarpa*. Some of these options include:

- The incorporation of civil design optimisation software which will lead to a reduction in bulk earthworks cut and fill requirements, and reduced clearance area for the Disturbance Footprint.
- Potential reductions in the width of Project access tracks and roads.
- Batter slope reduction.

The Project is currently assessing the feasibility of co-locating civil and electrical balance of plant items, and assessing 'just-in-time deliveries' of wind turbine components to minimise the need for onsite storage, reducing hardstand clearance.

Based on these findings, *Cycas megacarpa* habitat mapping was revised throughout the Study Area, the Development Corridor and Disturbance Footprint.

Desktop and field survey *Cycas megacarpa* records are shown on Figure 6.2, while the results of the IDW are shown on Figure 7.1B.

Cycas megacarpa habitat has been categorised as follows:

- Known habitat (confirmed): includes all land within 80 m of a confirmed record. No refinement based on habitat suitability was required.
- Known habitat (suspected): includes areas where known habitat (confirmed) does not overlap, however based on field validated data points, adjacent records and connective habitat (i.e., no clear break in vegetation, or evidence of land clearing). Suitable vegetation communities include RE 11.11.15, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.4d, 11.11.5, 11.11.5a, 11.12.1, 11.12.4, 11.12.6, 11.12.6a, 11.3.25b and 11.3.4 in remnant, regrowth and non-remnant condition. Select areas were excluded based on extensive field survey data.
- Nil recorded.

The criteria used to define these categories as well as the extent that habitat is mapped throughout the Development Corridor is provided in **Table 1.3** and shown on Figure 7.1A.

Table 1.3 Habitat Extent and Justification for *Cycas megacarpa*

Habitat Criteria[1]	Mapping Justification	Extent within Development Corridor (ha)	Extent within Disturbance Footprint (ha)
Known habitat (confirmed)	An 80 m buffer on confirmed *Cycas megacarpa* records, to reflect the latest population research which indicates most individuals disperse within 80 m of mature female plants (Etherington et al. 2018; James 2016 PhD thesis). Mapping has not been limited to certain REs noting the species was also recorded within non-remnant vegetation within the Study Area.	598.6	399.9
Known habitat (suspected)	Reasonable extrapolation of known habitat (confirmed) mapping. Known habitat (suspected) includes vegetation communities that *Cycas megacarpa* can occur in, including remnant and regrowth vegetation communities and select non-remnant areas.	414.8	241.6
Known habitat (total)	**Combined areas of confirmed and suspected habitat**	**1,013.4**	**641.5**

[1] Reference to nil recorded habitat has been removed as habitat for Cycas megacarpa is based on known (confirmed) and known (suspected) habitat only.

1.1.1.6 Habitat Critical to the Survival of the Species

As per the National Recovery Plan, habitat where remaining viable populations occur is considered to be critical to the survival of *Cycas megacarpa* (Queensland Herbarium 2007). The population within the Study Area is considered viable (>3,500 individuals), making all known habitat within the Study Area critical to the survival of the species. Known habitat has been defined as all land within 80 m of a confirmed record, or areas mapped as Known (suspected) habitat within the Study Area, refer to **Table 1.3** for further details.

1.1.1.7 Potential Impacts and Key Mitigation Measures

Potential impacts on this species as a result of the Project include habitat loss, fragmentation and degradation, soil erosion, dust generation, introduction and exacerbation of introduced flora species, increased intensity and frequency of fires and the disruption to breeding within the species life cycle. Vegetation clearing required for the construction of the Project will result in a maximum direct impact to 399.9 ha of known (confirmed) habitat and 241.6 ha of known (suspected) habitat (**Table 1.3**).

The avoidance of *Cycas megacarpa* has been demonstrated through both selection of the Study Area and the design of the Disturbance Footprint. Revisions to both have occurred throughout the life of the Project as a result of community and landholder consultation, wind resource data, grid connectivity options and an understanding of on-ground constraints. The Development Corridor size and configuration in particular has undergone at least three significant revisions (all of which have resulted in a reduced number of turbines) to account for impacts to *Cycas megacarpa*. Known high-density areas of *Cycas megacarpa* were prioritised for avoidance during the initial design phases.

As part of ongoing avoidance measures micro-siting around Project infrastructure would further prioritise the following, where possible:

- Areas where high densities of *Cycas megacarpa* are known to occur.
- Large reproductive-age individuals (>1 m).
- Mature female plants.

Further avoidance opportunities exist for *Cycas megacarpa* with the installation of overhead powerlines, with individuals less than 4 m potentially retained in these areas. Approximately 2,883 individuals within the Disturbance Footprint are mapped under 33 kilovolt (kV) and 275 kV reticulation. The final number of *Cycas megacarpa* individuals to be avoided will be based on the final detailed design and subject to micro-siting requirements of transmission line infrastructure, Project track and hardstands. With regards to the final Project design, there are several options the Project is considering to reduce impacts to *Cycas megacarpa*. Some of these options include:

- The incorporation of civil design optimisation software which will lead to a reduction in bulk earthworks cut and fill requirements, and reduced clearance area for the Disturbance Footprint.
- Potential reductions in the width of Project access tracks and roads.
- Batter slope reduction.

The Project is currently assessing the feasibility of co-locating civil and electrical balance of plant items, and assessing 'just-in-time deliveries' of wind turbine components to minimise the need for onsite storage, reducing hardstand clearance.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- Pre-clearance surveys for *Cycas megacarpa* will occur within the Disturbance Footprint plus 5 m buffer, to confirm the location, extent, numbers, and age class of the population within the clearing extent, with all efforts made to avoid impacts via micro-siting to high-density areas, large reproductive-age individuals and mature female plants.
- A pre-approved *Cycas megacarpa* Species Management Plan (SMP) will be implemented through all Project phases. The Preliminary SMP is provided as Attachment E of the Preliminary Documentation. This plan will provide detailed information regarding:
    - Species information including a description to aid identification.
    - Mitigation and management methods, including corrective actions.
    - Vegetation clearing requirements and methods to reduce impacts to surrounding individuals and their habitat.
    - Specific weed management measures to reduce impacts on the long-term integrity of the remaining habitat and population including high-biomass weeds.
    - Erosion, sedimentation, and dust management requirements specific to the species.

- A pre-approved *Cycas megacarpa* Translocation and Management Plan will be implemented for individuals that would otherwise be removed through clearing for the Project. The Translocation Plan aligns with the Translocation of Listed Threatened Species – Assessment under Chapter 4 of the EPBC Act Policy Statement (2013). The plan will specify pre and post monitoring requirements, translocation and propagation methods and protocols and reporting requirements and performance criteria.
The Preliminary *Cycas megacarpa Translocation and Management Plan* is provided as Attachment E of the Preliminary Documentation.

- This species is also considered a protected plant under the State NC Act. The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should the Project's clearing impact area (footprint inclusive of a 100 m buffer) contain high risk trigger area mapping or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the guidelines, and if necessary, an impact management plan will be developed and implemented.

1.1.1.8 Significant Impact Assessment

The significant impact assessment for the species is presented in **Table 1.4** below. This assessment reflects the latest records for the species and the National Recovery Plan (Queensland Herbarium, 2007).
In summary, the assessment found that the Project **will result in a significant impact** on *Cycas megacarpa*.

Table 1.4 Significant impact assessment – *Cycas megacarpa*

Significant impact criteria	Project impact
Lead to a long-term decrease in the size of a population	**No.** The projected population within the Study Area is 141,392 individuals. Of these, approximately 10,179 individuals occur within the Disturbance Footprint. The Disturbance Footprint is the maximum extent of direct impacts and is the indicative location of proposed Project infrastructure. While 10,179 individuals are known to occur within the Disturbance Footprint, the final impact to individuals is still to be confirmed, with detailed design ongoing. Avoidance and mitigation measures, such as micrositing of Project infrastructure, reduction in clearing widths of some Project tracks and retention of individuals under 33 kilovolt (kV) and 275 kV reticulation will contribute to a reduction in the number of *Cycas megacarpa* individuals impacted, as well as the final Project design. With regards to the final Project design, there are several options the Project is considering to reduce impacts to *Cycas megacarpa*. Some of these options include: • The incorporation of civil design optimisation software which will lead to a reduction in bulk earthworks cut and fill requirements, and reduced clearance area for the Disturbance Footprint. • Potential reductions in the width of Project access tracks and roads. • Batter slope reduction. The Project is currently assessing the feasibility of co-locating civil and electrical balance of plant items, and assessing 'just-in-time deliveries' of wind turbine components to minimise the need for onsite storage, reducing hardstand clearance. The Preliminary *Cycas megacarpa* Translocation and Management Plan (Ecologica Consulting 2022) and the Preliminary *Cycas megacarpa* Species Management Plan (Attachment E of the Preliminary Documentation) detail the avoidance and mitigation measures pertaining to *Cycas megacarpa*, which includes the translocation of individuals within the Disturbance Footprint. To increase the likelihood of a net gain of *Cycas megacarpa*, the translocation program will also include propagation using seeds collected from the Disturbance Footprint, wider Study Area and adjacent populations within the broader region. Although not confirmed at the time of this assessment, the recipient site for translocated and propagated *Cycas megacarpa* individuals is likely to be within or directly adjacent to the Study Area, ensuring the one population of the species will be affected and managed. Based on objectives and performance criteria, Preliminary *Cycas megacarpa* Translocation and Management Plan (Ecologica Consulting 2022) targets approximately 14,499 individuals to be alive at the end of the program, which is a net gain of 4,320 individuals to the existing, disturbed population. The number of individuals alive at the end of the program including net gains is based on the current ratio of individuals to be salvaged, translocated and propagated following pre-clearance surveys in 2023. Final counts will be provided within the final translocation plan for *Cycas megacarpa.* Based on the proposed gain in individuals over the translocation program, the removal of *Cycas megacarpa* individuals will not result in a long-term decrease in the size of the population.

Significant impact criteria	Project impact
	As the project is not considered to lead to a long-term decrease in the size of a population, neighbouring populations and the metapopulation it is part of are not likely to be impacted. The removal of individuals will not affect gene flow between surrounding populations. Small populations are at risk of not being visited by pollinators however the remaining population within the Study Area is large and will continue to attract pollinators and contribute to genetic variation. The collection and propagation of seeds for *Cycas megacarpa* as part of the translocation program, has the potential to disrupt the breeding cycle of existing population. This will be managed by undertaking seed collection over an extended period, targeting and alternating between existing populations within the broader region. Seed collection will also be undertaken in accordance with the Code of Practice for the Taking and Use of Protected Plants (Code of Practice) (EHP 2013). The final translocation plan for *Cycas megacarpa* will include information on the final number of individuals to be translocated, the number of seeds to be collected and propagated, and timing of these activities to minimise impacts to gene flow.
Reduce the area of occupancy of the species	**No.** The area of occupancy for *Cycas megacarpa* is 46 km² within an extent of occurrence of 18,726 km² over the species range (Queensland Herbarium, 2007). It is noted that the area of occupancy may be potentially overstated given the low resolution in the mapping methodology used (2 km x 2 km grid). Within the Disturbance Footprint 399.9 ha is known (confirmed) habitat and 241.6 ha is known (suspected) habitat. The Project proposes to remove approximately 10,179 individuals within the Disturbance Footprint of a population of approximately 141,392 individuals within the Study Area. Based on pre-clearance surveys, the population size within the Study Area is likely to exceed this value. The Preliminary *Cycas megacarpa* Translocation and Management Plan (Ecologica Consulting 2022) suggests that approximately 14,499 individuals will be alive at the end of the program, which includes a net gain of 4,320 individuals to the existing population. The final impact to individual is still to be confirmed, with detailed design ongoing. Based on current estimates and design planning, approximately 2,883 individuals within the Disturbance Footprint are mapped under 33 kilovolt (kV) and 275 kV reticulation. The final number of *Cycas megacarpa* individuals to be avoided will be based on the final detailed design and subject to micro-siting requirements of transmission line infrastructure, Project track and hardstands. As well as the avoidance opportunities above, it is anticipated that the clearing width around some sections of Project tracks will be reduced, leading to further avoidance opportunities. The area of occupancy is unlikely to be reduced as a result of the Project due to the following: • Unlikely to change the availability of habitat to the point where the species' occupancy would be reduced. • The linear nature of footprint. • The anticipated net gain of 4,320 individuals within the Study Area based on the current ratio of individuals to be salvaged, translocated, and propagated following pre-clearance surveys in 2023. Final counts will be provided within the final translocation plan for *Cycas megacarpa*.

Significant impact criteria	Project impact
Fragment an existing population into two or more populations	**No.** As described on the species' SPRAT profile, many populations of *Cycas megacarpa* are very small and greatly fragmented, with only a handful of adult plants (Forster 2007). Cycad species are known to have little genetic flow between fragmented populations and seed dispersal is predominantly gravitational resulting in the occurrence of new plants not far from the parent plant (Queensland Herbarium 2007). The projected population within the Study Area is estimated to exceed 141,392 individuals. Several known populations also occur in proximity to (within 10 km) the Study Area including Population 5 (5,600 individuals), Population 6 (28 individuals) and Population 7, 8, 9 (115,200 individuals). The Study Area population is very large, projected to exceed 141,392 individuals. This population has persisted in the area despite ongoing disturbance from agricultural workings including historical thinning and grazing. Individuals in all developmental classes have been recorded, including within previously cleared areas. The Project is linear in shape and clearing widths vary between 25 m and 165 m. Clearing will be completed only as strictly necessary and widths minimised where possible, increasing the chances of seed dispersal between areas of retained habitat. Although vegetation clearing required for the Project may result in a small increase in existing fragmentation impacts, the population present is not considered overly susceptible. The translocation of individuals from the Disturbance Footprint into the surrounding *Cycas megacarpa* population, and the addition of new propagated individuals, is likely to enhance the genetic diversity at the end of the translocation program. Seedlings created from translocated plants are also unlikely to lead to outbreeding depression and these would ideally be sourced from multiple locations to reduce the changes of genetic swamping by particular allelic variants (Ecologica Consulting 2022). Surveys of suitable recipient sites within the Project locality were undertaken. Numerous recipient sites have been identified for the species to be translocated within the broader Study Area (refer to the Preliminary *Cycas megacarpa* Translocation and Management Plan (Ecologica Consulting 2022)). Across the suitable recipient sites there is a potential for 31,770 individual cycads to be planted. The recipient sites allow for the challenges within the local landscape. That is, the sites allow for ongoing access for the purposes of monitoring and management and the habitat is known to support the species and that there is likely to be sufficient carrying capacity. Therefore, Project activities are unlikely to fragment an existing population, into two or more populations.
Adversely affect habitat critical to the survival of a species	**Yes.** Habitat critical to the survival is defined as 'habitat where remaining viable populations occur' for *Cycas megacarpa* (Queensland Herbarium, 2007). The population within the Study Area is considered viable (>3,500 individuals), with 141,392 individuals projected to occur in total based on available field data. Habitat where a *Cycas megacarpa* individual has been confirmed or is reasonably suspected is defined as critical to the survival of the species.

Significant impact criteria	Project impact
	The final impact area to habitat critical to the survival of *Cycas megacarpa* will be based on the final detailed design and subject to micro-siting requirements of transmission line infrastructure, Project track and hardstands. It is anticipated that the clearing width around some sections of Project tracks will be reduced, leading to a reduced area of impact. Based on current mapping within the Disturbance Footprint, 641.5 ha of known habitat occurs. Direct impacts to this quantum of habitat is likely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of a population	**Yes**. The large-scale collection and propagation of seeds for *Cycas megacarpa* as part of the translocation program, has the potential to temporarily disrupt the breeding cycle of existing populations within the broader region. This will be managed by undertaking seed collection over an extended period, targeting, and alternating between existing populations within the broader region. Collection and propagation are correlated to the number of Cycads that cannot be salvaged within the Disturbance Footprint. The number of *Cycas megacarpa* individuals to be translocated to recipient sites will be maximised, to reduce the number of seeds that will need to be collected and propagated, taken from the broader region. The final translocation plan for *Cycas megacarpa* will include information on the final number of individuals to be translocated, the number of seeds to be collected and propagated, and timing of these activities to minimise the impacts to the breeding cycle. Based on the current *Cycas megacarpa* translocation plan and what could be salvaged it is estimated that there will be a net gain of approximately 4,320 individuals to the local population. As part of the avoidance and mitigation measures stipulated within the Preliminary *Cycas megacarpa* Species Management Plan (Attachment E of the Preliminary Documentation), large reproductive-age individuals (>1 m) and mature female plants will be prioritised for further avoidance via micro siting, where possible.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** Vegetation clearance associated with the Project will result in the removal of a maximum 641.5 ha of habitat critical to the survival of the species, within the Disturbance Footprint. Species specific mitigation measures have been stipulated within the Preliminary *Cycas megacarpa* Species Management Plan (Attachment E of the Preliminary Documentation) to further avoid or reduce impacts to *Cycas megacarpa* individuals and habitat. Based on the number of individuals within the footprint, approximately 14,499 individuals will be alive at the end of the translocation program, which includes a net gain of 4,320 individuals to the existing population (Refer to the Preliminary *Cycas megacarpa* Translocation and Management Plan (Ecologica Consulting 2022)). It is noted that the number of individuals alive at the end of the program including net gains is based on the current ratio of individuals to be salvaged, translocated and propagated following pre-clearance survey data collected in 2023. Final counts, including proposed net gain estimates, will be provided within the final translocation plan for *Cycas megacarpa.*

Significant impact criteria	Project impact
	For these reasons, and given the linear nature of the Project, it is unlikely that the Project will alter habitat to the extent where the species is likely to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	**No**. Invasive species (weeds) within the Study Area are defined as exotic species that are Category 3 Restricted Matters or Weed of National Environmental Significance as per the Preliminary Vegetation Management Plan (Umwelt (Australia) Pty Limited 2022a). Weeds and high biomass grasses have been specifically targeted for treatment within the Disturbance Footprint and Development Corridor, to ensure habitat degradation or deterioration leading to loss of *Cycas megacarpa* individuals is minimised. Hot spot areas containing infestations will be treated prior to the commencement of site disturbance and any construction activities. Refer to the Preliminary Vegetation Management Plan (Umwelt (Australia) Pty Limited 2022b - Attachment F of the Preliminary Documentation) and the Preliminary *Cycas megacarpa* Species Management Plan (Attachment E of the Preliminary Documentation) for details pertaining to weed management. It should be noted that the beetle, *Lilioceris nigripes* and the lycaenid butterfly, *Theclinesthes onycha*, are known to predate on cycads, and are a potential threat to *Cycas megacarpa*. The *Cycas megacarpa Species Management Plan* (Attachment E of the Preliminary Documentation) includes details pertaining to the management of these insects. If impacts to *Cycas megacarpa* are directly correlated to the presence of *Lilioceris nigripes* or *Theclinesthes onycha* then treatment is suggested. At this point in time little is known on their relationship with cycads, although evidence suggests that impacts to new foliage from these species can be devastating. Monitoring proposed as part of the Preliminary *Cycas megacarpa* Species Management Plan will enable the detection and subsequent detection of insects damage on cycads. In summary Project activities are unlikely to result in an invasive species harmful to *Cycas megacarpa* becoming established in its habitat.
Introduce disease that may cause the species to decline	**No.** There are no diseases known to impact *Cycas megacarpa* individuals or habitat. The Project follows best practice construction and operational methods as stipulated in management plans pertaining to the Project, such as the Preliminary Vegetation Management Plan (Attachment F of the Preliminary Documentation) and the Preliminary *Cycas megacarpa* Species Management Plan (Attachment E of the Preliminary Documentation). Therefore, it is unlikely that Project activities will introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Yes.** A recovery plan has been developed for *Cycas megacarpa* titled *National Multi-species Recovery Plan for the cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis* (Queensland Herbarium, 2007). This document outlines the major threats and recovery actions pertaining to the species.

Significant impact criteria	Project impact
	The major threats include loss of habitat or individuals due to land clearing, removal of seeds or whole plants due to legal/illegal harvesting, and loss of genetic variation and insect pollinators. Specific threats pertaining to the Project include vegetation clearing, habitat loss, fragmentation and degradation, soil erosion, dust generation, introduction and exacerbation of introduced flora species and increased frequency and intensity of fires. Vegetation clearing associated with the Project will result in the removal of habitat critical to the survival of the species (upper limit of 641.5 ha) and the direct removal of individuals. It should be noted that individuals within the Disturbance Footprint will be translocated, and based on current individuals within disturbance footprint, the translocation program is anticipated to lead to a net gain of 4,320 individuals to the existing population. The number of individuals alive at the end of the program including net gains is based on the current ratio of individuals to be salvaged, translocated and propagated following pre-clearance survey data collected in 2023. Final counts will be provided within the final translocation plan for *Cycas megacarpa*. In summary, as habitat critical to the survival of the species will be removed, the Project will interfere with the recovery of the species.

1.1.2 *Cossinia ustraliana*

1.1.2.1 Description and Status under the EPBC Act

Cossinia ustraliana is a shrub or small slender tree to 7 m, with a sparse crown (Department of the Environment Water Heritage and the Arts 2008a). Leaves are compound, usually with a winged rachis and 3–5 elliptical to oblong leaflets. The leaflets are 2–7 cm long and densely hairy underneath. Small white flowers are in dense panicles. Fruits are hairy, three-lobed, inflated capsules with an orange inner surface and brown seeds.

Cossinia ustraliana is listed Endangered under the EPBC Act.

1.1.2.2 Distribution and Habitat Requirements

The species' distribution is from Rockhampton to Kingaroy, east of the Great Dividing Range, a distance of approximately 300 km. A record for the species from 2001 is centred immediately adjacent to the Study Area (less than 1 km west), although has a spatial inaccuracy of 25 km. Information provided with the record specifies that the specimen was located within a "creek bank surrounded by steep hills. Rocky clay loam soil, dry vine scrub".

Cossinia ustraliana occurs from 20 to 520 m altitude and is found in Araucarian vine forest or vine thicket on fertile soils in central and southern Queensland, including red volcanic soil and black loam (DES 2022a). Within these habitats it is generally uncommon, found as scattered individuals. The species appears to prefer ecotonal situations around dry rainforest edges. Trees and shrubs which *Cossinia ustraliana* is often associated include *Alyxia ruscifolia*, *Capparis arborea*, *Drypetes deplanchei*, *Flindersia australis*, *Owenia venosa* and *Siphonodon australis* (2022a).

1.1.2.3 Threats

The main identified and potential threats to *Cossinia ustraliana*, as identified in the Conservation Advice for the species (Department of the Environment Water Heritage and the Arts 2008a), are:

- Exotic weeds, including *Lantana camara*, Aristolochia elegans**, *Anredera cordifolia*, Macfadyena unguis-cat*i* and *Asparagus plumosus**.
- Invasion of vine forest margins by weeds also increases fuel loads and leads to fire incursions.
- Habitat loss due to clearing.
- Increased disease and susceptibility to insects due to the very small, isolated populations and fragmented habitat.
- Road widening and maintenance activities.

1.1.2.4 Occurrence and Potential Habitat within the Study Area

Cossinia ustraliana was not recorded within the Study Area during the field survey program. Within the Study Area, potential habitat for the species comprises semi-evergreen vine thicket. Based on the presence of suitable habitat and a potentially nearby record (noting the 25 km spatial uncertainty), the species has conservatively been determined to have a moderate likelihood of occurrence.

The extent of *Cossinia ustraliana* potential habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 1.5**. The desktop record and potential habitat for the species within the Study Area is shown on Figure 7.2.

Table 1.5 Habitat Extent and Justification for *Cossinia ustraliana*

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Potential Habitat				
Araucarian vine forest or vine thicket on fertile soils at altitudes between 20 m and 520 m in central and southern Queensland.	Vine thicket communities (i.e. Res 11.11.5a and 11.12.4) in remnant condition. Regrowth communities excluded due to the prevalence of exotic weeds. No Araucarian vine forest communities recorded. Entire Study Area occurs within required altitudinal range.	414.0	21.1	8.6
	Total	**414.0**	**21.1**	**8.6**

1.1.2.5 Habitat Critical to the Survival of the Species

Habitat critical to the survival of the species is not specifically defined for the species. However, the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a) define habitat critical to the survival of a species or ecological community as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long-term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

The species was not recorded during the field survey program. However, suitable habitat is present and there is a historical record potentially in proximity (noting 25 km spatial inaccuracy), indicating the area may have supported a population historically. Based on this, potential habitat within the Study Area is conservatively assessed as habitat critical to the survival of the species.

1.1.2.6 Potential Impacts and Key Mitigation Measures

Potential impacts on this species as a result of the Project include habitat loss, fragmentation and degradation, edge effects, soil erosion, dust generation, introduction and exacerbation of introduced flora species and increased intensity and frequency of fires. Vegetation clearing required for the construction of the Project will result in direct impacts to 8.6 ha of mapped potential habitat within the Disturbance Footprint (**Table 1.5**).

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for *Cossinia ustraliana*. If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence must be recorded including number of individuals, GPS location and extent. The plants or population area including a 5 m buffer must be demarcated and avoided via micro-siting. The pre-clearance survey constraints protocol (see Section 9.3.2.2 of the body of this report) will then be followed to ensure any potential impacts on the species are avoided or managed appropriately.
- This species is also considered a protected plant under the State NC Act. The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should the Project's clearing impact area (footprint inclusive of a 100 m buffer) contain high risk trigger area mapping or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the guidelines, and if necessary an impact management plan will be developed and implemented.

1.1.2.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 1.6** below. This assessment reflects the latest records for the species along with the relevant Conservation Advice document (Department of the Environment Water Heritage and the Arts 2008a). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the *Cossinia ustraliana*.

Table 1.6 Significant impact assessment – *Cossinia ustraliana*

Significant impact criteria	Project impact
Lead to a long-term decrease in the size of a population	**No.** There is no known population within the Disturbance Footprint or the Study Area. A record for the species occurs <1 km west of the Study Area, however, has spatial accuracy of ±25 km and is from 2001. The Project will have a maximum impact on 8.6 ha of potential habitat within the Disturbance Footprint. A total of 414.0 ha is modelled within the Study Area (Refer **Table 1.5**). Should the species be recorded during future targeted surveys, micro-siting will be undertaken to avoid all impacts to the species. As a population is not known to occur within the Disturbance Footprint or the Study Area and mitigation measures will be implemented if it is recorded, the Project is unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species	**No.** There is no known population within the Disturbance Footprint or the Study Area. Should the species be recorded during future targeted surveys, micro-siting will be undertaken to avoid all impacts to the species. As no individuals are proposed to be removed by the Project, it is unlikely to reduce the area of occupancy of the species.

Significant impact criteria	Project impact
Fragment an existing population into two or more populations	**No.** There is no known population within the Disturbance Footprint or the Study Area. In the event that this species is present within the Disturbance Footprint, the extent, location and configuration of vegetation clearing is unlikely to reduce the population's ability to continue to exchange genetic material between individuals and reproduce at the local site scale. It is considered unlikely that the Project will impact dispersal and isolate habitats. The Project will not fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**No.** Habitat critical to the survival of *Cossinia australiana* is not defined, and thus the definition in *Significant impact guidelines 1.1; Matters of National Environmental Significance* (DoE 2013) has been adopted Based on this definition, potential habitat has been conservatively assessed as habitat critical to the survival of the species (refer **Section 1.2.2.5**). The Project will disturb an upper limit of 8.6 ha of potential habitat within the Disturbance Footprint (Refer **Table 1.5**). The area of impact is expected to reduce as an outcome of the detailed design process. Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for *Cossinia australiana*. If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence must be recorded including number of individuals, GPS location and extent. The plants or population area, including a 5 m buffer, must be demarcated and avoided via micro-siting and the pre-clearance survey constraints protocol will be enacted. Indirect impacts on identified populations will be managed via the implementation of Project management plans, including vegetation management plan. Given the commitment to avoid any potential occurrences of the species, the management of indirect impacts and that the species remains undetected from the Disturbance Footprint, it is considered unlikely that the Project will adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	**No.** There is limited information on the life cycle of the species. No individuals have been recorded within the Disturbance Footprint or Study Area, therefore, no individuals are proposed to be removed. The Project will not create conditions that reduce seed viability or limit dispersal of seed. Therefore, the Project is unlikely to disrupt the breeding cycle of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** No individuals have been recorded within the Disturbance Footprint or Study Area, therefore, no individuals are proposed to be removed. A maximum of 8.6 ha of potential habitat within the Disturbance Footprint is proposed to be impacted by the Project. Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for *Cossinia australiana*. If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence must be recorded including number of individuals, GPS location and extent. The plants or population area including a 5 m buffer must be demarcated and avoided via micro-siting and the pre-clearance survey constraints protocol will be enacted. Indirect impacts on identified populations will be managed via the implementation of Project management plans, including vegetation management plan.

Significant impact criteria	Project impact
	The removal of this quantum of pot"ntia' habitat and the limited indirect impacts which will be managed via the Project management plans is considered unlikely to cause the species to decline (Refer **Table 1.5**).
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	**No.** Weeds incursion is the main threat to *Cossinia ustraliana*. Weeds were recorded throughout the Disturbance Footprint and the wider Study Area, in varying degrees of severity. There is an inherent risk of weed dispersal with the construction of any infrastructure project. The Project will follow best practice construction and operational method, such as the implementation of a Weed Management Plan to prevent the spread of weeds throughout the Disturbance Footprint. Therefore, it is unlikely that the Project will result in an invasive species becoming established.
Introduce disease that may cause the species to decline	**No.** Susceptibility to diseases due to the small, isolated populations is a potential threat to *Cossinia ustraliana*. No individuals have been recorded within the Disturbance Footprint or Study Area to be impacted by a disease. The Project will follow best practice construction and operational methods to prevent the spread of disease throughout the Disturbance Footprint and the wider Study Area. Therefore, it is unlikely that the Project will result in the introduction of a disease that may cause the species to decline.
Interfere with the recovery of the species	**No.** There is no recovery plan for the species. No individuals have been recorded within the Disturbance Footprint or Study Area, therefore, no individuals are proposed to be removed. The project proposes to remove a maximum of 8.6 ha of potential habitat within the Disturbance Footprint, which is expected to be reduced as an outcome of the detailed design process. Indirect impacts such as weed incursion and altered fire regimes will be managed through the Project management plans. As such, direct and indirect impacts are considered unlikely to interfere with the recovery of the species.

1.1.3 *Decaspermum struckoilicum*

1.1.3.1 Description and Status under the EPBC Act

Decaspermum struckoilicum, family Myrtaceae, is an erect shrub or small tree growing to 4 m high (Department of the Environment Water Heritage and the Arts 2008b). The leaves are elliptical, 18–55 mm long, and arranged in opposite pairs along the branchlets. The flowers are borne in clusters in the leaf axils, white, with four or five petals and sepals and 16–25 stamens. The fruit is a globose berry up to 8.5 mm in diameter, soft and dark bluish-black when ripe. The plant is hairless, although there may be hairs on the new vegetative growth and on the flowers.

Decaspermum struckoilicum is listed Endangered under the EPBC Act.

1.1.3.2 Distribution and Habitat Requirements

Decaspermum struckoilicum, also known as Mount Morgan myrtle, is known from five localities in an area known as Struck Oil (2022b). Struck Oil occurs approximately 8 km east of Mount Morgan in Queensland and 10.5 km north of the Study Area. The species is also known to occur within Bouldercombe Gorge Nature Reserve, which is approximately 12 km north of the Study Area.

The species occurs in semi-evergreen vine thicket on chocolate or reddish soil, often in disturbed areas and at elevations up to 300 m (2022b). As per the species Approved Conservation Advice (Department of the Environment Water Heritage and the Arts 2008b), known populations are restricted to remnant vegetation.

1.1.3.3 Threats

The main identified threat to *Decaspermum struckoilicum* is weed incursion, particularly by *Lantana camara*, Megathyrsus maximus** and *Cryptostegia grandiflora**. Potential threats to the species include wildfire from adjoining sclerophyll forests, and habitat disturbance from domestic stock (2022b).

1.1.3.4 Occurrence and Potential Habitat within the Study Area

Decaspermum struckoilicum was not recorded within the Study Area during the field survey program. Within the Study Area, semi-evergreen vine thicket below 300 m altitude is present and is regarded as potential habitat for the species. Although no records occur within the desktop search extent (10 km), the nearest is located approximately 11 km north. Based on this record and the presence of suitable habitat, the species is conservatively considered to have a moderate likelihood of occurrence.

The extent of *Decaspermum struckoilicum* potential habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 1.7**. Modelled habitat for the species within the Study Area is shown on Figure 7.4.

Table 1.7 Habitat Extent and Justification for *Decaspermum struckoilicum*

Habitat Criteria	Justification of Mapping Extent	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Potential Habitat				
Remnant, semi-evergreen vine thicket on chocolate or reddish soil at elevations up to 300 m.	Vine thicket communities (i.e. Res 11.11.5a and 11.12.4) in remnant condition below 300 m. Regrowth communities excluded due to the prevalence of exotic weeds.	53.3	6.3	2.3
	Total	**53.3**	**6.3**	**2.3**

1.1.3.5 Habitat Critical to the Survival of the Species

Habitat critical to the survival of the species is not specifically defined for the species. However, the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a) define habitat critical to the survival of a species or ecological community as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long-term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

Based on the above definition, potential habitat within the Study Area is not considered habitat critical to the survival of the species due to:

- The species was not detected during the field survey program, despite extensive survey effort relative to the extent of identified potential habitat.
- The species known from five localities in Queensland, none of which occur in vicinity of the Study Area (instead occurring >10 km north).

1.1.3.6 Potential Impacts and Key Mitigation Measures

Potential impacts on this species as a result of the Project include habitat loss, fragmentation and degradation, edge effects, soil erosion, dust generation, introduction and exacerbation of introduced flora species and increased intensity and frequency of fires. Vegetation clearing required for the construction of the Project will result in direct impacts to 2.3 ha of mapped potential habitat within the Disturbance Footprint (**Table 1.5**).

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for *Decaspermum struckoilicum*. If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence must be recorded including number of individuals, GPS location and extent. The plants or population area including a 5 m buffer must be demarcated and avoided via micro-siting. The pre-clearance survey constraints protocol (see Section 9.3.2.2 of the body of this report) will then be followed to ensure any potential impacts on the species are avoided or managed appropriately.
- This species is also considered a protected plant under the State NC Act. The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should the Project's clearing impact area (footprint inclusive of a 100 m buffer) contain high risk trigger area mapping or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the guidelines, and if necessary an impact management plan will be developed and implemented.

1.1.3.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 1.8** below. This assessment reflects the latest records for the species along with the relevant Conservation Advice document (Department of the Environment Water Heritage and the Arts 2008b). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the *Decaspermum struckoilicum*.

Table 1.8 Significant Impact Assessment – *Decaspermum struckoilicum*

Significant impact criteria	Project impact
Lead to a long-term decrease in the size of a population	**No.** There is no known population within the Disturbance Footprint or the Study Area. Therefore, no important population is likely to be impacted by the Project. The Project proposes to impact 2.3 ha of potential habitat within the Disturbance Footprint, out of 53.3 ha modelled within the Study Area (refer **Table 1.7**). The impact area is expected to further reduce as a result of the detailed design process. Should the species be recorded during future targeted surveys, micro-siting will be undertaken to avoid all impacts to the species. As a population is not known to occur within the Disturbance Footprint or Study Area and mitigation measures will be implemented if it is recorded, the Project is unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species	**No.** There is no known population within the Disturbance Footprint or the Study Area. Therefore, no important population is likely to be impacted by the Project. Should the species be recorded during future targeted surveys, micro-siting will be undertaken to avoid all impacts to the species and the pre-clearance survey constraints protocol will be enacted. As no individuals are proposed to be removed by the Project, it is unlikely to reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	**No.** There is no known population within the Disturbance Footprint or the Study Area. Therefore, no important population is likely to be impacted by the Project. In the event that this species is present within the Disturbance Footprint, the extent, location and configuration of vegetation clearing is unlikely to reduce the population's ability to continue to exchange genetic material between individuals and reproduce at the local site scale. It is considered unlikely that the Project will impact dispersal and isolate habitats. The Project is unlikely to fragment an existing population into two or more population.
Adversely affect habitat critical to the survival of a species	**No.** Habitat critical to the survival of *Decaspermum struckoilicum* is not defined, and thus the definition in *Significant impact guidelines 1.1; Matters of National Environmental Significance* (DoE 2013) has been adopted. Based on the assessment against this definition (refer **Section 1.1.3.5**), habitat within the Disturbance Footprint is not considered critical to the survival of the species. Therefore, the Project is unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	**No.** There is limited information on the life cycle of the species. No individuals have been recorded within the Disturbance Footprint or Study Area, as such, no individuals are proposed to be removed. The Project will not create environmental conditions that reduce seed viability or limit dispersal of seed. Therefore, the Project is unlikely to disrupt the breeding cycle of the species.

Significant impact criteria	Project impact
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** No individuals have been recorded within the Disturbance Footprint or Study Area, therefore, no individuals are proposed to be removed. A total of 2.3 ha of potential habitat within the Disturbance Footprint is proposed to be impacted by the Project, out of the 53.3 ha recorded within the Study Area (refer **Table 1.7**). Retained habitat will not be subject to further degradation as altered fire regimes, dust and weed incursion will be actively monitored or managed as required through Project management plans. The removal of this habitat is considered unlikely to cause the species to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	**No.** Weeds incursion is the main threat to *Decaspermum struckoilicum*. Weeds were recorded throughout the Disturbance Footprint, in varying degrees of severity. There is an inherent risk of weed dispersal with any infrastructure project. The Project will follow best practice construction and operational method, such as the implementation of a Weed Management Plan to prevent the spread of weeds throughout the Disturbance Footprint. Therefore, it is unlikely that the Project will result in an invasive species becoming established.
Introduce disease that may cause the species to decline	**No.** Disease is not an identified threat to *Decaspermum struckoilicum*. The Project will follow best practice construction and operational methods to prevent the spread of disease throughout the Disturbance Footprint. Therefore, it is unlikely that the Project will result in the introduction of a disease that may cause the species to decline.
Interfere with the recovery of the species	**No.** No individuals have been recorded within the Disturbance Footprint or Study Area, as such, no individuals are proposed to be removed. The Project proposes to remove 2.3 ha of potential habitat within the Disturbance Footprint, and indirect impacts will be managed through implementation of the Project management plans. As such, impacts from the Project are unlikely to interfere with the recovery of the species.

1.2 Endangered Fauna

1.2.1 Northern Quoll (*Dasyurus hallucatus*)

1.2.1.1 Description and Status Under the EPBC Act

Northern quolls are cryptic, nocturnal marsupials. Of the four Australian quoll species, northern quoll is the most arboreal and aggressive. The northern quoll was listed as Endangered under the EPBC Act on 12 April 2005.

1.2.1.2 Distribution and Habitat Requirements

The distribution of the northern quoll is discontinuous across northern Australia with core populations in rocky and/or high rainfall areas (Hill & Ward 2010). In Queensland, the species is known to occur as far south as Brisbane and Toowoomba in the south, as far north as Cape York and extends as far west into central Queensland to the Carnarvon Range National Park. The species' distribution is highly fragmented in Queensland and surveys by Woinarski *et al.* (2008) indicate severe reductions from the species' former distribution (Department of the Environment 2022a).

The northern quoll occupies a diversity of habitats including rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal. Eucalypt forest or woodland habitats usually have a high structural diversity containing large diameter trees, termite mounds or hollow logs for denning purposes. A study of northern quolls in Queensland found that the species is "more likely to be present in high relief areas that have shallower soils, greater cover of boulders, less fire impact and were closer to permanent water" (Department of the Environment 2022a).

The *EPBC Act referral guidelines for the northern quoll* (Department of the Environment 2016) states that, "on current knowledge, foraging or dispersal habitat is recognised to be any land comprising predominantly native vegetation in the immediate area (i.e. within 1 km) of shelter habitat, quoll records or land comprising predominately native vegetation that is connected to shelter habitat within the range of the species".

Northern quolls are opportunistic omnivores, which consume a wide range of prey items including invertebrates, carrion, fruit nectar, mammals, birds, reptiles and frogs. Cane toads are a food item of particular concern because ingestion of their toxins is a major cause of decline in northern quoll populations.

1.2.1.3 Threats

Key threats to the northern quoll include the loss, degradation and fragmentation of habitat, inappropriate fire regimes, and lethal toxic ingestion caused by cane toads – a key threatening process listed under the EPBC Act (Department of the Environment 2022a).

As per the species SPRAT profile, other recognised potential threats to the species include:

- Introduction of invasive species leading to increased competition, direct predation and habitat degradation (i.e. gamba grass, which may limit dispersal).
- Direct mortality as a result of vegetation clearing and traffic.
- Pastoralism, leading to altered fuel loads and fire regimes.
- Disease e.g. toxoplasmosis.

1.2.1.4 Occurrence and Potential Habitat Within the Study Area

Significant survey effort was undertaken within the Study Area in accordance with the *EPBC Act referral guidelines for the northern quoll* (Department of the Environment 2016) to determine the potential presence and density of northern quoll within the Study Area. The field survey program included a reconnaissance survey in 2019 and targeted trapping survey in 2020 which employed both camera traps (total of 490 trap nights) and Elliot traps (total of 320 trap nights).

The northern quoll was detected on camera traps on two occasions. Records were made within fringing riparian *Casuarina cunninghamiana* and *Melaleuca* spp. woodland (RE 11.3.25b) with a rocky stream bed, and in an adjacent rocky gully with large boulders fringed by *Corymbia citriodora* and *Eucalyptus crebra* woodland (RE 11.12.6). Vegetation, particularly the shrub layer, was structurally complex in these locations. These areas provided denning opportunities, as did similar habitats with rocky relief, predominantly on drainage lines in steep gullies.

Extensive foraging and dispersal habitat occurs throughout the Study Area and likely wider Study Area, generally represented by large, continuous tracts of open eucalypt woodland within 1 km of breeding and refuge habitat. Areas of potential habitat generally contain prey microhabitat including fallen logs, ground timber and small to medium-sized rocks in varying abundance.

The extent of northern quoll habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 1.9**. Modelled habitat for the species within these boundaries is also shown on Figure 7.6 of the body of this report.

Table 1.9 Habitat Extent and Justification for Northern Quoll

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Denning and Refuge				
Rocky habitats (such as major drainage lines or treed creek lines) and structurally diverse woodlands with moderate to high density of denning opportunities (i.e. large diameter trees, termite mounds, large hollow logs).	Vegetation, watercourse, and 10-metre contour mapping was examined in conjunction with survey data (including floristics and habitat assessments) and high-quality Queensland Globe satellite imagery to manually identify hilly and rocky habitats including gullies, creeklines and structurally diverse woodlands.	1,904.1	49.2	22.1
Foraging and Dispersal				
Any land comprising predominantly native vegetation within 1 km of breeding and refuge habitat.	All remnant and regrowth vegetation communities within 1 km of shelter habitat (mapped within and surrounding the Study Area) were identified as foraging and dispersal habitat.	9,401.4	880.3	574.8
	Total	**11,305.5**	**929.5**	**596.9**

1.2.1.5 Habitat Critical to the Survival of the Species

The *EPBC Act referral guidelines for the northern quoll* (Department of the Environment 2016) defines habitat critical to the survival of the species as habitat within the modelled distribution of the species which provides shelter for breeding, refuge from fire or predation and potential poisoning from cane toads. As stated in the Referral Guideline, critical habitat usually occurs in the form of:

- Off-shore islands where the northern quoll is known to exist.
- Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines.
- Structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.
- Dispersal and foraging habitat associated with or connecting 'populations important for the long-term survival of the northern quoll' is also considered critical habitat.

Modelled denning and refuge habitat (rocky gullies and treed creek lines, structurally diverse woodlands with denning resources) may constitute habitat critical to the survival of the species through the provision of shelter for breeding. However, based on the above definitions and the lack of an important population as described below (**Section 1.2.1.6**), modelled foraging and dispersal habitat is not habitat critical to the survival of the species.

1.2.1.6 Important Populations

As stated in the *EPBC Act referral guideline for the endangered northern quoll Dasyurus hallucatus* (Department of the Environment 2016), populations important for the long-term survival of the species includes populations which are:

- High density quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present.
- Occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water.
- Subject to ongoing conservation or research actions i.e., populations being monitored by government agencies or universities or subject to reintroductions or translocations.

For the purposes of this assessment, populations important for the long-term survival of the species are considered the same as important populations conceptually.

The *EPBC Act referral guideline for the endangered northern quoll Dasyurus hallucatus* (Department of the Environment 2016) identifies a high-density population as being characterised by numerous camera triggers of multiple individuals across multiple cameras and or traps. It characterises a low-density population by infrequent captures of one or two individuals confided to one or two traps. The targeted field survey deployed a large array of camera traps for a combined total of 490 trap nights. Two camera locations detected northern quoll, both detecting the species once during the same survey program. Based on the survey findings and referral guideline characterisation, the Mt Hopeful population is regarded as low density.

Given the low-density population determination, the prevalence of cane toad and absence of ongoing conservation action or research, the population of northern quoll at Mt Hopeful is not regarded as an important population.

1.2.1.7 Potential Impacts and Key Mitigation Measures

Potential impacts on this species as a result of the Project include habitat loss and fragmentation, direct mortality, altered foraging behaviour and exacerbation of pest populations including cane toad and feral predators. Vegetation clearing required for the construction of the Project will result in direct impacts to 22.1 ha of denning and refuge habitat and 574.8 ha of foraging and dispersal habitat.

In addition to the general mitigation and management measures outlined in Section 9.3.1 which include pest monitoring and sediment and erosion control, the following species-specific mitigation measures will be implemented:

- Micro-siting of Project infrastructure will aim to retain potential denning habitat features including large hollow logs and large boulders piles. Habitat features that can be avoided will be demarcated. Where they cannot be retained in situ, features will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance).
- Vegetation clearing required within or directly adjacent to areas of breeding and denning habitat should be completed outside of the northern quoll breeding season (late July to late August). Where this cannot be committed to, a trapping and relocation program for northern quoll in these areas must be undertaken prior to vegetation clearing commencing. Potential denning sites in areas to be cleared will have entrances closed to avoid use by northern quoll prior to and during clearing.
- Following the completion of the trapping program, should an active den be found within the Disturbance Footprint measures outlined in a pre-approved high-risk SMP will be implemented to ensure no impacts occur to an active breeding place. This may include blocking access to dens once vacated to ensure they are not re-utilised during construction. Where possible, detection dogs will be used to assist in locating northern quoll where potential denning habitat will be impacted.
- Nineteen 'pinch points' are proposed within mapped habitat for the northern quoll, which have been primarily designed to minimise fragmentation impacts on greater glider (southern and central) and yellow-bellied glider (south-eastern) (Figure 9.2 and Figure 9.3 of the body of this report). Pinch points describe locations of the Disturbance Footprint which are reduced in width to provide dispersal opportunities. Although pinch points have been designed primarily to facilitate movement for greater glider (southern and central) and yellow-bellied glider (south-eastern), the reduction in clearing width at these locations will also mitigate impacts to dispersal for northern quoll, for which mapped habitat coincides with pinch points.
- Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads.
- Carcass surveys will be conducted by a suitably qualified ecologist to detect and remove carrion in operational areas that may attract northern quolls. The Project's Bird and Bat Adaptive Management Plan (BBAMP) (Attachment G of the Preliminary Documentation) will include a carcass survey protocol and include details such as survey frequency and timing.
- Construction areas that may inadvertently provide potential denning opportunities through stockpiling of materials will have fauna exclusion fencing installed around the perimeter.

- In the event that a northern quoll is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.

1.2.1.8 Significant Impact Assessment

An assessment against the *EPBC Act referral guideline for the endangered northern quoll Dasyurus hallucatus* (Department of the Environment 2016) is presented in **Table 1.10** below. This assessment considers the latest species information presented in the referral guidelines and the species SPRAT profile (last updated on 13 July 2017). In line with the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a), only the adverse impacts on the species that may arise as a result of the Project have been considered (and not potential beneficial impacts). Although included in the broader discussion of potential impacts below, it is acknowledged that rehabilitation (which may be considered a beneficial impact) does not negate or offset the loss of habitat. The assessment of significance has been made independent of these measures and applies the precautionary principle as appropriate.

In summary, the assessment found that the Project **is likely to result in a significant impact** on the northern quoll as it will result in the loss of habitat critical to the survival of the northern quoll. As detailed above, habitat critical to the survival of the species is considered to be refuge and denning habitat within the Disturbance Footprint. On this basis, a significant impact is expected on refuge and denning habitat only and therefore, offsets have been proposed to compensate for impacts on these areas.

Table 1.10 Significant Impact Assessment – Northern Quoll

Evaluation Criteria	Response
Result in the loss of habitat critical to the survival of the northern quoll	**Likely**. As described in **Section 1.2.1.5** above, modelled denning and refuge habitat meets the definition of habitat critical to the survival of the species. Modelled foraging and dispersal habitat is not considered critical given the populations likely low-density (see **Section 1.2.1.6**). All habitat within the Study Area and likely wider area comprises large, contiguous patches with relatively high levels of connectivity. Although already impacted by low levels of historical clearing, weeds and pests, the habitat resources necessary to maintain a population are present. A maximum of 596.9 ha of modelled habitat will be directly impacted via vegetation clearing, however of this area only 22.1 ha is suitable for denning and refuge and considered critical habitat. This area of impact is expected to reduce as an outcome of the detailed design process and micro-siting, however critical habitat will still be subject to increased fragmentation (albeit low) and the loss of potentially important shelter features. Although potential shelter features will be relocated where possible, relocated features may no longer be suitable for a range of reasons and this may result in an overall net loss of potential denning opportunities. While large areas of habitat will remain following construction, there will be a loss of critical habitat and important features. As per the referral guidelines this is likely to result in a significant impact on the northern quoll.
Decrease the size of a population important for the long-term survival of the northern quoll and therefore interfere with the recovery of the species	**No.** The northern quoll is known to the Study Area, recorded twice during the field survey program. Based on the number of records relative to the total camera trapping effort (490 trap nights), the population present is regarded as low density and is therefore not considered important for the long-term survival of the species (as described above in **Section 1.2.1.6**). A maximum of 596.9 ha of northern quoll habitat will be directly impacted for construction of the Project, including 22.1 ha suitable for denning and refuge and 574.8 ha suitable for foraging and dispersal. Potential habitat for the northern quoll occurs commonly across the Study Area however it is degraded in places due to the historical clearing for agricultural works and ongoing disturbance from cattle grazing, weeds and pests. Although some fragmentation exists, habitat is generally well connected internally and to areas outside of the Study Area. Given the linear nature of the Project, this connectivity will largely be maintained following construction. Vegetation clearing will be completed in phases, ensuring only a subset of the Disturbance Footprint is impacted at one time and allowing time for individuals to relocate. Clearing proposed to occur within or directly adjacent to areas of denning and refuge habitat will aim to be completed outside of the northern quoll breeding season (late July to late August). If this is not possible, to reduce the chances of breeding individuals being impacted by Project works, a trapping and relocation program in these areas will be undertaken prior to clearing commencing. Active animal breeding places will not be tampered with unless an approved DES SMP is acquired and implemented.

Evaluation Criteria	Response
	Micro-siting of Project infrastructure will aim to retain identified potential denning habitat features including large hollow logs and large boulders piles. Where such features must be removed, efforts will be made to reinstate or relocate features to adjacent areas of habitat where safe and not overly disruptive to the environment. Overall, the quantum of habitat and habitat features that will remain following construction of the Project is considered sufficient to maintain the likely low-density population present. Potential indirect impacts on the species as a result of the Project are expected to be limited but will be actively managed through the Project's management plans which will include specific measures for the northern quoll including cane toad control, fencing specifications, speed limits for traffic and trapping requirements should clearing occur within or adjacent to denning and refuge habitat during the breeding season. Based on the above, the Project is unlikely to decrease the size of a population important for the long-term survival of northern quoll.
Introduce inappropriate fire regimes or grazing activities (i.e. increasing the risk of late dry season high intensity fires to the area) that substantially degrade habitat critical to the survival of the northern quoll or decrease the size of a population important for the long-term survival of the species.	**No.** As described above, an important population of northern quoll does not occur within the Study Area. However, modelled denning and refuge habitat is considered habitat critical to the survival of the species. Although approximately 22.1 ha suitable for denning and refuge (habitat critical) and 574.8 ha suitable for foraging and dispersal will be removed via vegetation clearing, large areas of suitable habitat will remain which should be of sufficient size to maintain the population present. Retained habitat will not be subject to further degradation as altered fire regimes, weed and pest incursion will be actively monitored or managed as required through Project management plans (i.e. Weed and Pest Management Plan; Bushfire Management Plan). Cattle grazing operations will continue, largely unchanged, once construction is completed, and as such, fuel loads are unlikely to be significantly altered from current levels. A portion of the grazing land within the Study Area has been identified as potential offset locations. If these areas are secured for offsets, they will be subject to active management to improve the vegetation quality. As such, it is unlikely that the Project will introduce inappropriate fire regimes or grazing activities that substantially degrade habitat critical or decrease the size of an important population.
Fragment a population important for the long-term survival into two or more populations	**No.** The northern quoll is highly mobile and may utilise open habitats such as grasslands while foraging or dispersing through the landscape. Modelled habitat has a relatively high degree of connectivity both internally and to external areas including the State Forests, and this connectivity will be largely maintained following the construction of the Project. Habitat fragmentation impacts have been considered in the design and siting of the Disturbance Footprint. The use of existing cleared areas has been maximised and no significant patch isolation will occur. Nineteen pinch points will be maintained within the Disturbance Footprint, all of which are also within mapped habitat for the northern quoll. Furthermore, it is expected approximately 20% of the final clearing footprint will be rehabilitated post construction. Pinch points and rehabilitated areas will minimise habitat fragmentation and provide safe movement opportunities for northern quolls within the Disturbance Footprint (i.e. less distance required to travel in exposed areas where there may be an increased risk of predation, and reduced chances of hindered movement by weeds such as exotic grasses).

Evaluation Criteria	Response
	During construction, increased vehicle activity and ground excavations may present temporary barriers to dispersing individuals. However, the risk of mortality as a result of entrapment and collision will be actively managed via the Project's management plans. Vehicle traffic will be localised to the construction site and speed limits will be enforced. Any open excavations will contain materials to aid evacuation (i.e. ramps, sticks, hessian sacks) and be checked at set times by a spotter catcher. These excavations would be temporary and only present in a small area within the site at any one time. Once constructed, the Project itself will not create a barrier to movement as ground surfaces will be reinstated and turbines will occur in discrete locations. Based on the above reasons, the Project is unlikely to present significant barriers to the existing population to the extent where it would become fragmented into two or more populations. Furthermore, as already detailed, the population of northern quoll within the Study Area is low-density and not considered important for the long-term survival of the species.
Result in invasive species or increases of them that are harmful to the northern quoll becoming established in its habitat, namely cane toads, feral cats, red foxes or exotic grasses which increase fire risk.	**No.** Several invasive species are a recognised threat to the northern quoll. Weeds may degrade habitat and exotic fauna species including feral cats, pigs, wild dogs and cattle may directly predate or compete with the northern quoll or spread disease. Cane toads in particular have known to cause significant local declines as ingestion usually results in death. Invasive species relevant to northern quoll, particularly weeds including exotic grasses, feral cats and cane toads, were recorded throughout the field survey program and are likely to be well established in the Study Area and surrounds. Although modelled habitat is generally moderately to highly connected, existing conduits for movement do occur comprising cleared areas for tracks, fence lines and cattle grazing areas. Although the Project is unlikely to exacerbate invasive species levels beyond the current extent, the Project will employ best practice control methods for weeds and pests. To ensure cane toad breeding opportunities are not provided, where pits, voids or trenches are required they will be appropriately covered to prevent extended water retention in these spaces. Monitoring will ensure any pest population outbreaks are detected and managed as required.

1.2.2 Koala (*Phascolarctos cinereus*)

1.2.2.1 Description and Status under the EPBC Act

The koala is an arboreal, folivorous mammal found across eastern Australia, including Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia. On 12 February 2022, the koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) was listed as Endangered under the EPBC Act.

1.2.2.2 Distribution and Habitat Requirements

Koalas are reported to be widespread across Queensland, occurring in patchy and often low-density populations across the different bioregions (Department of Agriculture Water and the Environment 2022a). As per the modelled species distribution in the Conservation Advice, koala is 'known or likely' to occur in the wider Rockhampton region.

Koalas occur in coastal and inland locations and inhabit eucalypt forests and woodlands. The koala's diet is defined by the availability and palatability of a limited variety of *Eucalyptus*, *Corymbia* and *Angophora* species (Department of Agriculture Water and the Environment 2022a). They are nocturnal and spend significant periods of time moving across the ground between food and shelter trees. Movement increases in the breeding season (typically September to February). Home ranges across the species' distribution are highly variable; in Queensland and New South Wales individual home ranges are reported to vary between 3 and 500 ha (Wilmott 2020, cited by DAWE 2022a).

As described in the *National Recovery Plan for the Koala* (Department of Agriculture Water and the Environment 2022b), the species uses shelter trees to thermoregulate, especially during hot days and to avoid predators. Koalas appear to prefer larger and more shady trees and use a wide range of tree species for shelter. Based on known use, recorded shelter tree species in Queensland include rainforest trees (Pfeiffer et al. 2005), *Callitris columellaris* (Cristescu et al. 2011; Woodward et al. 2008), *Acacia harpophylla* and *Melaleuca bracteata* (Ellis et al. 2002).

Koala habitat suitability is based on the availability of the total set of attributes (i.e. presence of feed and shelter trees, connectivity, proximity to other populations) required by the species to meet its' survival and reproduction requirements (Department of Agriculture Water and the Environment 2022c). In consideration of this, koala habitat will often include:

- Forests or woodlands, especially with a higher proportion of feed tree species, and may include remnant or non-remnant vegetation.
- Roadside and railway vegetation and paddock trees.
- Safe intervening ground for travelling between trees and patches to forage, shelter and reproduce.
- Access to vegetated corridors or paddock trees to facilitate movement between patches.

As per DCCEEW (2022), climate refugia such as drainage lines, riparian zones and patches can also be important attributes as they contribute to a location's resilience to drying conditions and are likely to provide a cooler refuge during periods of bushfire and heatwaves.

1.2.2.3 Threats

The koala is considered particularly sensitive to a range of anthropogenic impacts. The main identified threats to the species are (Department of Agriculture Water and the Environment 2022a):

- Climate change driven processes and drivers including increased intensity/frequency of natural disasters, loss of climatically suitable habitat or declined nutritional value of foliage.
- Clearing and degradation of habitat.
- Vehicle strike.
- Disease.
- Predation by dogs.

Koala populations across parts of Queensland and NSW were significantly impacted by the 2019–2020 bushfires. Drought and extreme heat are also known to cause very significant mortality, and population recovery post-event may be substantially impaired by the range of other threatening factors (Threatened Species Scientific Committee 2012).

1.2.2.4 Occurrence and Potential Habitat within the Study Area

Following an extensive field survey program which employed a range of recommended field survey methods, this species was recorded incidentally on one occasion within the Disturbance Footprint indicating that the population of this species within the Study Area is likely to be of low density. The single observation of the species was of an adult female with a joey, occupying a narrow-leaved ironbark (*Eucalyptus crebra*) within RE 11.11.3.

The closest desktop records are both from 1940 and occur east of the Study Area within 14 km. Undated desktop records also occur west (approximately 28 km away) near Wowan, and south (approximately 21 km away) near Round Mountain.

Historical accounts indicate that in the early 1900s, widespread pelt hunting practices within the Rockhampton region severely reduced and fragmented the regional koala population. Since then, there have been very few sightings in the area suggesting population numbers are likely low and still recovering.

Field survey methods employed to detect this species including spotlighting (62 person-hours), camera trapping (490 nights) and Spot Assessment Technique (SAT) assessments (20 sites). The results of the SAT assessments are provided in below in **Table 1.11**.

The SAT methodology (Phillips & Callaghan 2011) uses activity levels to quantify the use of an area by koalas by calculating the percentage of scat trees relative to the total number of trees searched per site. Due to the absence of any scat trees, activity levels for all sites in the assessment was 0%. It is noted that the absence of scats does not preclude the persistence of koala, i.e. the detection of scats amongst a low density population and over a large area, coupled with the deterioration of scats over time can lead to false negatives.

Table 1.11 Koala SAT Results

RE ID	Short Description	Sites	Scat Trees
11.3.25b	*Melaleuca leucadendra* and/or *M. fluviatilis*, *Nauclea orientalis* open forest	1	0
11.3.26	*Eucalyptus moluccana* or *Eucalyptus microcarpa* woodland to open forest on margins of alluvial plains	1	0
11.11.3	*Corymbia citriodora*, *Eucalyptus crebra*, *Eucalyptus acmenoides* open forest on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges	3	0
11.11.4b	*Corymbia trachyphloia* or *Eucalyptus acmenoides, Eucalyptus crebra woodland* +/- *Acacia leiocalyx*	2	0
11.12.1	*Eucalyptus crebra* woodland on igneous rocks	1	0
11.12.6	*Corymbia citriodora* open forest on igneous rocks (granite)	12	0
	Total	**20**	**0**

Suitable habitat for the species is widely available across the Study Area. The Study Area is dominated by large tracts of *Eucalyptus* and/or *Corymbia* forest, which are functionally connected to tracts of suitable habitat outside of the Study Area at a landscape scale. The access road corridor is within an area which has experienced broadscale clearing for cropping and other agricultural purposes. Habitat within this area is limited to narrow strips of retained vegetation woodland vegetation within the road reserve. This habitat is connected to larger areas of woodland habitat at a landscape scale via networks of narrow riparian vegetation which may act as dispersal conduits.

The habitat that falls within the Disturbance Footprint is suitable to support the ecological requirements of the species including breeding, foraging and dispersal. Riparian forests and woodlands are also present in low-lying, alluvial areas and may provide climate refugia during extreme weather conditions. However, it is noted that water availability within the Study Area is generally limited due to the limited extent of perennial watercourses and large watercourses (i.e. stream order 4 or higher – noting that the access road corridor does intersect one stream or 4 and one stream order 5 watercourse). Based on this, more valuable areas of refugia are likely to occur outside of the Study Area associated with riverine and floodplain communities to the east.

The extent of koala habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 1.12** below. The field survey record, desktop records and modelled habitat for the species within the Study Area is shown on Figure 7.5.

Table 1.12 Habitat Extent and Justification for Koala

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Breeding, Foraging and Dispersal				
Any forest or woodland (remnant, regrowth and modified vegetation communities) containing species that are koala food trees (trees of the genus *Eucalyptus*, *Corymbia* and *Angophora*) or any shrubland or grassland with emergent koala food trees or paddock trees.	All vegetation communities except SEVT in remnant or regrowth condition included.	12,819.8	1,085.1	641.6
Climate Refugia				
Forests or woodlands on drainage lines or riparian zones likely to provide a cooler refuge during periods of bushfire and heatwaves, including but not limited to regional ecosystems on land zone 3.	All eucalypt woodlands on land zone 3 are considered potential climate refugia.	359.5	10.0	5.3
	Total	**13,179.3**	**1095.1**	**646.9**

1.2.2.5 Habitat Critical to the Survival of the Species

Potential significant impacts on koala may occur if habitat that is considered to be critical to the survival of the species is adversely impacted. The *Conservation Advice for Phascolarctos cinereus (Koala)* (Department of Agriculture Water and the Environment 2022c) defines habitat critical to the survival of the species as "the areas that the species relies on to avoid or halt decline and promote the recovery of the species". The following factors may be considered when identifying habitat that is critical to the survival of a species:

- Whether the habitat is used during periods of stress (examples: flood, drought or fire).
- Whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes).
- The extent to which the habitat is used by important populations.
- Whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development.
- Whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements.
- Whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation.
- Any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community.

As per the species' Conservation Advice (Department of Agriculture Water and the Environment 2022c), such areas, if identified, would be expected to include habitat occupied and habitat currently unoccupied, areas necessary for population processes and maintenance of genetic diversity and evolutionary potential, and areas required to accommodate future population increase, recolonisation, reintroduction, or as climate refugia.

Koala habitat within the Study Area comprises large, contiguous patches with high connectivity to the surrounding landscape. Smaller areas of climate refugia habitat also occur. Only two individual koalas (a mother with back young) were observed during extensive field surveys, suggesting that the local population is of low density. Despite this, it is reasonably possible that the habitat within the Study Area may be recolonised and support greater numbers of the species in the future given its' suitability for the species. Mapped habitat already provides important movement corridors in the local area. Based on this, mapped breeding, foraging and dispersal habitat as well as mapped climate refugia for the species is considered to comprise habitat critical to the survival of the species.

1.2.2.6 Important Populations

While not generally applicable to species listed Endangered under the EPBC Act, the *Conservation Advice for Phascolarctos cinereus (Koala)* (Department of Agriculture Water and the Environment 2022c), defines important populations of the species. These have been identified as those which are valuable for cultural, social and economic reasons as well as for the species conservation. Important populations for the conservation of the species are those that:

- Have the potential to act as source populations to adjacent areas of suitable, or potentially suitable, habitat.
- Exist in areas of climatically suitable refugia during periods of environmental stress including droughts, heatwaves, and long-term climate change.
- Are genetically diverse.
- Are disease free and/or exhibit low rates of infection with important pathogens.
- Contain genes which may confer adaptation to current and future environmental stressors.
- Are geographical or environmental outliers within the species range.

Populations which are considered to be important for social, cultural or economic reasons include:

- Cultural and spiritual importance to Indigenous people.
- The social value and enjoyment of having koalas close to residential areas.
- The economic value brought to local business and tourism.
- The iconic species value at the national and international political and community level.

State-level important populations have not been identified for Queensland.

One record of the species (mother with back young) has been made within the Study Area following an extensive field survey program. Records in the region are scattered and often undated or >50 years old, indicating the population is still recovering following the cessation of historical hunting practices. Noting this and the species known occurrence at low densities within parts of Queensland, it is considered likely only a small number of individuals utilise the habitat of the Study Area. The small, low density population within the Study Area may be important for maintaining genetic diversity. Given that evidence of breeding was recorded based on the confirmation of a joey accompanying an adult female, the population has the potential to act as source population for the species. Based on this, it is assumed that the population of koala persisting within the Study Area is an important population.

1.2.2.7 Potential Impacts and Key Mitigation Measures

Potential impacts on this species as a result of the Project include habitat loss and degradation, mortality from vehicle strike, operational noise masking mating calls and exacerbation of pest populations including wild dogs. Vegetation clearing required for the construction of the Project will result in direct impacts to 641.6 ha of potential breeding, foraging and dispersal habitat and 5.3 ha of potential climate refugia habitat. Although a one-off event, the loss of habitat is expected to be the impact with the greatest potential consequences.

Although habitat fragmentation is a known threat to the species, it is not anticipated that impacts from the Project would result in isolation of koala populations due to habitat fragmentation. The species is highly mobile and known to readily disperse large distances including across cleared areas. Connectivity within and to adjacent protected areas will be largely maintained and the extent of clearing would not result in a barrier to movement for the species.

The severity of operational noise impact to koalas is expected to be low as the increase from ambient noise levels is limited to 2 dB/ 5% at 0.5–3 km and 7 dB/ 15% within 0.1–1 km from the WTGs. Moreover, the overall predicted ambient noise level remains below typical noise thresholds of a rural area (50–55 dB) and other scenarios where koalas persist (Dooling and Popper, 2007). There are three factors of the Mt Hopeful koala population that contribute to its capacity to adapt to the limited expected operational noise impact of the wind turbines. These include a high dispersal range during breeding season, alternative and non-impacted olfactory communication method through scent marks and the non-reliance of audio communication for foraging. The noise impact is not expected to reduce the ecosystem function of nearby vegetation nor prevent communication between koalas or other wildlife.

In addition to the general mitigation and management measures outlined in Section 9.3.1 which include pest monitoring, the following species-specific mitigation measures will be implemented:

- Pre-clearance surveys will include canopy searches for koalas. If a koala is located during pre-clearance surveys or during clearing activities:
    - The individual must not be forcibly relocated.
    - Any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition.
    - Allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter-catcher.
    - Any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer.

- Requirements for koalas subject to handling to be examined and if suspected of Chlamydia infection will be taken to a predesignated veterinarian/wildlife care facility for treatment prior to release.
- Clearing must be carried out in a way that ensures any koala present has time to move out of the clearing site without human intervention.
- Speed limit restrictions (40 km/hr) will be enforced throughout the site to minimise potential vehicle strike risk to the species.
- Revegetation works in areas of potential koala habitat cleared for the Project will consider the recommendations outlined in the *Revegetating koala habitat* document (Beale, Marsh & Youngentob, 2022).
- Nineteen ‘pinch points’ are proposed within the Disturbance Footprint, which have been primarily designed to minimise fragmentation impacts on greater glider (southern and central) (Figure 9.2). Pinch points describe locations of the Disturbance Footprint which are reduced in width to provide dispersal opportunities. Although pinch points have been designed primarily to facilitate movement for greater glider (southern and central) and yellow-bellied glider (south-eastern), the reduction in clearing width at these locations will also mitigate impacts to dispersal for koala, for which mapped habitat coincides with pinch points.
- In the unlikely event that a koala is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.

1.2.2.8 Significant Impact Assessment

On 22 February 2022, the koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) status of Vulnerable was upgraded to Endangered under the EPBC Act. At this time, the *EPBC Act Referral Guidelines for the Vulnerable Koala* (Department of the Environment 2014) was redacted. Recently, the DCCEEW published *Referral Guidance for the Endangered Koala*, replacing the previous Referral Guidelines for the species.

The significant impact assessment for the species is present in **Table 1.13** below. This assessment considers the latest species information presented in the *Conservation Advice* (Department of Agriculture Water and the Environment 2022a), *National Recovery Plan* (Department of Agriculture Water and the Environment 2022b) and recent Referral Guidelines.

In line with the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a), the assessment below only considers the adverse impacts on the species that may arise as a result of the Project (and not potential beneficial impacts). Although included in the broader discussion of potential impacts below, it is acknowledged that rehabilitation (which may be considered a beneficial impact) does not negate or offset the loss of habitat. The assessment of significance has been made independently of these measures and applies the precautionary principle as appropriate.

In summary, the assessment found that the Project **is likely to result in a significant impact** on the koala.

Table 1.13 Significant Impact Assessment – Koala

Evaluation Criteria	Response
Lead to a long-term decrease in the size of a population	**No.** The species was recorded once during the field survey program (a mature female with joey) in narrow-leaved ironbark (*Eucalyptus crebra*). Desktop records in the region are scarce and generally >50 years old. Hunting practices within and surrounding Rockhampton in the early 1900s are known to have severely reduced the regional population and recovery has been very slow. Only a small, low -density population of the species is likely to inhabit the Study Area. As described in **Section 1.2.2.6**, this population is considered to constitute an important population as it may be important for maintaining genetic diversity or have the potential to act as a source population. A maximum of 646.9 ha of koala habitat will be directly impacted for construction of the Project, including 641.6 ha suitable for breeding, foraging and dispersal and 5.3 ha of climate refugia. Potential habitat for koala dominates the Study Area and is not considered unique or high quality due to the ongoing disturbance from cattle grazing, weeds and pests. Potential habitat associated with the non-remnant vegetation communities especially, is highly disturbed and in places contains a low abundance of koala food trees. Within the wider region, potential habitat is likely to occur extensively and include areas of higher quality particularly in protected areas such as the adjacent State Forests. The extent of habitat that will remain following the construction of the Project is of the magnitude and quality to support a much larger population than is currently expected to occur. Noting this, any population present is expected to continue to persist within the region regardless of the Project. Indirect impacts on the species as a result of the Project are anticipated to be limited, as the Project is unlikely to exacerbate predatory pest populations or vehicle strikes with the suite of general mitigation measures proposed including speed limits and pest monitoring. Nonetheless, koala specific measures including pre-clearance survey requirements are also proposed and will be captured in one or multiple Project management plans. Given the presence of a small, low-density population of the species within the Study Area as well as the implementation of mitigation measures and Project management plans, a long-term decrease in the size of a population is unlikely to result from the Project.
Reduce the area of occupancy of the species	**No.** As stated in the species' Conservation Advice, the area of occupancy for the koala is estimated at 19,428 km^2 and is contracting. It is noted that the area of occupancy may be potentially overstated given the low resolution in the mapping methodology used by the Commonwealth (2 km x 2 km grid).

Evaluation Criteria	Response
	The koala is widespread across Queensland and the Study Area is not located near the limit of the species distribution. Although the Project would result in the removal of up to 646.9 ha of habitat, only a very small number of individuals are expected to be utilising such habitat. The quantum of potential habitat that will remain is sufficient to continue to maintain the current low-density population. Furthermore, habitat of similar and higher quality is widely available in the local area and connectivity to these areas will be maintained. Based on this, Project works are considered unlikely to materially reduce the availability or quality of habitat for the species to the extent that the area of occupancy of a population would be reduced.
Fragment an existing population into two or more populations	**No**. The species is considered highly mobile and known to readily disperse large distances including across cleared areas. As described above, a population comprising a small number of individuals is known to utilise modelled habitat. Modelled potential habitat generally has low to moderate levels of fragmentation as a result of historical clearing and ongoing agricultural practices. Where potential habitat is associated with non-remnant vegetation, existing fragmentation impacts are more pronounced, and the canopy cover overall is notably lower. Modelled habitat does however have a relatively high degree of connectivity to adjacent protected areas. Through considered design and siting of the Development Corridor and Disturbance Footprint, connectivity within and to adjacent protected areas will be largely maintained. The use of existing cleared areas has been maximised and nineteen pinch points will be maintained within koala habitat in the wind farm area. Further, the access road corridor, where koala habitat is mapped at numerous locations, will also serve as a pinch pint throughout given its narrow clearing width. It is expected 20% of the Disturbance Footprint will be revegetated post construction with native species including eucalypt trees where practical. Where rehabilitation is proposed in areas previously identified as potential koala habitat, recommendations provided in the *Revegetating koala habitat* (Beale, Marsh & Youngentob, 2022) document available on the koala referral guidance website will be considered. Pinch points and rehabilitated areas will minimise habitat fragmentation and provide safe movement opportunities for koalas within the Disturbance Footprint (i.e. less distance required to travel in exposed areas where there may be an increased risk of predation). During construction, increased vehicle activity and ground excavations may become temporary barriers to dispersing individuals. However, the risk of mortality as a result of entrapment and collision will be actively managed via Project management plans. Vehicle traffic will be localised to the construction site and speed limits will be enforced. Any open excavations will contain materials to aid evacuation (i.e. ramps, sticks, hessian sacks) and be checked at set times by a spotter catcher. Once constructed, the Project itself will not create a barrier to movement as ground surfaces will be reinstated and turbines will occur in discrete locations. Any koala deaths will be reported to DCCEEW within 2 business days. Based on the above, the Project is considered unlikely to present significant barriers to the species local movement to the extent that it fragments a population into two or more populations.

Evaluation Criteria	Response
Adversely affect habitat critical to the survival of a species	**Likely**. As described in **Section 1.2.2.5** above, modelled habitat may comprise habitat critical to the survival of the species. The modelled koala habitat comprises large, contiguous patches with high connectivity to the surrounding landscape. It is considered reasonably possible that the habitat may be recolonised and support larger numbers of the species in the future. This habitat may provide important movement corridors in the local area. There is a paucity of information regarding koala presence in the Rockhampton region, however, one observation of two individuals (adult female and joey) has been recorded within the Study Area. A maximum of 646.9 ha of habitat will be directly impacted via vegetation clearing required for construction of the Project. Of this total area, >100 ha comprises non-remnant vegetation that is notably degraded relative to the surrounds. Exotic pest species including the dog are also common and established. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Nonetheless, while large areas of habitat will remain, the magnitude of habitat removal required is likely to be considered an 'adverse effect' on habitat critical as per the Conservation Advice.
Disrupt the breeding cycle of a population	**No**. As described above, only a small number of individuals are likely to utilise modelled habitat, however these may comprise an important population. Male koalas are known to disperse large distances during the breeding season in search of a mate, and dispersal will not be hindered by the Project, as described earlier. Koalas are nocturnal and mating calls generally occur at night when construction noise would be minimal. The severity of impact from operational noise is also considered minor as increases from ambient noise levels will be limited to 2 dB/ 5% at 0.5–3 km and 7 dB/ 15% within 0.1–1 km from the WTGs. Moreover, the overall predicted ambient noise level remains below typical noise thresholds of a rural area (50–55 dB) and other scenarios where koalas persist (Dooling and Popper, 2007). As the species does not have specific breeding requirements, all potential habitat may be suitable for breeding and large areas will be retained following construction of the Project. Potential habitat degradation will be actively managed through the Project management plans. Given the low density of the population of this species in the area, the Project is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No**. As described above, the koala was historically hunted in the Rockhampton region and occurs at very low densities at the landscape scale. The species has very broad habitat requirements and can inhabit vegetation in varying condition, including non-remnant areas. Habitat that may be used preferentially for climate refuge and movement across the landscape (eucalypt woodland on alluvial soils) has been largely avoided by the Project. Although a maximum 646.9 ha of habitat will be removed via vegetation clearing for construction, large, connected areas of habitat will remain. Retained habitat is highly likely to be of sufficient size and quality to support any individuals present. The Project will not result in degradation of retained habitat, as potential impacts such as weed incursion will be actively managed.

Evaluation Criteria	Response
	As already described, habitat fragmentation impacts have been minimised through considered design and siting of the Development Corridor and Disturbance Footprint. The use of existing cleared areas has been maximised and no patches will become significantly isolated. Movement will be facilitated at the pinch points. The final area of impact is expected to reduce as an outcome of the detailed design process and on ground micro-siting of Project infrastructure. As such, it is unlikely that the Project will alter habitat to the extent where the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**No**. Several exotic fauna species were identified during the field survey program. Wild dogs were recorded commonly and are expected to occur throughout the wider Study Area and surrounding region. Although potential habitat is generally moderately to highly connected, existing conduits for movement do occur comprising cleared areas for tracks, roads, fence lines and cattle grazing areas. Based on this, it is considered unlikely that clearing required for construction of the Project will significantly exacerbate the movement of exotic predators. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Introduce disease that may cause the species to decline	**No**. Chlamydia and Koala Retrovirus (KoRV) are known threats to the species. Project works are unlikely to spread disease; nonetheless, best practice biosecurity measures will be implemented through the Project management plans. Should an unwell koala be identified during clearing works, it will be handled appropriately by a qualified spotter catcher and taken to a predesignated veterinarian/wildlife care facility for treatment prior to release. Based on the above, it is unlikely the Project will introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely.** A National Recovery Plan for the Koala was published in 2022. Four main objectives are detailed: • Stabilise and then increase the area of occupancy and size of populations that are declining. • Maintain or increase the area of occupancy and size of populations that are stable. • Metapopulation processes are maintained or improved. • Partners, communities and individuals have a greater role and capability in koala monitoring, conservation and management. There is limited information available about the koala population viability and trend within the Rockhampton region. However, historical hunting practices are known to have reduced numbers severely in the 1900s. Since then, several threatening processes have increased in the region which may have halted or slowed recovery including road traffic, wild dog populations, bushfires and clearing for agricultural purposes. One observation of two individuals (adult female and joey) has been recorded within the Study Area. Given the infrequency of records made from within the Study Area and the surrounding region, it is expected that only a small, low-density population of koala utilises modelled habitat within the Study Area.

Evaluation Criteria	Response
	Habitat for koala dominates the Study Area and is not considered unique or high quality due to the ongoing disturbance from cattle grazing, weeds and pests. Habitat associated with the non-remnant vegetation communities especially, is highly disturbed and in places contains a low abundance of koala food trees. Within the wider region, habitat is likely to occur extensively and include areas of higher quality particularly in protected areas such as the adjacent State Forests. The extent of habitat that would remain following the construction of the Project is of the magnitude and quality to support a much larger population than is currently expected to occur. Noting this, any population present in the region is expected to continue to persist and the quantum and quality of habitat which would be removed as a result of the Project would not be sufficient to interfere with the species' recovery.

2.0 Vulnerable Species

2.1 Vulnerable Flora

2.1.1 *Samadera bidwillii*

2.1.1.1 Description and Status under the EPBC Act

Samadera bidwillii is a small shrub or tree that grows to about 6 m in height (Department of Environment and Science 2022c). The petioles are 3 to 7 mm long. Its leaves are narrowly elliptic or narrowly ovate, the apex is obtuse, the base cuneate (wedge shaped), to attenuate, 4.5 to 18.5 cm long by 1 to 3.5 cm wide, they are glabrous (hairless) or sub glabrous, the lateral venation is parallel and prominent beneath when dry. The flowers occur in axillary clusters of 1 to 4, and each flower has 8 to 10 stamens, the filaments are pubescent on the outer surface, the sepals are 0.75 to 1 mm long and the petals about 2.5 mm long. The fruits are compressed, ovoid or ellipsoid, about 1 cm long and are 1-seeded (Ross, 1984).

Samadera bidwillii is listed Vulnerable under the EPBC Act.

2.1.1.2 Distribution and Habitat Requirements

Samadera bidwillii is endemic to Queensland and is currently known to occur in several localities between Scawfell Island near Mackay and Goomboorian, north of Gympies (Department of the Environment Water Heritage and the Arts 2008c). The nearest records for the species are located 20 km north, near Mt Morgan, and 33 km south, within the Callide Timber Reserve, east of Biloela.

Samadera bidwillii commonly occurs in lowland rainforest or at rainforest margins, but it can also be found in other forest types, such as open eucalypt forest and woodland. It is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510 m altitude (Department of the Environment Water Heritage and the Arts 2008c). The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils (Department of the Environment Water Heritage and the Arts 2008c).

Samadera bidwillii is commonly associated tree species include *Corymbia citriodora, Eucalyptus propinqua, Eucalyptus acmenoides, Eucalyptus tereticornis, Corymbia intermedia, Eucalyptus siderophloia, Eucalyptus moluccana, Eucalyptus cloeziana* and *Eucalyptus fibrosa* (Department of the Environment Water Heritage and the Arts 2008c).

2.1.1.3 Threats

As per the Conservation Advice for the species, identified threats include soil erosion and habitat clearing.

Potential threats to the species include:

- Inappropriate fire regimes.
- Exotic shrubs and grasses (e.g. *Lantana camara**, *Megathyrsus maximus** and *Chloris gayana**).

2.1.1.4 Occurrence and Potential Habitat within the Study Area

Following an extensive field survey program, a population of *Samadera bidwillii* was recorded across an area of approximately 0.03 ha within the Development Corridor. Approximately 100 individuals were recorded within the patch. The population occurs within RE 11.11.3 and persists as a low shrub from 0.3 to 0.7 m in height.

Targeted searches for the species were completed throughout the field survey program, including during the flowering and fruiting periods for this species. Searches generally comprised opportunistic and random walking meanders in areas of suitable habitat. A total of seven secondary plots and 341 quaternary plots were completed throughout the field survey program. In addition, in combination with pre-clearance surveys and protected plant surveys conducted in accordance with the *Flora Survey Guidelines – Protected Plants* (Department of Environment and Science 2020) and *Management of Endangered Plants* (Cropper 1993), the extent of mapped potential habitat for *Samadera bidwillii* within the Disturbance Footprint was searched for evidence of this species occurrence. No further records of this species were made and as such, the extent of mapped habitat, independent of the area that this species was recorded, remains potential.

Based on the description of potential habitat provided within the Approved Conservation Advice (Department of the Environment Water Heritage and the Arts 2008c) and SPRAT, modelled habitat includes all areas of remnant vegetation below 510 m altitude. All remnant vegetation types within the Study Area have broad alignment to the habitat description for the species given the dominance of eucalypt species in the canopy. Regrowth vegetation has been excluded given the extent of disturbances noted, including presence of threats such as clearing, fire and exotic shrubs and grasses.

The extent that habitat is mapped throughout the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 2.1**. Desktop records and modelled habitat within the Study Area is shown in Figure 7.3.

Table 2.1 Habitat Extent and Justification for *Samadera bidwillii*

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Potential Habitat				
Lowland rainforest or rainforest margins, and other forest types including open eucalypt forest and woodland up to 510 m altitude.	All forest and woodland communities. Non-remnant and regrowth vegetation has been excluded due to the high degrees of disturbance, including clearing and weed species. Entire Study Area occurs within altitudinal range.	7,308.5	638.5	347.8
Habitat Critical to the Survival of the Species				
Habitat known to support an important population of the species.	Select area of RE 11.11.3 where this species was recorded (patch size 0.03 ha) including a 25 m buffer around the known extent of the species.	0.4	0.4	0.1 (all will be avoided)
	Total	**7,308.9**	**638.9**	**347.9 (0.1 to be avoided)**

2.1.1.5 Habitat Critical to The Survival of The Species

Habitat critical to the survival of the species is not specifically defined for the species. However, the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a) define habitat critical to the survival of a species or ecological community as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long-term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

This species is known from a population of approximately 100 individuals covering and area of 0.03 ha located within the Development Corridor. The extent of this area, along with a 25 m buffer around the boundary of the patch is considered habitat critical to the survival of the species. The patch supports a substantial population and is expected to provide opportunity for reproduction and maintenance of genetic diversity.

Approximately 0.1 ha of habitat critical to the survival of the species exists within the Disturbance Footprint.

Important Populations

No specific definition for an important population exists for this species, however, the Significant Impact Guidelines 1.1 – MNES (Department of the Environment 2013a) define an important population as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity
- populations that are near the limit of the species range.

Samadera bidwillii is known to the Study Area. The extent of this species within the Study Area (0.03 ha patch) represents the extent of an important population as the population is considered necessary for a species' long-term survival and recovery.

2.1.1.6 Potential Impacts and Key Mitigation Measures

The known extent of this species within the Disturbance Footprint and Development Corridor, along with a 25 m buffer of the patch will be avoided, therefore, habitat critical to the survival of the species will not be impacted by Project activities.

Under the worst-case scenario, a total of 347.8 ha of potential habitat will be cleared for construction of the Project. It is anticipated that micro-siting efforts will result in a reduction in the further clearing of potential habitat. Other Project related indirect impacts relevant include weed incursion and altered fire regimes.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for the respective potentially occurring threatened flora species. The plants or population area including a minimum 5 m buffer must be demarcated and completed avoided via micro-siting. The pre-clearance survey constraints protocol (see Section 9.3.2.2 of the body of this report) will then be followed to ensure any potential impacts on the species are avoided or managed appropriately.
- This species is also considered a protected plant under the State NC Act. The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should the Project's clearing impact area (footprint inclusive of a 100 m buffer) contain high risk trigger area mapping or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the guidelines, and if necessary an impact management plan will be developed and implemented.

2.1.1.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 2.2** below. This assessment reflects the latest records for the species along with the relevant Conservation Advice document (Department of the Environment Water Heritage and the Arts 2008b). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the *Samadera bidwillii*.

Table 2.2 Significant Impact Assessment – *Samadera bidwillii*

Significant impact criteria	Project impact
Lead to a long-term decrease in the size of an important population of a species	**No.** An important population of this species is known to the Study Area, existing as a patch of approximately 100 individuals across an area of 0.03 ha. This population occurs within the Development Corridor and will be avoided entirely via the micro-siting process. Project infrastructure will be relocated to an alternate location within the Development Corridor and avoid the population by a minimum of 25 m (Department of the Environment 2023), avoiding both direct and indirect impacts to the species. The Project proposes to impact a maximum of 347.8 ha of potential habitat within the Disturbance Footprint. Following targeted flora surveys, pre-clearance surveys and protected plant surveys within mapped potential habitat for this species, no further populations were recorded. Given the absence of an important population within mapped potential habitat for the species, clearance of 347.8 ha of potential habitat is unlikely to lead to a long-term decrease in the size of an important population. During progressive habitat clearing, additional pre-clearance surveys will be conducted for the species where required by the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation) (e.g., within 12 months prior to clearing). Should the species be recorded during future surveys, micro-siting will be undertaken to avoid all impacts to the species and the pre-clearance survey constraints protocol will be enacted in accordance with the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation). An important population of this species is known from the Study Area, though it will be avoided entirely by Project activities. If further records are identified, mitigation measures will be implemented, the Project is unlikely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	**No.** An important population of this species is known to the Study Area, existing as a patch of approximately 100 individuals across an area of 0.03 ha. This population occurs within the Development Corridor and will be avoided entirely via the micrositing process. Project infrastructure will be relocated to an alternate location within the Development Corridor and avoid the population by a minimum of 25 m (Department of the Environment 2023), avoiding both direct and indirect impacts to the species. Mapped potential habitat within the Disturbance Footprint is unlikely to support an additional important population following targeted surveys, pre-clearance surveys and protected plants surveys throughout these areas given that no additional individuals or populations were recorded.

Significant impact criteria	Project impact
	During progressive habitat clearing, additional pre-clearance surveys will be conducted for the species where required by the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation) (e.g., within 12 months prior to clearing). Should the species be recorded during future surveys, micro-siting will be undertaken to avoid all impacts to the species and the pre-clearance survey constraints protocol will be enacted in accordance with the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation). As no important population of this species will be impacted by Project activities, the Project is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**No.** An important population of this species is known to the Study Area, existing as a patch of approximately 100 individuals across an area of 0.03 ha. This population occurs within the Development Corridor and will be avoided entirely via the micrositing process. Project infrastructure will be relocated to an alternate location within the Development Corridor and avoid the population by a minimum of 25 m (Department of the Environment 2023), avoiding both direct and indirect impacts to the species. Mapped potential habitat within the Disturbance Footprint is unlikely to support an additional important population following targeted surveys, pre-clearance surveys and protected plants surveys throughout these areas given that no additional individuals or populations were recorded. During progressive habitat clearing, additional pre-clearance surveys will be conducted for the species where required by the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation) (e.g., within 12 months prior to clearing). Should the species be recorded during future surveys, micro-siting will be undertaken to avoid all impacts to the species and the pre-clearance survey constraints protocol will be enacted in accordance with the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation). For reasons above, no individuals are proposed to be removed and any additional populations will be avoided. In the event that an additional population is present within the Disturbance Footprint, the extent, location and configuration of vegetation clearing is unlikely to reduce the population's ability to continue to exchange genetic material between individuals and reproduce at the local site scale. It is considered unlikely that the Project will impact dispersal and isolate habitat. The Project will not fragment an existing important population into two or more populations.

Significant impact criteria	Project impact
Adversely affect habitat critical to the survival of a species	**No.** Habitat critical to the survival of *Samadera bidwillii* is not defined, and thus the definition in *Significant impact guidelines 1.1; Matters of National Environmental Significance* (DoE 2013) has been adopted. Assessment of habitat critical to the survival of the species (refer **Section 2.1.1.5**) determined that the known extent of the species within the Development Corridor plus an additional 25 m buffer constitutes habitat critical to the survival of the species. Project activities will avoid any areas of habitat critical to the survival of the species that intersect with the Disturbance Footprint through the micrositing process. Relevant infrastructure will be relocated to facilitate the full 25 m buffer of this species known extent, avoiding both direct and indirect impacts to habitat critical to the species survival. Therefore no adverse affects to habitat critical to the survival of the species are likely to result from Project activities.
Disrupt the breeding cycle of an important population	**No.** An important population of this species is known to the Study Area, existing as a patch of approximately 100 individuals across an area of 0.03 ha. This population occurs within the Development Corridor and will be avoided entirely via the micrositing process. Project infrastructure will be relocated to an alternate location within the Development Corridor and avoid the population by a minimum of 25 m (Department of the Environment 2023), avoiding both direct and indirect impacts to the species. Additional pre-clearance surveys will be undertaken within suitable habitat prior to During progressive habitat clearing, additional pre-clearance surveys will be conducted for the species where required by the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation) (e.g., within 12 months prior to clearing). Should the species be recorded during future surveys, micro-siting will be undertaken to avoid all impacts to the species and the pre-clearance survey constraints protocol will be enacted in accordance with the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation). Fore reasons above, no individuals are proposed to be removed and in avoidance of impact to the known important population, no disruption of the breeding cycle is expected. The Project will not create conditions that reduce seed viability or limit dispersal of seed.
Modify, destroy, remove of isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** This species is known from the Study Area, existing as a patch of approximately 100 individuals across an area of 0.03 ha. This population occurs within the Development Corridor and will be avoided entirely via the micrositing process. Project infrastructure will be relocated to an alternate location within the Development Corridor and avoid the population by a minimum of 25 m (Department of the Environment 2023), avoiding both direct and indirect impacts to the species.

Significant impact criteria	Project impact
	Mapped potential habitat within the Disturbance Footprint is unlikely to support an additional important population following targeted surveys, pre-clearance surveys and protected plants surveys throughout these areas given that no additional individuals or populations were recorded. During progressive habitat clearing, additional pre-clearance surveys will be conducted for the species where required by the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation) (e.g., within 12 months prior to clearing). Should the species be recorded during future surveys, micro-siting will be undertaken to avoid all impacts to the species and the pre-clearance survey constraints protocol will be enacted in accordance with the Project's Preliminary Vegetation Management Plan (VMP) (Attachment F of the Preliminary Documentation). Retained habitat will not be subject to further degradation as altered fire regimes, dust and weed incursion will be actively monitored or managed as required through Project management plans. Complete avoidance of this species known population is expected by relocating Project infrastructure via the micrositing process. Therefore, the Project is unlikely to modify, destroy, remove of 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	**No.** Weed incursion is a potential threat to *Samadera bidwillii*, particularly due to inappropriate fire regimes. Weeds were recorded throughout the Disturbance Footprint in varying degrees of severity. There is an inherent risk of weed dispersal with any infrastructure project. The Project will follow best practice construction and operational methods, such as the implementation of a Weed Management Plan to prevent the spread of weeds. Particular emphasis on weed and pest management will be applied to the areas directly adjacent to the known population of the species within the Development Corridor.
Introduce disease that may cause the species to decline	**No.** Disease is not an identified threat to *Samadera bidwillii*. The Project will follow best practice construction and operational methods to prevent the spread of disease throughout the life of the Project. Therefore, it is unlikely that the Project will result in the introduction of a disease that may cause the species decline.
Interfere substantially with the recovery of the species.	**No.** This species is known from the Study Area, existing as a patch of approximately 100 individuals across an area of 0.03 ha. This population occurs within the Development Corridor and will be avoided entirely via the micrositing process. Project infrastructure will be relocated to an alternate location within the Development Corridor and avoid the population by a minimum of 25 m (Department of the Environment 2023), avoiding both direct and indirect impacts to the species.

Significant impact criteria	Project impact
	Despite this, habitat modelling has conservatively mapped 347.8 ha of potential habitat, although this figure is likely to reduce during the detailed design phase. Following extensive field survey within potential habitat for this species, no additional populations were recorded and as such, impacts to these areas are unlikely to interfere with an additional population. Additional pre-clearance surveys will be undertaken within mapped potential habitat for the species and in the event that an additional population is identified, complete avoidance via micro-siting will occur and the pre-clearance survey constraints protocol will be enacted in accordance with the Project's (VMP) (Attachment F of the Preliminary Documentation). Indirect impacts will be managed through implementation of the Project management plans. As such, impacts from the Project are unlikely to interfere with the recovery of the species given the lack of known populations and with the implementation of the proposed mitigation measures.

2.2 Vulnerable Fauna

2.2.1 Collared Delma (*Delma torquata*)

2.2.1.1 Description and Status under the EPBC Act

Collared delma is a cryptic lizard belonging to the Pygopodidae family. The collared delma is currently listed as Vulnerable under the EPBC Act.

2.2.1.2 Distribution and Habitat Requirements

The collared delma is endemic to Queensland and inhabits open-forest and woodlands that are typically adjacent to rocky terrain. The species distribution extends from the western edges of Brisbane in southeast Queensland, northwest to the Blackdown Tablelands and west to the Roma region of inland Queensland (Steve K Wilson 2015). The population is heavily fragmented with records occurring at the Bunya Mountains, Blackdown Tablelands National Park (NP), Bullyard Conservation Park, D'Aguilar Range NP Expedition NP, Naumgna and Lockyer Forest Reserves, Western Creek near Millmerran, the Toowoomba Range (Davidson 1993; Ryan 2006) and Kroombit Tops National Park (Atlas of Living Australia 2023). Collared delma is thought to be sedentary with one study finding that individuals occupy a small (<20 m) home range (Porter 1998a).

As per the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt reptiles* (DSEWPC, 2011), suitable habitat includes: open-forest, woodlands and adjacent exposed rocky areas in Queensland RE Land Zones 3, 9 and 10. Known important habitat is described as suitable habitat within the known or likely to occur distribution mapping for collared delma. However, collared delma records from the Kroombit Tops National Park approximately 55 km south of the Study Area indicate that this species may also use suitable habitats on Land Zone 12 (Atlas of Living Australia 2023). An additional record has recently been made available from within the southern extent of the Study Area along the western edge of the Ulam Range indicating that this species may also occur in association with Land Zone 11 (Atlas of Living Australia 2023).

The Approved Conservation Advice for *Delma torquata* (Department of the Environment Water Heritage and the Arts 2008d) provides further detail on specific habitat requirements for collared delma as: 'Eucalypt dominated woodland to open forest where it is associated with suitable microhabitats (exposed rocky outcrops) where ground cover is predominantly native grasses and forbs, such as *Themeda triandra*, *Cymbopogon refractus*, *Aristida* sp. and *Lomandra* sp. (Peck & Hobson, 2007). The species is also known from two locations featuring woodlands of *Eucalyptus tereticornis* or *Acacia harpophylla* where significant rock components were absent (Steve K Wilson 2015).

As per SPRAT, the presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30–100 mm thick) appears to be an essential characteristic of the microhabitat and is always present where the species occurs (Brigalow Belt Reptiles Workshop 2010).

2.2.1.3 Threats

Several factors are thought to have contributed to the decline of the collared delma over the past few decades including habitat loss through clearing for agriculture, habitat degradation by overgrazing of stock, removal of rocks, coarse woody debris and ground litter, use of agricultural chemicals, predation by feral cats and foxes and weed invasion (particularly *Lantana montevidensis**) (DCCEEW, 2023).

Land clearing associated with agriculture has resulted in severe modification of suitable habitat across the species' range. The most common agricultural practices impacting collared delma habitat include grazing livestock and cropping for wheat and cotton. Overgrazing of livestock has the potential to reduce the ability for the species to find suitable shelter resulting from compaction of soils. Soil compaction results in drier soils making difficult for collared delma to access suitable habitat. The rapid expansion of mining and resource extraction has further driven land clearing throughout the species' range (Brigalow Belt Reptiles Workshop 2010).

The collared delma is considered sedentary and has a very small home range, possibly using the same rocks for shelter. This is thought to make them particularly susceptible to localised disturbance (Ryan 2006). The removal of surface rock associated with development and landscaping activities is believed to pose a significant threat to the species as this removes important collared delma micro-habitat features and reduces the availability of shelter for the species (Brigalow Belt Reptiles Workshop 2010; Davidson 1993). Research on the species has revealed the collared delma will avoid disturbed rocky habitat (Porter 1998b).

The impact of fire on collared delma is not clearly understood, however declines in reptile populations have been observed following fire events (Peck & Hobson 2007). Fire poses a potential threat to this species, particularly large fires and inappropriate fire regimes (Davidson 1993).

2.2.1.4 Occurrence and Potential Habitat within the Study Area

As outlined in **Section 4.2.3** of the body of this report, this species was the subject of targeted field assessment which included recommended survey methods as outlined in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt reptiles* (DSEWPaC, 2011). Active diurnal searches, the survey method considered most effective in detecting the species, were completed extensively throughout the field survey program including within the ideal seasonal period (late September to late March).

The collared delma was not recorded during the field survey program but is conservatively considered to have a moderate likelihood of occurrence. One historical record from 1989 exists within the Study Area; however there is a very high degree of spatial uncertainty associated with this record (100 km). The Study Area occurs within the north-east of the species distribution within an area mapped as 'species may occur' (DSEWPaC, 2011) as per the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt reptiles* (DSEWPaC, 2011) and 'species or species habitat may occur' as per the SPRAT profile (DCCEEW, 2023).

While Land Zone mapping may present a useful metric when characterising collared delma habitat, recent records exist from Land Zones not described in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt reptiles* (DSEWPaC, 2011). This indicates that the species may be more reliant on the presence of suitable microhabitat features (surface rocks, course woody debris, leaf litter and native grass) than on the specific geology of an area. As such, the occurrence of suitable vegetation structure in combination with microhabitat features within the Study Area has been used to inform habitat mapping of collared delma habitat regardless of Land Zone (**Table 2.3**).

Recorded microhabitat features relevant to collared delma include:

- Stones >20 cm in diameter.
- Coarse woody debris and ground timber.

- Fine and coarse litter.
- Native grasses and herbs including *Themeda triandra, Cymbopogon refractus* and *Aristida spp.*and *Lomandra sp.*

Across the Study Area, potential collared delma habitat was identified on rocky hills and slopes as well as on alluvial soils, often in association with a watercourse. Potential habitat was found to support varying levels of required microhabitat features. Potential habitat was considered present where the above microhabitat features were identified in suitable abundance to provide shelter from predation and habitat for activities such as breeding and foraging.

In eucalypt woodland on hills and slopes, areas that were associated with suitable habitat were those which presented moderate to high abundance of loose surface stones (>20 cm diameter) in combination with other microhabitat features including native grass, litter and woody debris. Across the assessment sites, fine and coarse litter was generally present and in varying abundance with most sites located within suitable habitat recording moderate to high abundance of these features. Native grasses were common to abundant across most of the hills and slopes of the Study Area, however, where weed incursion was high, native grass abundance was generally lower than other areas.

Within the Study Area, riparian eucalypt woodlands generally occur adjacent to steep hillslopes with exposed rocky boulders and other microhabitat features. In select patches of these communities, ground timber and woody debris was recorded as being common to abundant across a range of sizes from less than 10 cm to greater than 30 cm. Leaf litter was also abundant in places but generally comprised a single thin layer and did not form 'mats'. Outcrops of stones consisted of sizes that were generally less than 20 cm in diameter. Native grass cover was largely absent in these areas.

The extent of modelled habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 2.3**. Desktop records and modelled habitat for the species within the Study Area is shown on Figure 7.12.

Table 2.3 Habitat Extent and Justification for Collared Delma

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Breeding and Foraging				
Open eucalypt forest to woodland with exposed rocky areas. Must be associated with suitable microhabitat (rocks, logs, coarse woody debris and leaf litter) where ground cover is predominantly native grasses.	Remnant and mature regrowth open eucalypt forest to woodland on hilltops, slopes and alluvial soils where loose surface rocks are present in combination with course woody debris, fine and course litter to support breeding and foraging.	4,109.3	448.6	272.8
	Total	**4,109.3**	**448.6**	**272.8**

2.2.1.5 Habitat Critical to the Survival of the Species

There is no species-specific guidance for determining habitat critical to the survival of the collared delma and at present no recovery plan exists. As important habitat has been defined in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (DSEWPaC, 2011), this terminology is considered to be interchangeable with 'habitat critical to the survival of the species.

Known important habitat for the collared delma includes:

- Suitable habitat within the Known / Likely-to occur distribution of the species and the Toowoomba Range.
- Suitable habitat between grazed or cropped areas, along road reserves, and travelling stock routes, especially the Donnybrook Stock Route region.

For all Brigalow Belt reptile species, suitable habitat may comprise important habitat if one or more of the following applies:

- Habitat where the species has been identified during a survey.
- Near the limits of the species' known range.
- Large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over generations).
- A habitat type where the species has been identified during a survey, but which was previously thought not to support the species.

The Study Area does not occur at the limit of the species range, nor is not located within known/likely to occur species distribution. The single record in the south of the Study Area indicates the potential capacity for habitat to have supported the species historically. However, this record is not recent (dated 1989) and due to the sensitive conservation status of the species, has a very high degree of spatial uncertainty (100 km) making its location unreliable.

Habitat mapped within the Study Area extends primarily along the Ulam Range and exists in large, connected corridors along the ridges, slopes and gullies. The extent of habitat is such that it may be necessary for the purposes of maintaining genetic diversity and providing movement and breeding opportunities at a landscape scale, should the species be present. As such, suitable habitat within the Study Area broadly meets the definition of important habitat and therefore is also considered as habitat critical to the survival of the species.

2.2.1.6 Important Populations

The *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Department of the Environment 2013b) describes an important population for a vulnerable species as a population that is essential for the long-term survival and recovery of a species. This may include populations that have been identified in recovery plans, and/or that are:

- Key source populations for breeding or dispersal.
- Populations that are required for maintaining genetic diversity.
- Populations that occur at the limit of the species range (Department of the Environment 2013a).

Given the difficulty in detecting this species, important habitat is considered a surrogate for important populations as outlined in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt reptiles* (DSEWPaC, 2011). As described above, modelled potential habitat does meet the definition of important habitat and as such an important population/s may also occur.

2.2.1.7 Potential Impacts and Key Mitigation Measures

A total of 272.8 ha of potential breeding and foraging habitat would be cleared for construction of the Project. Other Project related indirect impacts relevant to the collared delma include weed incursion and altered fire regimes.

In addition to the general mitigation and management measures outlined in Section 9.3.1 which include weed control and management, the following species-specific mitigation measures will be implemented:

- Micro-siting of Project infrastructure will aim to retain terrestrial habitat features including large surface rocks, stones, boulders and coarse woody debris. Habitat features that can be avoided will be demarcated. Where they cannot be retained in situ, features will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance).
- Where clearing is proposed for areas of potential collared delma habitat, pre-clearance surveys must include active searches targeting areas with common surface rocks. Should an individual or eggs of the species be located, relocation of captured individuals will occur at least 200 m from the Disturbance Footprint within habitat that is considered the same or better quality based on the availability of microhabitat features.
- In the event that a collared delma is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.

2.2.1.8 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 2.4** below. This assessment considers the latest species information presented in SPRAT and the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt reptiles* (DSEWPaC, 2011). In summary, the assessment found that the Project **may result in a significant impact** on the collared delma.

Table 2.4 Significant Impact Assessment – Collared Delma

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**Potential**. The collared delma is considered to have a moderate likelihood of occurrence within the Study Area. It was not recorded during the field survey program and the Study Area does not occur within the known or likely to occur extent of the species distribution. However, as described in **Section 2.2.1.6**, modelled potential habitat broadly meets the definition of important habitat which is considered a surrogate for important populations. As such an important population has the potential to occur. A maximum of 272.8 ha potential habitat will be cleared for construction of the Project. Potential habitat is considered to be of only moderate quality due to the presence of threats including cattle, weeds and pests. Direct impacts to potential habitat will be minimised via micro-siting wherever possible including at watercourse crossings. As the species is sedentary, there is a risk of mortality during clearing works. To manage this risk, pre-clearance surveys will include targeted searches for the species in areas of potential habitat to be cleared. Potential indirect impacts on the species including habitat degradation via weed incursion and altered fire regimes, will be actively managed via the Project management plans. Despite methods employed to mitigate and manage the impact to collared delma habitat, the Project will remove approximately 272.8 ha of important habitat for the collared delma. The extent of this habitat removal has the potential to lead to a long term decrease in the size of an important population (if present).
Reduce the area of occupancy of an important population	**Potential**. The species' area of occupancy has not been estimated. However, as per SPRAT, the species has previously been reported to be relatively common in occupied areas. As described above, modelled potential habitat meets the definition of important habitat and therefore, important populations may occur. The extent of habitat removal will be a maximum of 272.8 ha. If the species is present, this quantum of impact may be sufficient to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**Potential**. Little is known about the movement patterns of the species, though it is thought to be sedentary with one study finding that individuals occupy a small (<20 m^2) home range (Porter 1998b). A maximum of 272.8 ha of suitable habitat will be removed. The remaining habitat would continue to support the ecological requirements of the species. Nevertheless, it is likely that vegetation clearance for the Project's access tracks and other infrastructure would present a barrier to movement for the species, given its' low dispersal capacity. If important populations are present within the Study Area, there is a possibility that the shape and scale of the clearing could result in fragmenting these populations into two or more populations.

Evaluation Criteria	Response
	Suitable microhabitat features such as ground timber and boulders will be retained where possible or relocated to adjacent areas of potential habitat. Pre-clearance surveys will also be undertaken and will aim to relocate any individuals present to adjacent areas of suitable habitat. Any individuals or eggs observed, will be relocated within suitable adjacent habitat. Despite the implementation of these mitigation and management methods, the Project may fragment an existing important population into two or more populations if the species is present.
Adversely affect habitat critical to the survival of a species	**Yes**. As described in **Section 2.2.1.5**, modelled potential habitat meets the definition of important habitat which is considered to be interchangeable with habitat critical to the survival of the species. Under worst-case scenario, a maximum of 272.8 ha of habitat critical to the survival of the species would be cleared for construction of the Project. Direct impacts to this potential habitat will be minimised wherever possible via micro-siting and the final clearance area is expected to be less than the proposed impact area. The risk of further habitat degradation via weed incursion and altered fire regimes in areas retained will be actively managed via the Project management plans. As potential habitat within the Study Area meets the broad criteria to be considered as habitat critical to the survival of the species, removal of the 272.8 ha of this habitat is likely to result in an adverse impact.
Disrupt the breeding cycle of an important population	**No.** As described above, the species was not detected during field surveys and a conservative approach to the mapping of potential habitat has been applied. The breeding cycle of the species is not well defined, however females are known to produce two eggs in December that hatch between February – March (Peck & Hobson 2007)**.** Clearing and construction of the Project will be staged so only a subset of the Disturbance Footprint will be impacted at one time. Pre-clearance surveys will include targeted searches for individuals and any potential eggs (should clearing occur within potential habitat during December). Where practical, microhabitat features that cannot be avoided through micro-siting will be relocated to areas of adjacent potential habitat. Project works are therefore unlikely to disrupt the breeding cycle of a population or 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	**No**. As described above, potential habitat within the Study Area is generally of moderate quality as a result of ongoing disturbance from cattle, weeds and pests. The extent of habitat removal will be a maximum of 272.8 ha. However, it is likely that the clearing limits will be significantly less due to the micrositing of Project infrastructure. Construction works involve the modification, disruption and removal of habitat for the species. However, this species has not been observed within the Study Area and habitat of similar quality is widely available in the landscape. Further, large areas of retained habitat within the Study Area would continue to support the ecological requirements of the species.

Evaluation Criteria	Response
	As such, although the Project would result in impacts to potential habitat for the species, this is not considered to be of the magnitude that would result in the likely decline of the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**No.** Invasive species, particularly weeds including lantana (*Lantana camara**) were recorded throughout the field survey program. The feral cat, a recognised threat to the species, was also recorded multiple times. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Introduce disease that may cause the species to decline	**No**. There are no known diseases affecting the species. Nonetheless, the Project will employ best practice biosecurity protocols; therefore, introduction of a disease that may cause the species to decline is unlikely.
Interfere substantially with the recovery of the species	**No**. As outlined on SPRAT, a recovery plan for the Queensland Brigalow Belt Reptiles including the collared delma has been drafted by WWF-Australia in 2006 (Richardson 2006). Several recovery objectives are outlined in the plan and on the species SPRAT profile and broadly cover a range of topics including identification of threats and key habitat, research priorities, conservation and the establishment of reserves, monitoring programs and the development of management guidelines. The Project is unlikely to hinder the success of any of the recovery actions. Furthermore, the Project will not exacerbate any known threats to the species including cattle grazing, urban and agricultural development, weed and pest levels and altered fire regimes. Potential indirect impacts on the species as a result of the Project will be actively managed via one or multiple Project management plans. Given the above and that the species was not recorded during the field survey program, the Project is unlikely to interfere substantially with the recovery of the species.

2.2.2 Red Goshawk (*Erythrotriorchis radiatus*)

2.2.2.1 Description and Status under the EPBC Act

Red goshawk is a non-migratory raptor that is listed as Endangered under the EPBC Act, effective 31 March 2023. At the time that the referral decision was made, this species was listed as Vulnerable under the EPBC Act and has since been uplisted. As such, red goshawk has been assessed as a Vulnerable species herein.

2.2.2.2 Distribution and Habitat Requirements

The red goshawk is found in coastal and subcoastal, tall, open forest and woodlands and tropical savannas traversed by rivers lined with timber, and along the edges of rainforest (Threatened Species Scientific Committee, 2015). The species occupies intact, extensive woodlands and forests are preferred with a mosaic of open vegetation types (DCCEEW 2023a). The species is sparsely distributed across 15 % of coastal and near coastal Australia, from the Kimberley in Western Australia to north-eastern New South Wales (Department of Environment and Resource Management, 2012). It occurs at low densities across eastern Queensland, to the western slopes of the Great Dividing Range (Czechura *et al.*2010). Historically (1970–1975), the species was recorded rarely (11–50 records) in the Rockhampton region, and as of 2020 it is considered to be regionally extinct (Noske 2021).

Red goshawks are currently known to breed from the Kimberley east to Cape York Peninsula and on the Tiwi Islands. They may still breed at very low densities in the Wet Tropics and Einasleigh Uplands, though record data are scarce (MacColl *et al.* 2021, cited by DCCEEW 2023). It is suggested that since European settlement, development and habitat alteration have rendered about 20% of the species' predicted range, especially in coastal Queensland, unsuitable for breeding (Aumann & Baker-Gabb 1991, cited by DCCEEW 2023). Given the species wide ranging habits, inconspicuous nature, and difficulties with reliable field identification, its status in many regions outside northern Australia can be considered uncertain (C MacColl pers. comm. May 2022, cited by DCCEEW 2023).

Red goshawks are probably monogamous and may occupy the same breeding territories year after year (Threatened species Scientific Committee, 2015). Red goshawks typically breed in trees >20 m tall (range 18.5–40.5 m) with an open limb and canopy structure, though there is anecdotal evidence of birds using trees 14 m in height (DCCEEW 2023a). Nests are located above 20 m in tall trees (>30 m) that are usually within groups of the tallest trees (>25 m) in a given region of sub-coastal woodlands (Department of the Environment, Water, Heritage and the Arts (DEWHA) 2010). Further inland, trees tall enough for nesting are restricted to alongside major rivers' banks (DEWHA 2010). All identified nest trees having been within 1 km of permanent water, often adjacent to rivers or clearings, and usually the tallest and largest trees (DERM 2012).

When foraging, the red goshawk shows a preference for intact, extensive woodlands and forests with a mosaic of vegetation types that are open enough for fast manoeuvring flight (DERM 2012). These favoured areas contain permanent water, are relatively fertile and biologically rich with large populations of birds (DERM 2012). The species generally avoids very densely vegetated or very open habitats but will hunt along ecotones between such habitats and woodlands or forests (DERM 2012). In northern Queensland, the species is mainly associated with extensive, uncleared, mosaics of native vegetation, especially riparian vegetation, open forest and woodland that contain a mix of eucalypt, ironbark and bloodwood species (DERM 2012). The species have large home ranges, estimated at 120 km² for females and 200 km² for males (Aumann & Baker-Gabb 1991, cited by DCCEEW 2023).

2.2.2.3 Threats

The main threats causing the decline of the red goshawk are extensive habitat loss, degradation, and fragmentation (DCCEEW 2023a). Habitat loss is identified as the biggest threat to the species (DCCEEW 2023). Other threats include inappropriate fire regimes, draining of wetlands, rural and residential development, domestic livestock grazing, and climate change (DCCEEW 2023).

The *Conservation Advice for Erythrotriorchis radiatus (red goshawk)* (DCCEEW 2023a) also identifies psittacine beak and feather disease as a potential threat to the species.

2.2.2.4 Occurrence and Potential Habitat within the Study Area

Despite extensive survey effort through bird utilisation surveys (BUS) over four seasons and diurnal bird survey throughout the field survey program, the red goshawk was not recorded. The species is considered to be extinct in the Rockhampton region (Noske 2021), and therefore has a low likelihood of occurrence.

No potential breeding habitat was identified in the Study Area. The majority of woodlands and forests within the Study Area contain trees that are <20 m in height. However, some patches of woodland were noted as containing trees 20–25 m in height that may be suitable for nesting, including:

- Trees up to 24 m tall in *Eucalyptus moluccana* woodland (RE 11.11.3c) in the northernmost section of the Study Area.
- Trees 20–25 m tall in sections of riparian woodland containing *Casuarina cunninghamiana*, *Melaleuca* spp. And *Corymbia tessellaris* (RE 11.3.25).
- Trees up to 22 m tall in sections of alluvial eucalypt woodlands containing *Corymbia tessellaris/Eucalyptus tereticornis* (RE 11.3.4) within the access road corridor.
- Trees up to 21 m in sections of alluvial eucalypt woodlands containing *Eucalyptus populnea* woodland (RE 11.3.2) within the access road corridor.
- Trees approximately 20 m tall in mixed eucalypt woodland on steep slopes along the eastern boundary of the Study Area (REs 11.11.3, 11.11.4, 11.11.4b).

Despite some areas of tall trees being present, there are no large or perennial watercourses within proximity to the Study Area, with the exception of the access road corridor which is adjacent the Don River. The next closest major perennial watercourses to the wind farm are the Calliope River (7 km southeast) and Dee River (15 km west). The closest major watercourse is Centre Creek (stream order 4, non-perennial), which meanders along the southern boundary of the Study Area before flowing into the Don River. Reflecting their highly ephemeral nature, watercourses within the Study Area were generally observed during the field survey program to be dry or containing rare pools of water.

Suitable foraging and dispersal habitat may occur within the Study Area and wider Study Area, comprising open woodlands and ecotones between habitats including woodlands and vine forests. However, the absence of nearby permanent water greatly limits the overall suitability of potential habitat given the presence of permanent freshwater is an essential habitat component. Permanent pools were present in Don River adjacent the access road corridor, however vegetation in this area was limited to riparian zones and narrow strips of woodland in the road reserve, surrounded by cropping and agricultural land. Foraging habitat has been conservatively mapped in association with the woodland and forest communities in the western half of the access road corridor.

The extent of modelled habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 2.5**. Desktop records and modelled habitat for the species within the Study Area are shown on Figure 7.11.

Table 2.5 Habitat Extent and Justification for Red Goshawk

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Breeding				
Forested or wooded areas, within 2.5 km of permanent water, and in a large (over 20 m tall) tree, within the species known breeding range (Kimberley east, Cape York Peninsula, the Tiwi Islands, the Wet Tropics and Einasleigh Uplands).	The Study Area does not occur within the species' known breeding range and lacks proximal permanent watercourses; therefore, no breeding habitat is mapped.	-	-	-
Foraging and Dispersal				
Extensive tall open forest and woodlands traversed by wooded or forested rivers (no densely vegetated areas or very open habitat), ecotones, and wetlands and their margins.	Tall (>14 m) open woodlands and ecotones (represented by a 50 m buffer on patch boundaries) are mapped as marginal foraging habitat, noting that this habitat is only suitable for temporary use given the absence of proximal permanent water sources – with the exception of the western portion of the access road corridor which did not contain extensive tall open forest or woodlands.	12,523.1	1,092.4	633.0
	Total	**12,523.1**	**1,092.4**	**633.0**

2.2.2.5 Habitat Critical to the Survival of the Species

The *Conservation Advice for Erythrotriorchis radiatus (red goshawk)* (DCCEEW 2023a)identifies habitat critical to the survival of the species. Due to the small total population size, all potential habitat is considered critical to the survival of the species. This includes:

- Foraging habitat:
  - Coastal and subcoastal tall open forests and woodlands.
  - Tropical savannas traversed by wooded or forested creeks and rivers.
  - Freshwater wetlands and their margins.
  - Edges of rainforest.

- Breeding habitat:
  - Areas with large, tall trees (>14 m) within proximity to a watercourse (within 2.5 km), that occur within foraging habitat. Particularly important breeding habitat includes:
    - Riparian vegetation supporting tall stands of remnant paperbark trees (*Melaleuca sp.*) with horizontal limbs along watercourses.
    - Tall dry woodlands in proximity to watercourses with Darwin stringybark (*Eucalyptus tetrodonta*) dominated woodlands the primary breeding habitat across northern Australia.
  - These breeding habitats are often found in areas of topographic ruggedness such as plateaus or gorges where breeding can occur on elevated country in dry woodlands or on lower creek systems.

Any breeding or foraging habitat in areas where the species is known or likely to occur (as defined by the distribution map provided in Map 1 of the species conservation advice (DCCEEW 2023)) and any newly discovered breeding or foraging locations should be considered habitat critical to the survival. Areas that are not currently occupied by the species, but which may become suitable in the future, should also be considered habitat critical to survival (DCCEEW 2023).

While the Study Area contains woodlands and forests with trees >14 m in height, no critical breeding habitat occurs given the absence of permanent watercourses within 2.5 km of the Study Area. Similarly, potential foraging and dispersal habitat within the Study Area is unlikely to comprise critical habitat given the absence of proximal water sources which are a necessary habitat component for the species. Although the access road corridor contains large trees and is within the specified proximity to a watercourse, it does not meet the requirements for critical foraging habitat or breeding habitat.

Although the Study Area does occur within the ‘know/likely to occur extent’ of the species distribution map, the species was recently found to be regionally extinct (Noske 2021). Potential habitat is unlikely to become suitable in the future given the ephemeral nature of watercourses on-the wind farm site and in the adjacent landscape. Within the road corridor this habitat is unlikely to become suitable in the future given that adjacent land is well established cropping and agricultural land and large tracts of vegetation surrounding the corridor are unlikely to develop.

2.2.2.6 Important Populations

There is currently no definition of ‘Important populations’ of the red goshawk, however Action 4.1 of the species’ Recovery Plan is to identify important populations using a set of criteria developed by experts (DERM 2012). The *Conservation Advice for Erythrotriorchis radiatus (red goshawk)* (DCCEEW 2023a)also identifies this as an information and research priority.

The *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013) defines an ‘important population’ as a population that is necessary for a species’ long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity.
- Populations that are near the limit of the species range.

Given the species is considered to be regionally extinct, it is unlikely that an important population occurs within or near the Study Area.

2.2.2.7 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a total of 633.0 ha of marginal foraging and dispersal habitat will be cleared for construction of the Project. However, as described above the species is considered regionally extinct. Modelled potential habitat is unlikely to be regularly inhabited, instead utilised only by vagrant individuals while dispersing through the landscape. This loss of habitat is likely to be inconsequential to the species success within Queensland.

Potential impacts on the red goshawk as a result of the Project are anticipated to occur primarily during the operational phase. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the red goshawk has a Moderate risk of turbine collision. While the species is likely to only occur very rarely within the Study Area, it may fly at Rotor Swept Area (RSA) height and turbines may pose a barrier to movement. Project related potential indirect impacts relevant to the red goshawk include altered fire regimes.

In addition to the general mitigation and management measures outlined in Section 9.3.1 the following species-specific mitigation measures will be implemented:

- Pre-clearance nest surveys will be undertaken for red goshawk within the Disturbance Footprint. Searches will be undertaken during fauna spotter catcher pre-clearance surveys whereby suitably qualified fauna spotter catchers will actively search for red goshawk nests. Where a potential nest is identified, clearance activities within the area will cease and a suitably qualified ecologist will undertake an investigation to determine the species that the nest belongs to. If the nest does not belong to a red goshawk, or any other threatened or migratory fauna species, clearance activities will continue as planned in accordance with the Project management plans. In the event that a red goshawk nest is identified within the Study Area DCCEEW will be notified within 10 business days. A review of the current mitigation measures outlined in the BBAMP and recommendation of additional actions will be made where necessary.
- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single red goshawk death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to red goshawk are detailed in the Preliminary BBAMP.

2.2.2.8 Significant Impact Assessment

The significant impact assessment for the species is presented in **Table 2.6** below. This assessment considers the latest species information presented in the *Conservation Advice for Erythrotriorchis radiatus (red goshawk)* (DCCEEW 2023a) and where applicable, the National Recovery Plan (Department of Environment and Resource Management 2012). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the red goshawk.

Table 2.6 Significant Impact Assessment – Red Goshawk

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**No**. The red goshawk is considered to have a low likelihood of occurrence as it is reported to be extinct within the Rockhampton region. The Study Area does however occur within the 'likely to occur' extent of the species mapped distribution as per the SPRAT database. On this basis, it is considered possible that within the life of the Project a very small number of red goshawk individuals may disperse across the Study Area while on passage to higher quality habitat. As described in **Section 2.2.2.6**, any individuals that may occur are not considered to comprise an important population. Under worst-case scenario, a maximum of 633.0 ha marginal foraging and dispersal habitat will be cleared for construction of the Project. Potential habitat within the Study Area occurs extensively but is unlikely to be inhabited permanently or support a population due to the lack of permanent water within 2.5 km. Where permanent water does occur in the Don River adjacent the access road corridor, the extensive tracts of tall woodland to open forest required by the species are not present. Relative to the area of habitat that will be lost, large areas will remain. Outside of the Study Area, extensive areas of higher quality habitat are likely to occur in association with the Fitzroy River Basin and floodplain systems. As such, the loss of marginal foraging and dispersal habitat within the Study Area is expected to have a negligible effect on the species. During operation of the Project, this species may be susceptible to mortality as a result of turbine collision. Such impacts will be actively managed via the BBAMP which governs the operational response following a confirmed mortality event and will include trigger limits. Due to the species rarity in the region it is considered unlikely trigger limits will be reached. For these reasons, a long-term decrease in the size of an important population of the species is unlikely to result from the Project.
Reduce the area of occupancy of an important population	**No**. The red goshawk has a very large distribution across northern Australia. It's area of occupancy is reported to be 200,000 km², though the reliability of this estimate is low. The Study Area does not occur near the limit of the species distribution, nor does it occur in the vicinity of a known breeding pair. As described above, the Study Area does not support an important population and is unlikely to in the future due to the lack of permanent water. Although a maximum of 633.0 ha of marginal foraging and dispersal habitat may be cleared for construction of the Project, large areas of potential habitat will remain which should be of sufficient size to support any individuals that may occur temporally. Project works are therefore unlikely to reduce the area of occupancy of an important population.

Evaluation Criteria	Response
Fragment an existing important population into two or more populations	**No**. The red goshawk is highly mobile and young individuals especially may disperse far (Aumann & Baker-Gabb 1991; Debus 1982), based on records several hundred kilometres outside the breeding range. Direct impacts to marginal foraging and dispersal habitat will not result in habitat fragmentation in the context of the species, given its high dispersal capacity. Further, the Project is linear in nature and clearing will be minimised via the micro-siting of infrastructure. Through considerate design and siting of the Disturbance Footprint, clearing required for the Project will not result in habitat isolation or the creation of large clearings. Wind turbines, once operational may pose a barrier to movement for the species. However, mortality as a result of collision is not a recognised threat to the species and existing wind farm data within Australia to date does not suggest this species is overly susceptible. Collision risk will be actively managed via the BBAMP which governs the operational response following a confirmed mortality event. As described above, an important population of the red goshawk is unlikely to occur within the Study Area. Therefore, the Project will not fragment an important population into two or more.
Adversely affect habitat critical to the survival of a species	**No**. As described in **Section 2.2.2.5**, modelled potential habitat is not considered habitat critical to the survival of the species. This is due to the predicted absence of the species in the region and the marginal quality of the habitat (lacking permanent water or extensive tracts of vegetation, suitable for foraging and dispersal only); both of these factors indicate that there is a low chance of future occupation. Under worst-case scenario, a maximum of 632.8 ha marginal foraging and dispersal habitat will be cleared for construction of the Project. Direct impacts to potential habitat will be minimised wherever possible via micro-siting. The risk of further habitat degradation via altered fire regimes and other factors will be actively managed via the Project management plans. Potential habitat within the Study Area is not critical to the survival of the species and therefore no adverse impacts to habitat critical will occur as a result of the Project.
Disrupt the breeding cycle of an important population	**No.** The red goshawk has known breeding regions (the Kimberley east, Cape York Peninsula, the Tiwi Islands, the Wet Tropics and Einasleigh Uplands) and strict breeding requirements including tall trees within 1 km of permanent water. The Study Area does not occur within or in close proximity to any of the aforementioned regions. Only the access road corridor is in close proximity to perennial watercourses or large watercourses with a stream order of 4 or higher, however this does not contain the large tracts of vegetation required by the species. As such, no potential breeding habitat is considered present.

Evaluation Criteria	Response
	Clearing and construction of the Project will be staged so only a subset of Disturbance Footprint will be impacted at one time. Pre-clearance surveys will include targeted searches for red goshawk individuals and nests, despite both being considered very unlikely to occur. The minimisation of vegetation clearing will be prioritised in riparian vegetation, with tall trees retained where possible. As described above, the species was not detected during field survey program and any individuals that may occur do not comprise an important population. Project works are therefore unlikely to disrupt the breeding cycle of a population or 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	**No**. As described above, marginal foraging and dispersal habitat occurs extensively within the Study Area and is likely to be extensive in the wider region. Potential habitat has already been modified through historical clearing and thinning for agricultural works, cattle grazing, weeds and pests. Under worst-case scenario, a maximum of 633 ha marginal foraging and dispersal habitat will be cleared for construction of the Project. However, the true extent of direct impacts to potential habitat is likely to be lower as infrastructure will be micro-sited and clearing will only occur as deemed strictly necessary. Relative to the amount that will be cleared, large areas of potential habitat will remain. This quantum of habitat is sufficient to support the temporary utilisation of any individuals that may occur in the future. Retained habitat will not be further degraded via altered fire regimes or other processes as potential indirect impacts will be actively managed via the Project management plans. Therefore, the Project is unlikely to modify, destroy, remove, isolate or decrease 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	**No.** Invasive and domestic species (i.e. cattle) may contribute to the degradation of potential red goshawk habitat. Cattle grazing activities occur throughout the Study Area, and both weeds and pest species were recorded commonly during the field survey program. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels with adherence to the Project management plans. Therefore, it is unlikely the Project will result in the establishment of invasive species within red goshawk habitat.
Introduce disease that may cause the species to decline	**No.** Psittacine beak and feather disease may impact on the red goshawk as identified in the recently published *Conservation Advice for Erythrotriorchis radiatus (red goshawk)* (DCCEEW 2023a). The disease spreads primarily by food sharing through the bird's crop, fresh or dried excrement and feather and skin particles. There are no processes relevant to the Project that would facilitate the introduction or spread of this disease to any red goshawk individuals that may occur. Nonetheless, the Project will employ best practice biosecurity protocols; therefore, introduction of a disease that may cause the species to decline is unlikely.

Evaluation Criteria	Response
Interfere substantially with the recovery of the species	**No**. The need for a recovery plan has been identified, but one has not yet been developed. Conservation and recovery actions are identified in the *Conservation Advice for Erythrotriorchis radiatus (red goshawk)* (DCCEEW 2023a). Priority actions have been developed to manage the known threats to the species and cover six key themes including land clearing and fragmentation, fire regimes that cause biodiversity decline, habitat degradation cause by domestic livestock grazing, stakeholder and community engagement, survey and monitoring priorities and research priorities. The Project is unlikely to hinder the success of any of the recovery actions. Although clearing will occur in marginal foraging and dispersal habitat, this habitat is unsuitable for breeding and highly likely to be unoccupied both now and in the future. Furthermore, the Project will not exacerbate any known threats to the species including disease, cattle grazing and altered fire regimes. Potential indirect impacts on the species as a result of the Project will be actively managed via the Project management plans. Given the above, the Project is unlikely to interfere substantially with the recovery of the species.

2.2.3 Squatter Pigeon (Southern) (*Geophaps scripta scripta*)

2.2.3.1 Description and Status under the EPBC Act

The squatter pigeon (southern) is a ground-dwelling bird that inhabits open-forests to sparse, open-woodlands and scrub. The squatter pigeon (southern) is listed Vulnerable under the EPBC Act.

2.2.3.2 Distribution and Habitat Requirements

The squatter pigeon (southern) occurs on the inland slopes of the Great Dividing Range, from the Burdekin-Lynd Divide in central Queensland, south to West Wyalong in northern NSW. As per the species SPRAT, the known distribution is estimated to occur within the latitudes, 17° to 30° S, and the longitudes, 141° to 153° 30’ E (Department of Climate Change Energy the Environment and Water 2023). As per the distribution map on SPRAT, the Study Area occurs in the central part of the sub-species range, in the ‘likely to occur’ extent.

North of the Carnarvon Ranges in Central Queensland and possibly in the area between Injune and the Carnarvon Ranges, the species is relatively common and likely to comprise a single, continuous sub-population. Populations in the southern parts of the subspecies’ distribution however (i.e. south of Injune and Tin Can Bay, Queensland and NSW) are largely fragmented and isolated; in these areas there have also been noticeable disappearances. The southern boundary of the known distribution of the squatter pigeon (southern) is contracting northwards (Department of Climate Change Energy the Environment and Water 2023).

The subspecies is known to access suitable waterbodies to drink on a daily basis, including permanent or seasonal rivers, creeks, lakes, ponds and waterholes, and artificial dams. The subspecies prefers to drink where there is gently sloping, bare ground on which to approach and stand at the water’s edge.

The requirements for breeding and foraging habitat are well defined. Breeding habitat comprises remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils (predominantly areas mapped as Queensland land zones 3, 5 or 7) within 1 km of a suitable waterbody (Department of Climate Change Energy the Environment and Water 2023). Foraging habitat is almost identical, however occurring within 3 km of a suitable waterbody.
As described on SPRAT, the ground layer vegetation in foraging and breeding habitat is typically considerably patchy consisting of native, perennial tussock grasses or a mix of perennial tussock grasses and low shrubs or forbs. This patchy, ground layer of vegetation rarely exceeds 33% of the ground area. The remaining ground surface consisting of bare patches of gravelly or dusty soil and areas lightly covered in leaf litter and coarse, woody debris (e.g. fallen trees, logs and smaller debris) (Department of Climate Change Energy the Environment and Water 2023).

Although breeding can occur throughout the year if conditions are good, breeding generally coincides with the dry season (April to October) when their primary food source (grass seed) is most abundant. The nest is a depression scraped into the ground beneath a tussock of grass, bush, fallen tree or log and is sparsely lined with grass.

Squatter pigeon (southern) dispersal habitat is any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies. Such patches facilitate the local movement of the subspecies between patches of foraging habitat, breeding habitat and/or waterbodies, or the wider dispersal of individuals in search of reliable water sources during the dry season or droughts.

The subspecies may also move across cleared or degraded land between remnant trees or patches of habitat that does not exceed 100 m (Department of Climate Change Energy the Environment and Water 2023).

2.2.3.3 Threats

The key threats to the subspecies are the loss and fragmentation of habitat, the degradation of habitat by overgrazing by domesticated herbivores, habitat degradation by invasive weeds such as buffel grass (*Cenchrus ciliaris**), and predation by invasive fauna including the European fox (*Vulpes vulpes**) and feral cat (*Felis catus**) (Department of Climate Change Energy the Environment and Water 2023). Feral cats and European foxes are likely to have the greatest impact upon the squatter pigeon (southern) population (Ayers et al. 1996; EPA 2006). For example, cats were implicated in the decline of squatter pigeon (southern) sub-populations in the Duaringa and Murphy's Creek districts in south-eastern Queensland and most declines in sub-populations have occurred in areas where European foxes are highly abundant.

2.2.3.4 Occurrence and Potential Habitat within the Study Area

The squatter pigeon (southern) is known to occur within the Study Area, recorded on 78 occasions throughout the field survey program, although this is likely to include multiple observations of the same individuals. It was commonly recorded along access tracks in non-remnant areas of the Study Area and several records exist within the access road corridor.

Water sources suitable for the foraging of the squatter pigeon (southern) are uncommon within the Study Area. Although stream order 1 and 2 watercourses occur throughout the Study Area as well as several stream order 4 and 5 watercourses in the access road corridor, these were found to be unsuitable due to their occurrence within rugged and steep terrain at elevation or due to their steep banks. Farm dams identified using the Department of Resources (DoR) Reservoirs dataset occur sporadically but are all considered suitable despite ongoing cattle use in varying degrees of severity. Farm dams are likely to be the primary water resource utilised by the species due to their permanency and shallow sloping banks.

Suitable habitat within the Study Area includes areas that may provide breeding, foraging and dispersal opportunities. Breeding and foraging habitat is generally limited, reflecting the dominant surface geology types (metamorphic and igneous rocks) and steep terrain associated with mapped watercourses. Breeding, foraging and suitable water sources within the Study Area and adjacent were found to all largely occur within 1 km of each other. The local movements of the subspecies will largely be driven by the presence of these resources, and given their tendency to utilise cleared, low-lying areas it is considered likely that the shortest and most direct route to adjacent habitat will be utilised. Based on this, the extent of dispersal habitat was limited to a 1 km distance from breeding and foraging habitat. The access road corridor is the exception to this where flat to undulating terrain was dominant. Although abundant exotic grasses excluded some areas from breeding and foraging opportunities, vegetated areas were largely considered suitable for dispersal in spite of distances larger than 1 km between breeding and foraging habitat.

The extent of modelled habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 2.7**. Records (Umwelt and ALA) and modelled habitat for the species within the Study Area are shown on Figure 7.13.

Table 2.7 Habitat Extent and Justification for Squatter Pigeon (Southern)

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Breeding				
Any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils with patchy perennial tussock grasses or a mix of perennial tussock grasses and low shrubs and forbs (including but not limited to areas mapped as Queensland land zones 3, 5 or 7) and within 1 km of a permanent or seasonal waterbody with gently sloping banks.	Although no land zone 5 or 7 occurs, woodland communities associated with land zone 3 are present and, in places, are within 1 km of a suitable water source (i.e. farm dams, lacustrine wetlands and watercourses with a stream order of 3 or higher).	270.5	31.9	5.9
Foraging				
Any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils with patchy perennial tussock grasses or a mix of perennial tussock grasses and low shrubs and forbs (including but not limited to areas mapped as Queensland land zones 3, 5 or 7) and within 3 km of a permanent or seasonal waterbody with gently sloping banks (i.e. farm dams, lacustrine wetlands and watercourses with a stream order of 3 or higher).	Although no land zone 5 or 7 occurs, woodland communities associated with land zone 3 are present and, in places, are within 3 km of a suitable water source (i.e. farm dams, lacustrine wetlands and watercourses with a stream order of 3 or higher).	78.7	2.0	1.2
Dispersal				
Any forest or woodland occurring between patches of foraging or breeding habitat that facilitates movement between patches of foraging habitat, breeding habitat and/or waterbodies, and areas of cleared land less than 100 m wide linking areas of suitable breeding and/or foraging habitat.	Breeding, foraging and suitable water sources within the Study Area and adjacent all largely occur within 1 km of each other. Based on this, all woodlands and areas of cleared land less than 100 m within 1 km of breeding and foraging were included.	8,831.9	607.6	361.4

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
	The exception to this rule is the access road corridor where all areas of forest or woodland connected to breeding and dispersal habitat were included despite >1 km distances between foraging and breeding habitat. Dispersal habitat includes non-remnant areas enclosed by breeding, foraging or dispersal habitat that are less than 100 ha. Dispersal habitat buffers were extended to include known records of squatter pigeon within the Study Area.			
	Total	**9181.1**	**641.5**	**368.5**

2.2.3.5 Habitat Critical to the Survival of the Species

There are no species-specific guidelines for determining habitat critical to the survival of squatter pigeon (southern) and at present no recovery plan exists. However, the *Significant Impact Guidelines 1.1 – MNES* define habitat critical to the survival of a species or ecological community as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long-term evolutionary development. Or,
- For the reintroduction of populations or recovery of the species or ecological community.

The Study Area occurs within the central extent of the subspecies known distribution, and in this area individuals present are likely to comprise one continuous population that extends north and west. Modelled habitat for this species within the Study Area includes areas considered suitable for breeding, foraging and dispersal. Although these areas may contain the necessary habitat resources, they are subject to ongoing impacts from recognised threatening processes including exotic predators. Therefore, habitat within the Study Area is not considered a refuge for squatter pigeon (southern) and is not considered to contain any unique characteristics or conditions that do not exist in other areas of habitat that occur in the region. In addition, a large extent of habitat for squatter pigeon (southern) occurs in the local area and across the region, some of which is considered better quality. Based on these factors, modelled habitat is not considered critical to the survival of squatter pigeon (southern) and is not considered to play a critical role in the long-term maintenance of the species.

2.2.3.6 Important Populations

'Important populations' of the squatter pigeon (southern) are identified on SPRAT. As the southern boundary of the subspecies distribution is contracting northwards, important populations are identified as all of the relatively small, isolated and sparsely distributed sub-populations occurring south of the Carnarvon Ranges in Central Queensland (Department of Climate Change Energy the Environment and Water 2023). This includes, but is not limited to:

- Populations occurring in the Condamine River catchment and Darling Downs of southern Queensland.
- The populations known to occur in the Warwick-Inglewood-Texas region of southern Queensland.
- Any populations potentially occurring in northern NSW.

As habitat within the Study Area is highly connected in the wider landscape, there is no evidence to indicate that the population present is genetically isolated. Further, the Study Area does not occur within NSW or near the limit of the sub-species' distribution. Based on this, any population of individuals utilising the Study Area are not considered an important population.

2.2.3.7 Potential Impacts and Key Mitigation Measures

Potential impacts on this species as a result of the Project include habitat loss and degradation, mortality due to vehicle or turbine collision, weed incursion and exacerbation of pest populations including foxes and feral cats. Vegetation clearing required for the construction of the Project will result in direct impacts of up to 5.9 ha of breeding habitat, 1.2 ha of foraging habitat and 361.4 ha of dispersal habitat. Although a one-off event, the loss of habitat is expected to be the impact with the greatest potential consequences.

As described in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the squatter pigeon (southern) is determined to have a Moderate turbine collision risk despite being highly unlikely to fly at RSA height. This risk categorisation is considered conservative and reflects the sub-species' common occurrence within the Study Area and Vulnerable status.

In addition to the general mitigation and management measures outlined in Section 9.3.1 which include weed and pest management, the following species-specific mitigation measures will be implemented:

- Where clearing is proposed for areas of squatter pigeon (southern) breeding, foraging or dispersal habitat, pre-clearance surveys must include flushing to encourage the movement of individuals out of the clearing area.
- As squatter pigeon (southern) nests on the ground and is at high risk of direct mortality, nests should be identified and clearly demarcated by a spotter catcher during pre-clearance surveys. If the spotter-catcher determines a nest to be active, it will be managed in accordance with an approved High-risk SMP.
- To reduce vehicle or plant collision or crushing of nests, all vehicles and pedestrians will remain within designated access tracks in areas of squatter pigeon (southern) breeding habitat.
- To minimise the chances of a collision, in known squatter pigeon (southern) habitat speed limits will be reduced to 40 km/hr or less (in private areas) and signage will be instated that indicates subspecies' presence (in both private areas and local roads i.e. the access road corridor).

- The construction contractor will not conduct water extraction activities at any location that provide suitable resources for squatter pigeon (southern) (i.e. suitable watercourses and reservoirs mapped on Figure 7.13).
- As outlined in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single squatter pigeon (southern) death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to squatter pigeon (southern) are detailed in the Preliminary BBAMP.

Progressive Rehabilitation for Squatter Pigeon (Southern)

One of the intentional benefits of progressive rehabilitation is to restore dispersal habitat for the squatter pigeon (southern), and therefore minimise the Project impacts in relation to loss/degradation of habitat for this species.

Progressive rehabilitation aims to re-establish a native ground cover that aligns with the pre-disturbed vegetation where possible. Initial rehabilitation works will be completed within 3 months of the construction phase and aims to re-establish vegetation communities (including grasslands, woodlands and forests) that provide dispersal habitat for the squatter pigeon (southern).

Natural regeneration of plant species is anticipated from seed in the soil seed bank and/or from vegetation sources in surrounding areas to match the historical vegetation of the rehabilitation site where possible. The squatter pigeon (southern) is known to utilise and disperse through grasslands and highly modified environments and has specific ground cover requirements (DCCEEW 2023b). Re-establishing the ground layer will provide improved dispersal opportunities in the short-term (DCCEEW 2023b). Ground cover is expected to be re-established and be self-sustaining within five months to two years after completion of temporary works (Ladouceur, E. and Mayfield 2017; Baskerville, L, Spain, CS, Nuske, S, Gagen 2023). Within 6 months after the beginning of rehabilitation, grass species will start to mature and seedlings of canopy species will begin to emerge (Ladouceur, E. and Mayfield 2017; Baskerville, L, Spain, CS, Nuske, S, Gagen 2023). Therefore, within this timeframe, progressive rehabilitation efforts will provide dispersal habitat for the squatter pigeon (southern). Eucalypts and other canopy species (where relevant) will regenerate more substantially in the longer term (~10 years) (and provide further protection for the species and improved understory development (Ladouceur, E. and Mayfield 2017; Baskerville, L, Spain, CS, Nuske, S, Gagen 2023).

In areas of squatter pigeon (southern) habitat, the rehabilitation actions benefit the species by:

- Re-establishing appropriate ground cover to facilitate safe dispersal opportunities in the short-term.
- Providing and protecting groundcover (and therefore food sources and dispersal opportunities) from erosion and sedimentation.
- Ensuring weeds are not established (which is a high risk in the early stages of re-vegetation) beyond the historical condition of the site to provide suitable dispersal habitat without prevention of movement.
- Improving and maintaining the condition of water sources and associated riparian vegetation impacted by the Project back to historical condition. This will support access for the squatter pigeon (southern) to the permanent water sources this species is known to depend on.

- Re-establishing other relevant vegetation strata to provide improved habitat condition and function in the longer term.

2.2.3.8 Significant Impact Assessment

The significant impact assessment for the species is presented in **Table 2.8** below. This assessment considers the latest species information including habitat utilisation definitions provided in the RFI. In line with the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a), only the adverse impacts on the species that may arise as a result of the Project have been considered (and not potential beneficial impacts). Although included in the broader discussion of potential impacts above and below, it is acknowledged that rehabilitation (which may be considered a beneficial impact) does not negate or offset the loss of habitat. The assessment of significance has been made independent of these measures and applies the precautionary principle as appropriate.

In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the squatter pigeon (southern).

Table 2.8 Significant Impact Assessment – Squatter pigeon (southern)

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**No.** The squatter pigeon (southern) is known from the Study Area and surrounds, primarily recorded in cleared non-remnant vegetation. As described in **Section 2.2.3.6**, individuals within the Study Area are not considered to comprise an important population. There is no evidence to indicate that the population present is genetically isolated and the Study Area does not occur within NSW or near the limit of the sub-species' distribution. Under worst-case scenario, a maximum of 368.5 ha of suitable habitat including 5.9 ha of breeding habitat, 1.2 ha of foraging habitat and 361.4 ha of dispersal habitat will be directly impacted via vegetation clearing required for construction of the Project. Habitat is considered to be of moderate quality due to the presence of cattle, weeds and pests including feral cat which was recorded during the field survey program. Nonetheless, direct impacts to habitat will be minimised wherever possible via micro-siting and the final clearing areas are expected to be lower. Farm dams will be maintained to ensure the availability of suitable water sources required by the species is not affected. The quantum of habitat that will remain following construction of the Project, particularly breeding and foraging habitat, will be sufficient to maintain the population present. As the subspecies is predominantly ground-dwelling and known to frequent tracks, there is a risk of mortality during construction as a result of vehicle/plant strike. To manage this risk, speed limits will be strictly enforced (in private areas) and pre-clearance surveys will include flushing for the subspecies in areas of habitat to be cleared. Potential indirect impacts on the species including habitat degradation via weed and pest incursion will be actively managed via the Project management plans. The temporary worker's accommodation camp is adjacent to squatter pigeon (southern) dispersal habitat and although the anticipated noise and light levels may result in temporary avoidance of this habitat by the species, it is unlikely to disrupt breeding or foraging behaviours given the buffer distance between the camp and these habitat types (approximately 100 m to breeding habitat and 850 m to foraging habitat). The turbine collision risk assessment identified the species as being of Moderate risk for impacts from the Project, reflecting the species' vulnerable listing and frequency of occurrence within the Study Area. However, it is noted that the species is highly unlikely to fly at RSA height. Any potential operational impacts on this subspecies will be managed by the Project BBAMP. Given the implementation of the Project management plans including the BBAMP, it is considered unlikely that the Project will lead to a long-term decrease in the population.
Reduce the area of occupancy of an important population	**No.** The squatter pigeon (southern) occurs across a large portion of eastern Queensland. It's area of occupancy was estimated to be 10,000 km^2 (1,000,000 ha) in 2000. However, it is noted that this estimate may be potentially overstated given the low resolution in the mapping methodology used by the Commonwealth (2 km x 2 km grid).

Evaluation Criteria	Response
	During the field survey program the subspecies was commonly recorded in low-lying land both within the Study Area and in areas adjacent. These areas were generally highly disturbed from historical clearing and ongoing cattle grazing activities. The Project is linear in nature and infrastructure has been sited to maximise wind patterns in the landscape i.e. along ridgelines and hill tops. As a result, direct impacts to breeding and foraging habitat are particularly limited and clearing in these areas will be further minimised via micro-siting. As detailed above, the population of squatter pigeon (southern) within the Study Area is not considered important. Therefore, the Project is unlikely to reduce the area of occupancy of any population including an important population.
Fragment an existing important population into two or more populations	**No.** As described above, individuals that occur within the Study Area are not considered to comprise an important population. The squatter pigeon (southern) is considered highly mobile and was frequently recorded in highly disturbed and cleared areas, highlighting the subspecies' ability to utilise fragmented landscapes. The Project has been strategically sited to maximise the use of cleared areas, minimising additional habitat fragmentation including within breeding and foraging habitat, which are likely important for the population's persistence in the area. Clearing will be completed only as strictly necessary and final impact areas are likely to be lower. The turbine collision risk assessment identified the species as being of Moderate risk for impacts from the Project. However, the species is highly unlikely to fly at RSA height and as such it is unlikely the wind turbines will create a barrier to movement. Potential operational impacts on squatter pigeon (southern) will be managed by the Project BBAMP. As such, it is unlikely the Project will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**No.** As described in **Section 2.2.3.5** habitat within the Study Area is not considered critical to the survival of the subspecies as it is unlikely to provide a refuge for the species and is average in quality, subject to ongoing impacts from recognised threatening processes. The vast majority of identified habitat is suitable for dispersal purposes only due to the dominant surface geology and lack of suitable water sources. Potential habitat for squatter pigeon (southern) is likely to occur extensively in the wider local area associated with lower elevation coastal communities; this habitat is likely to be higher quality due to the increased water availability. Vegetation clearing required for construction of the Project will result in maximum disturbance of 368.5 ha of habitat, including 5.9 ha suitable for breeding and 1.2 ha suitable for foraging. However, clearing will be staged and occur only as strictly required. Via micro-siting, it is anticipated that final clearing areas will be lower. Furthermore, farm dams will be maintained and areas known to be commonly utilised by squatter pigeon (southern) individuals avoided. For these reasons, the Project is unlikely to adversely affect habitat critical to the survival of the species.

Evaluation Criteria	Response
Disrupt the breeding cycle of an important population	**No.** Squatter pigeon (southern) may breed throughout the year if conditions are suitable. Within the Study Area, breeding habitat for the subspecies is of average quality and limited. Although under worst case scenario 5.9 ha of breeding habitat will be impacted via vegetation clearing, micro-siting efforts are anticipated to reduce this extent significantly as many areas will also be associated with watercourse crossings. Specific mitigation measures are also proposed to ensure no squatter pigeon (southern) nests are impacted during construction, including nest searches during pre-clearance surveys and demarcating any located. Active animal breeding places will only be tampered with under an approved DES SMP. Additionally, to reduce vehicle or plant collision or crushing of nests, all vehicles and pedestrians will remain within designated access tracks. As described above, an important population of squatter pigeon (southern) does not occur within the Study Area. The Project is therefore unlikely to 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	**No.** As described above, vegetation clearing required for construction of the Project will result in direct impacts to a maximum of 368.5 ha of suitable habitat. However, the majority of habitat identified within the Study Area is suitable for dispersal only. The quantum of breeding, foraging and dispersal habitat that will remain following construction is expected to be sufficient to support the population present. The subspecies is known to utilise fragmented landscapes and important habitat resources (suitable water sources) will be maintained. Potential indirect impacts on the species including habitat degradation via weed and pest incursion will be actively managed via the Project management plans. Therefore, the Project is unlikely to 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	**No.** Invasive species including weeds and predators such as the feral cat were recorded throughout the field survey program. Historical clearing has occurred in discrete locations across the Study Area primarily for cattle grazing purposes. It is considered likely that these areas already act as conduits for pest movement in the landscape. The Project will employ best practice control methods for weeds and pests including monitoring and adaptive management. Based on this, it is unlikely the Project will result in invasive species that are harmful to the squatter pigeon (southern) becoming established.
Introduce disease that may cause the species to decline	**No.** There are no known diseases affecting the subspecies. Nonetheless, the Project will follow best practice biosecurity protocols during both construction and operation; therefore, introduction of a disease is unlikely.

Evaluation Criteria	Response
Interfere substantially with the recovery of the species	**No.** There is no recovery plan currently in place for the subspecies nor is one considered required. As per SPRAT, the following recovery actions have been recommended (EPA 2006; Garnett & Crowley 2000): • Determine the population size and distribution of the Squatter Pigeon (southern) in southern Queensland and New South Wales and assess the pigeon's conservation status and requirements. • Undertake studies in North and Central Queensland to determine the relationship between pigeon abundance, tree density and stocking rates. • Establish sites for sub-population monitoring. If possible, these sites should be established with the cooperation of local land-owners and/or conservation organisations. • Develop and implement public education programs and community based tree planting schemes to revegetate favoured habitat types. • Establish control measures for predators (especially cats and foxes) at important sites. • Establish conservation measures to protect grassy woodlands and forests. The Project is highly unlikely to impede any of the above actions and populations within central Queensland are likely to be stable. Although clearing will occur within areas of suitable habitat, the majority of the area to be impacted comprises habitat suitable for dispersal only. Construction of the Project is unlikely to change the subspecies utilisation of the Study Area or limit its success in the region. Implementation of the Project’s BBAMP will assist in minimising potential impacts to the subspecies during operation. Therefore, the Project is unlikely to interfere with the recovery of the subspecies.

2.2.4 Ghost Bat (*Macroderma gigas*)

2.2.4.1 Description and Status under the EPBC Act

The ghost bat is the largest microchiropteran bat in Australia, as well as the only carnivorous bat in the country. The ghost bat is listed Vulnerable under the EPBC Act.

2.2.4.2 Distribution and Habitat Requirements

The ghost bat is endemic to northern Australia. It has a disjunct distribution, comprising isolated populations extant in the semi-desert Pilbara region of Western Australia, the mesic Kimberley and Top End of the Northern Territory, north-western Queensland south of the Gulf of Carpentaria, Cape York peninsular, wet and dry tropics and the central Queensland coastal and hinterland regions. As per SPRAT, within Queensland their estimated range extends from Cape York to the Queensland – New South Wales border. The Rockhampton region falls within the species 'likely' distribution, with known breeding sites occurring at Mount Etna and the surrounding area. The Study Area is situated approximately 64 km south of Mount Etna.

The species occupies a wide range of habitats from rainforest, monsoon and vine scrub to open woodlands in arid areas. Recent studies have also indicated the use of cleared agricultural land (Bat Call WA Pty Ltd 2021). These habitats are used for foraging, while roost habitat is more specific. Ghost bats move between a number of roosts seasonally or as dictated by weather conditions and/or foraging opportunities, as such they require a range of roost sites (Van Dyck & Strahan 2008). Roost sites can include caves, rock crevices and disused mine adits. Based on recently published species-specific guidance on the species, roost habitat can be categorised based on utilisation (maternity/diurnal roost or nocturnal roost) and occupancy rates (permanent, regular, occasional or opportunistic) (Bat Call WA Pty Ltd 2021). Diurnal roost sites are generally deep natural caves or disused mines with a relatively stable temperature of 23°−28°C and a moderate to high relative humidity of 50−100 percent. Most breeding sites appear to require multiple entranced or chambered caves. In contrast, shallow caves, shelters and deep overhangs are likely to be used opportunistically by transient individuals as nocturnal roosts (Bat Call WA Pty Ltd 2021).

The nightly foraging range is 10 to 15 km (Bat Call WA Pty Ltd 2021). In the cooler months (non-breeding season) individuals may disperse up to 150 km from their permanent roost locations in small groups or pairs (Hoyle, Pople & Toop 2001).

2.2.4.3 Threats

As per the species' Conservation Advice (Threatened Species Scientific Committee 2016), the key threat to the ghost bat is habitat loss and degradation due to mining activities. The species' slow reproductive rate, and the lack of suitable habitat which restricts its movement, renders it vulnerable to threats and localised extinctions. Known threats to the ghost bat include:

- Habitat loss (destruction of, or disturbance to, roost sites and nearby areas) due to mining.
- Disturbance of (human visitation at) breeding sites.
- Loss and modification to foraging habitat.
- Collision with fences, especially those with barbed wire.
- Collapse or reworking of old mine adits.

- Contamination by mining residue at roost sites.
- Disease.
- Poisoning by cane toads.
- Competition for prey with foxes and feral cats.

As per Bat Call WA (2021), other indirect sources potentially causing impacts to colonies include:

- Sound, vibration, airborne dust and pollutants (NOx).
- Increased light.
- Changed fire regimes.

2.2.4.4 Occurrence and Potential Habitat within the Study Area

The ghost bat is considered a low likelihood of occurrence within the Study Area. Although the species is known from Mount Etna also located within the Rockhampton region, this site occurs >60 km north of the Study Area. Desktop records of the species in the wider local area are scarce and generally pre-1990; the nearest is located at Stanwell approximately 34 km north-west and has a 20 km spatial uncertainty.

No evidence of the species was recorded despite extensive field survey effort, which included several recommended ghost bat survey methods including roost searches and characterisation, habitat assessments, spotlighting and use of passive call detectors (Anabat Swifts). Harp trapping has also been completed in natural flyways.

No potential roost sites including caves, rock overhangs or crevices were recorded during the field survey program. A total of five mineral occurrences (gold) are mapped within the Study Area by the Queensland DoR and three of these sites are associated with abandoned mines including the King Solomon mine, Queen of Sheba mine and an unnamed mine (ID 569551). Based on the information associated with these sites including dimensions, work extent and general location (i.e. gully), only one of the three mines (Queen of Sheba) was determined to potentially contain a mine adit. The Queen of Sheba historical mine was investigated by an ecologist in November 2022 and found to comprise an open cut excavation with a narrow vertical shaft, likely similar to what is reported at the nearby sites (see **Photo 2.1** below). Based on this finding and the known information about historical workings in the wider area, no abandoned mines within or directly adjacent to the Study Area were considered potentially suitable for the roosting of ghost bat.

Photo 2.1 Queen of Sheba abandoned mine

Due to the absence of potential roost sites within the Study Area and the known nightly foraging distance of up to 15 km, no foraging habitat is considered present. While a known maternity roost occurs at Mount Etna, as described above this site occurs a significant distance from the Study Area (>60 km) and is not within the species foraging range. As the species disperses up to 150 km during the non-breeding season, potential habitat within the Study Area is restricted to seasonal foraging and dispersal habitat.

The extent of modelled habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 2.9** below. Ghost bat ALA records, Mt Etna (the nearest known roost) and modelled potential habitat are shown on Figure 7.8.

Table 2.9 Habitat Extent and Justification for Ghost Bat

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Roosting				
Caves, rock crevices, rock outcrops and disused mine adits. Preference for those deep enough to maintain a relatively stable temperature and high relative humidity.	No caves or suitable rocky crevices or outcrops were identified during the field survey. Mapped abandoned mines are all presumed to be opencut or alluvial and do not contain a suitable adit.	-	-	-
Foraging				
All vegetation within 15 km from potential diurnal roosting sites, including: • Productive plain areas with thin mature woodland over patchy or clumped tussock or hummock grass on sand or stony ground. • Trees along edges of watercourse woodland. • Edges of improved agricultural areas.	Due to the absence of roosting habitat, no associated foraging habitat is expected to occur.	-	-	-
Seasonal Foraging and Dispersal				
All vegetation within 150 km of a known roost that may be used when completing local migrations during the non-breeding season.	All vegetation communities including non-remnant areas.	16,976.0	1,583.1	883.6
	Total	**16,976.0**	**1,583.1**	**883.6**

2.2.4.5 Habitat Critical to the Survival of the Species

The recently published report *A review of ghost bat ecology, threats and survey requirements* (Bat Call WA Pty Ltd 2021) provides species-specific guidance for determining habitat critical to the survival of ghost bat. The species ongoing persistence in most parts of its distribution is due to the presence of suitable roosting habitat. Based on this, habitat critical to the survival of the ghost bat may comprise the following (Bat Call WA Pty Ltd 2021):

- Maternity/diurnal roost sites with permanent ghost bat occupancy (category 1 roost).
- Maternity/diurnal roost sites with regular occupancy (category 2 roost).
- Diurnal roost caves with occasional occupancy (category 3 roost), when adjacent to category 2 roosts.

Modelled potential habitat is limited to seasonal foraging and dispersal habitat and is expected to be utilised infrequently, during the non-breeding season only. No potential roosting habitat occurs, and no evidence of this species was recorded during the field survey program. The nearest known roost occurs >60 km to the north west (Mount Etna). Relative to Mount Etna, the Study Area does not occur within the species reported nightly foraging range. Based on this, potential habitat is not considered to meet the definition of habitat critical to the survival of the species.

2.2.4.6 Important Populations

'Important populations' of the ghost bat have not been identified in Departmental guidance documents. However, populations are reported to be highly structured, being genetically distinct at both regional and local scales. Highly genetically divergent populations are known from Mount Etna, Cape Hillsborough and Camooweal in Queensland, and the Pilbara in Western Australia. The once 'major' colony at Mount Etna was estimated in 2018 to have decreased in size by 79% (Bat Call WA Pty Ltd 2021).

As described above, the ghost bat is considered to have a low likelihood of occurrence within the Study Area. Given the Study Area's significant distance from Mount Etna (>60 km) and the lack of other known roost locations in the region, it is likely that only transient individuals dispersing to areas of higher quality habitat during the non-breeding season may utilise the Study Area. As such, any individuals utilising the Study Area are not considered to constitute an important population.

2.2.4.7 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a maximum of 883.4 ha of seasonal foraging and dispersal habitat will be cleared for construction of the Project. However, as described above the species is dependent on the presence of suitable roosts. Potential habitat within the Study Area is unlikely to be regularly inhabited, instead utilised only by rare individuals only while dispersing during the non-breeding season. This loss of habitat is likely to be inconsequential to the species' success within Queensland.

Potential impacts on the ghost bat as a result of the Project are anticipated to occur primarily during the operation phase. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the ghost bat is determined to have a Moderate turbine collision risk despite being unlikely to fly at RSA height. Project related potential indirect impacts relevant to the ghost bat include increased pest populations including the cane toad.

In addition to the general mitigation and management measures outlined in Section 9.3.1 the following measure specific to MNES will be implemented:

- Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads.
- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single ghost bat death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to ghost bat are detailed in the Preliminary BBAMP.

2.2.4.8 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 2.10** below. This assessment considers the latest species information including that presented in the Bat Call Wa Pty Ltd (2022) report *A review of ghost bat ecology, threats and survey requirements*. In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the ghost bat.

Table 2.10 Significant Impact Assessment – Ghost Bat

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**No**. The ghost bat is considered to have a low likelihood of occurrence within the Study Area as it is located >60 km from the Mt Etna Caves and no records occur nearby. The Study Area does however occur within the 'likely to occur' extent of the species mapped distribution as per the SPRAT database. On this basis, it is considered possible that within the life of the Project a small number of ghost bat individuals may temporarily utilise habitat while dispersing in the non-breeding season. As described in **Section 2.2.4.6**, any individuals that may occur are not considered to comprise an important population. Under worst-case scenario, a maximum of 883.6 ha seasonal foraging and dispersal habitat will be cleared for construction of the Project. Potential habitat within the Study Area occurs extensively but is unlikely to be inhabited permanently or support a population due to the lack of diurnal and nocturnal roosting opportunities. Relative to the area of habitat that will be lost, large areas will remain. Foraging and dispersal habitat requirements are broad and as such it is likely suitable habitat also occurs extensively in the wider area. Based on this, the loss of seasonal foraging and dispersal habitat as a result of the Project is expected to have a negligible effect on the species. During operation of the Project, this species may be susceptible to mortality as a result of turbine collision. As described above, the species was determined to have a Moderate risk of collision, largely reflecting the high consequence of blade strike and low likelihood of collision in the Study Area. Such impacts will be actively managed via the BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. For these reasons, a long-term decrease in the size of an important population of the species is unlikely to result from the Project.
Reduce the area of occupancy of an important population	**No**. The ghost bat has a large but discontinuous distribution across northern Australia, however it's area of occupancy is less than 10 km^2 and reducing. This estimate may also overstate the true area given the low resolution in the mapping methodology used (2 km x 2 km grid) by the Commonwealth.

Evaluation Criteria	Response
	Ghost bats are continuing to decline at the Mount Etna Caves National Park (Bat Call WA, 2022), which is also located in the Rockhampton region. However, the Study Area occurs >60 km south of the Mt Etna Caves. As described above, the Study Area is unlikely to support an important population and is unlikely to in the future due to the lack of roosting opportunities. Noting the typical nightly foraging range of 10–15 km, individuals occupying the Mt Etna Caves are likely to primarily utilise areas in the immediate surrounds. Although a maximum of 883.6 ha of seasonal foraging and dispersal habitat may be cleared for construction of the Project, large areas of potential habitat will remain which should be of sufficient size to support any individuals that may occur temporally. Project works are therefore unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**No.** The ghost bat is highly mobile and recent studies have confirmed their use of cleared agricultural land while foraging. Direct impacts to seasonal foraging and dispersal habitat will not result in habitat fragmentation in the context of the species, given its high dispersal capacity. Further, the Project is linear in nature and clearing will be minimised via the micro-siting of infrastructure. Through considerate design and siting of the Development Corridor and Disturbance Footprint, clearing required for the Project will not result in habitat isolation or the creation of large clearings. Based on the recognised threats to the species, collision with barbed-wire fences may lead to mortality. Where new fencing is required, the Project will use 'fauna-friendly' fencing options, and only result in the creation of new barbed-wire fences as strictly required for the protection of electrical infrastructure (i.e. substations). Collisions with wind turbines are not documented and information regarding their known flight patterns does not suggest the species is overly susceptible. Nonetheless, turbines may present a moderate risk of collision to the species. This will be actively managed via the BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. As described above, an important population of the ghost bat is unlikely to occur within the Study Area. Therefore, the Project will not fragment an important population into two or more.
Adversely affect habitat critical to the survival of a species	**No**. As described in **Section 2.2.4.5**, modelled potential habitat is not considered habitat critical to the survival of the species. This is due to the significant distance from a known maternity roost and the lack of both diurnal and nocturnal roosting opportunities within the Study Area; both of these factors indicate that there is a low chance of future occupation.

Evaluation Criteria	Response
	Under worst-case scenario, a maximum of 883.6 ha seasonal foraging and dispersal habitat will be cleared for construction of the Project. Direct impacts to potential habitat will be minimised wherever possible via micro-siting. The risk of further habitat degradation via altered fire regimes and other factors will be actively managed via the Project management plans. Potential habitat within the Study Area is not critical to the survival of the species and therefore no adverse impacts to habitat critical will occur as a result of the Project.
Disrupt the breeding cycle of an important population	**No**. Maternity roost sites are typically found in temperature-stable caves with chambers and/or cavities that trap humidity. The Study Area does not contain any suitable roosting habitat and as such, no potential breeding habitat is present. The species is known to permanently inhabit and breed at the Mt Etna Caves, north of Rockhampton (>60 km form the Study Area). Pregnant females or females carrying pups from the Mt Etna colony are unlikely to disperse far from the maternity roost and hence would not utilise potential habitat within the Study Area As described above, the species was not detected during field survey program and any individuals that may occur do not comprise an important population. Project works are therefore unlikely to disrupt the breeding cycle of a population or 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	**No**. As described above, seasonal foraging and dispersal habitat occurs extensively within the Study Area. Potential habitat has already been modified through historical clearing and thinning for agricultural works, cattle grazing, weeds and pests, however the species is known to use such environments. Under worst-case scenario, a maximum of 883.6 ha of seasonal foraging and dispersal habitat will be cleared for construction of the Project. However, the true extent of direct impacts to potential habitat is likely to be lower as infrastructure will be micro-sited and clearing will only occur as deemed strictly necessary. Relative to the amount that will be cleared, large areas of potential habitat will remain within the Study Area. The risk of further habitat degradation via altered fire regimes and other factors will be actively managed via the Project management plans. This quantum of retained habitat will be sufficient to support the temporary utilisation of any individuals that may occur in the future. Therefore, the Project is unlikely to modify, destroy, remove, isolate or decrease 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	**No**. The ghost bat may be impacted by invasive species, including poisoning by cane toads and competition for prey with foxes and feral cats. Invasive species including feral cats and cane toads were recorded throughout the field survey program. Historical clearing has occurred in discrete locations across the Study Area and it is considered likely that these areas already act as conduits for pest movement in the landscape.

Evaluation Criteria	Response
	As pests are already established and likely to be common, the Project is unlikely to further exacerbate population levels. Nonetheless, pest measures including monitoring will be implemented via the Project management plans. To ensure breeding opportunities for the cane toad are limited, where pits, voids or trenches are required they will be appropriately covered to prevent extended water retention in these spaces. Based on this, it is unlikely the Project will result in invasive species that are harmful to the ghost bat becoming established.
Introduce disease that may cause the species to decline	**No**. There are no known diseases affecting the species. The Project will employ best practice biosecurity protocols during construction and operation; therefore, introduction of a disease that may cause the species to decline is unlikely.
Interfere substantially with the recovery of the species	**No**. The need for a recovery plan has been identified, but one has not yet been developed. The species' Conservation Advice identifies primary conservation and management actions. The two primary conservation actions are: 1) protect roost sites from mining, human disturbance and collapse, and 2) replace the top strands of barbed wire in fences near roost sites with single-strand wire. Management actions are grouped into six key themes including active mitigation of threats, captive breeding, quarantining isolated populations, translocation, community engagement and reduce disturbance of roost sites. Specific actions relevant to the theme of 'active mitigation of threats' all relate to the protection of roost sites and significant colonies. The Project is unlikely to hinder the success of the conservation actions, given no potential roost sites occur and barbed-wire fence will only be installed at very select locations in small quantities. Although clearing will occur in seasonal foraging and dispersal habitat, this habitat is unsuitable for breeding and is likely to be unoccupied both now and in the future. Furthermore, the Project will not exacerbate any known threats to the species including pest populations. Potential indirect impacts on the species as a result of the Project will be actively managed via Project management plans. Given the above, the Project is unlikely to interfere substantially with the recovery of the species.

2.2.5 White-throated Needletail (*Hirundapus caudacutus*)

2.2.5.1 Description and Status under the EPBC Act

The white-throated needletail is listed Vulnerable and Migratory under the EPBC Act.

2.2.5.2 Distribution and Habitat Requirements

The white-throated needletail is a large species of swift which is a non-breeding migrant to Australia typically arriving in September and October (Draffan et al, 1983). They most commonly migrate to Australia via the Torres Strait and disperse in a southerly direction along the eastern and western sides of the Great Divide in Queensland and New South Wales. By November the species reaches the southern extent of its range in Australia dispersing throughout parts of Victoria, south-eastern South Australia and Tasmania (Higgins 1999a). In the Northern Territory and Western Australia, they occur as vagrants. Estimates place the white-throated needletail's range in Australia at 126,200 km^2. (Barrett et al, 2003; Blakers et al, 1984; Higgins, 1999).

White-throated needletails are an almost exclusively aerial, large-bodied swift that are insectivorous feeding on a variety of insect prey items during their migration in Australia across a range of habitat types and landscapes. Whilst in Australia the species is gregarious observed flying in flocks of hundreds and even thousands of birds. They are occasionally observed individually or in smaller groups and can sometimes be found in mixed flocks with other insectivorous aerial species such as fork-tailed swift (*Apus pacificus*) and fairy martins (*Hirundo ariel*) (Learmonth 1950, 1951; McMicking 1925; Wheeler 1959).

They are regularly recorded above wooded areas including open forest and rainforest, though may also fly below the canopy between trees or in clearings. When flying above farmland, they are more often recorded above partly cleared pasture, plantations, or remnant vegetation at the edge of paddocks. According to the *Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment 2015a) trees with dense canopy foliage and tree hollows are considered to provide roosting habitat for white-throated needletail (Corben et al, 1982; Day, 1983; Quested, 1982; M. Tarburton., 2015; M. K. Tarburton, 1993), although the degree to which the species roosts in trees in potentially over-emphasised (Higgins 1999a). A radiotracking study on white-throated needletails was able to track an individual to a roosting site in open sclerophyll forest. Although the study was unable to detect the exact roosting tree the dominant tree species included *Eucalyptus crebra*, *Eucalyptus muellerana, Eucalyptus gummifera* and *Lophostemon confertus*. It is thought the species will return to roost sites over consecutive nights (Tarburton 1993). Home ranges and territories are not maintained while the birds are in Australia.

During non-breeding migrations to Australia the white-throated needletail feeds on a variety of insects including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers (Cameron 1968; Madden 1982; Rose 1997; Tarburton 1993). The species feeds up to the height of clouds over a variety of foraging habitats including heavily treed forests. Open foraging habitats include farmland, heathland or mudflats (McDonald 1938; Tarburton 1993; Templeton 1991; Learmonth 1951), although the species has been observed feeding at lower altitudes closer to the ground as low as 15 cm at a coastal saltworks (Watson 1955). They occasionally forage above recently disturbed habitats, such as recently burned or cleared forest, or above paddocks being ploughed or cut (Blakers et al, 1984; Bravery, 1971). The species is also known to hunt in updraught locations like ridges, cliffs, or sand dunes (Legge, 1927; Loyn, 1985; Mitchell et al, 1996). Low pressure systems both lift food sources and provide assistance with flight and needletails often forage at the edge of these systems (Boehm 1939).

2.2.5.3 Threats

Within Australia threats to white-throated needletails include wind turbine collision (Hull et al. 2013), overhead wires (Cameron, R., Hinchey 1981; Campbell 1930; Wheeler 1965), windows (Slater 1964), and lighthouses (Draffan et al, 1983; Stokes, 1983). Further research is required to determine the extent of the impact at the population level for this species.

It is possible that the species may decline as a result of pesticide use either through a reduction of prey abundance or secondary poisoning through the accumulation of sublethal doses in prey species (Tarburton, 2014). The decrease of roosting locations in Australia may potentially be a factor in the species' decline. It's possible that the decline in invertebrate prey was also a result of the loss of woodland and forest ecosystems (Tarburton, 2014).

2.2.5.4 Occurrence and Potential Habitat within the Study Area

White-throated needletail was recorded on 30 occasions flying over a diversity of habitat types, both incidentally and during the Bird and Bat Utilisation Surveys (BBUS). Six hundred and ninety-eight individuals have been recorded during surveys with a total of 320 individuals recorded at vantage points during BBUS and a total of 378 individuals recorded incidentally across all survey events. The number of individuals observed in aggregations ranged from 1 to 180. During the morning BBUS survey period (6 am to 10 am) a total of 318 individuals were recorded. During the midday BBUS survey period (10 am to 2 pm) a total of 236 individuals were recorded. During the afternoon BBUS survey period (2 pm to 6 pm) a total of 144 individuals were recorded.

Records throughout a migration event generally begin during spring when the species arrives in Australia and ends in autumn when the species is leaving Australia. Data has been collected across two migration events recording 305 individuals during the 2019–2020 migration, 388 individuals during the 2020–2021 migration and 5 individuals during the 2021–2022 migration. Database records indicate the species is regularly recorded in the region surrounding Rockhampton and Gladstone with the closest record occurring within 13 km of the Study Area dated from 2021. Several database records dated 2021 to 2022 occur to the north-west of Project and within 40 km of the Study Area.

Potential habitat for white-throated needletail consists of roosting, foraging and dispersal habitat. Given the species is a non-breeding migrant to Australia, no breeding habitat exists and will not be considered further. The Study Area is dominated by woodland communities dominated by *Eucalyptus* species, semi-evergreen vine thicket and non-remnant pasture which provide foraging habitat for the species. The Project is located at the Ulam Range, which forms a part of the Great Dividing Range. South-easterly trade winds generated by warm Pacific and Tasman maritime air create the potential for convection along the Great Dividing Range which is aided by orographic lift, the movement of air masses from lower to higher elevations over rising terrain (Spassiani 2020). During the summer months, easterly troughs along the inland side of the Great Dividing Range form a boundary between moist coastal air and the drier air that occurs inland producing a ridge of high pressure along the coast (Bureau of Meteorology 2010).
The combination of montane topography and pressure systems along the Great Dividing Range produce updrafts and with it, foraging opportunities for white-throated needletail.

Given the preference for roosting on tall and /or hollow bearing trees at the top of ridges, as well as vertical tree trunks, rock faces and dense canopy foliage, white-throated needletail roosting habitat is limited to remnant vegetation with mature stands of trees confined to ridgelines and mountains throughout the Study Area. As per the Queensland DoR Mountain peaks and capes dataset, the North Pimple is the landscape feature with the lowest elevation (454 m) in the local area. To ensure a conservative approach, all areas with an elevation of 400 m or higher were therefore considered the limit of potential roosting and foraging habitat. Due to the species broad habitat requirements and aerial nature, all remaining areas of regrowth and remnant vegetation are considered potential foraging and dispersal habitat.

The extent of modelled habitat within the Study Area Development Corridor and Disturbance Footprint is provided in **Table 2.11**. Records (Umwelt and ALA) and modelled habitat within the Study Area is displayed on Figure 7.7.

Table 2.11 Habitat Extent and Justification for White-throated Needletail

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Roosting and Foraging				
Areas containing tall and/or hollow bearing trees at high elevations including the top of ridges, peaks and mountains.	Remnant vegetation occurring within areas above 400 m AHD.	3,235.5	430.2	269.6
Foraging and Dispersal				
A range of habitats, although more often over wooded areas, where it is almost exclusively aerial.	All remaining vegetation communities in remnant or regrowth condition.	10,183.5	666.5	370.6
	Total	**13,419.0**	**1,096.7**	**640.2**

2.2.5.5 Habitat Critical to the Survival of the Species

Habitat critical to the survival of the species is not specifically defined for the species. However, the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a) define habitat critical to the survival of a species or ecological community as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long-term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

The species is a non-breeding migrant to Australia and is mostly aerial, foraging on the wing and moving with weather systems. Foraging habitat requirements are therefore very broad. The species may roost in tall, hollow bearing trees at the top of ridges, on vertical tree trunks, rock faces and dense canopy foliage (Department of the Environment, 2015). Relative to foraging and dispersal habitat, roosting habitat is likely to be more restrictive. As such, modelled roosting and foraging habitat associated with ridges and mountains within the Study Area may conservatively be considered as habitat critical to the survival of the species.

2.2.5.6 Important Populations

The SPRAT database does not identify 'important populations' of the white-throated needletail. However, it does state that while in Australia, all individual white-throated needletails are expected to comprise a single, continuous population. The total population for the species is estimated to be approximately 41,000 birds (Garnett and Baker 2021). An ecologically significant proportion of a population for white-throated needletail is considered to be 410 individuals with a significance internationally and 41 individuals with a significance nationally (Department of the Environment 2015a). Although the spatio-temporal occurrence of white-throated needletails is considered to be dynamic and dependent on weather conditions, such as storm fronts, the quantum of individuals observed during the field survey program constitutes a nationally significant proportion of the population, with an internationally significant proportion anticipated to move through the Project. For the purpose of this impact assessment, can be considered an important population.

2.2.5.7 Important Habitat

Important habitat for white-throated needletail is defined in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015) as 'a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites'. In the context of the Study Area, all foraging, dispersal and potential roosting habitat meets this broad definition.

No threshold area for important habitat which is likely to result in a significant impact has been identified given lack of species knowledge. Research on white-throated needletail may reveal site thresholds in suitable habitat used by roosting birds.

2.2.5.8 Ecologically Significant Proportion of the Population

As stated above, an ecologically significant proportion of a population for white-throated needletail is considered to be 410 individuals with a significance internationally and 41 individuals with a significance nationally (Department of the Environment 2015a). Pre-commission survey data has been collected across two migration events recording 310 individuals during the 2019–2020 migration and 384 individuals during the 2020–2021 migration. The largest flock observed during the field survey program was estimated at 180 individuals. Based on this data, an internationally significant proportion of the population is considered likely to move through the Project.

2.2.5.9 Potential Impacts and Key Mitigation Measures

Potential impacts on the white-throated needletail will occur during both the construction and operation phases, however operational impacts are considered to be of greater consequence. As described in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the white-throated needletail has a Very High risk of turbine collision. This risk rating reflects the species known flight patterns which include a high proportion of flights at RSA height and its regular occurrence within the Study Area. Collision Risk Modelling completed for the Project by Biosis (2022) predicts 0.17 collisions per annum (equating to one mortality every 5.9 years). At this rate, it is unlikely that an ecologically significant proportion of the population (national or international significance) would be impacted over the life of the Project.

Under the worst-case scenario, a total of 269.6 ha of roosting and foraging habitat and 370.6 ha of foraging and dispersal habitat will be cleared for construction of the Project. Noting that the species is almost exclusively aerial, occurs above a range of habitat types and extensive habitat of similar value will remain, this loss of habitat is likely to represent only a minor impact to the species.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the Preliminary BBAMP (Attachment G of the Preliminary Documentation) will include measures specific to potential operational impacts. The implementation of a mortality trigger will be the primary mechanism for monitoring and managing impacts on the white-throated needletail.

2.2.5.10 Significant Impact Assessment

The significant impact assessment for the species using the Vulnerable criteria is presented in **Table 2.12** below. An assessment against the migratory criteria is presented in **Table 2.13**. Both assessments consider the latest information available in the species' Conservation Advice (Threatened Species Scientific Committee 2019) and where applicable, the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the white-throated needletail.

Table 2.12 Significant Impact Assessment (Vulnerable Criteria) – White-throated Needletail

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**No.** The white-throated needletail is known to the Study Area, recorded on 30 occasions during the field survey program, totalling 698 individuals. It is a non-breeding migrant to eastern Australia where it occurs as transient populations, often influenced by prevailing weather conditions. The species generally arrives in Australia during spring and migrates along both sides of the Great Diving Range in Queensland and NSW to the southern parts of their range. The journey is reversed as the species leaves Australia in autumn. While migrating, it is likely the species will inhabit the airspace above all remnant and regrowth habitat types within the Study Area. The population observed during the field survey program constitutes an important population and it is considered likely that an internationally significant proportion of the population may also utilise the Study Area at some point. However, as described above the population is only present for a short period before it continues to move north or south. Under worst-case scenario, up to 269.6 ha of roosting and foraging habitat and 370.6 ha of foraging and dispersal habitat will be directly impacted via vegetation clearing for construction of the Project. Relative to the area that will be cleared, large areas of suitable habitat will remain. Given the species aerial nature and broad requirements for roosting and foraging, it is unlikely this loss of habitat will result in a material change to the species' utilisation of the area. The turbine collision risk assessment identified the species as being of Very High risk for impacts from the Project, reflecting the Vulnerable status of the species and the frequency at which the species occurs at RSA. Given the flight behaviours of the species and known occurrence within the Study Area, the mortality of individual birds may occur during the lifetime of the Project, particularly whilst the species is present in Australia (October–March). However, collision risk modelling completed for the Project indicates overall mortality numbers will be very low (i.e. 1 individual every 5.9 years). The potential impact on this species would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. As the plan is adaptive, the death of a single white-throated needletail would result in notification to DCCEEW, an investigation and additional monitoring. Given the implementation of a BBAMP, it is considered unlikely that the Project will lead to a long-term decrease in the population.
Reduce the area of occupancy of an important population	**No.** While in Australia the species has a large distribution that extends across eastern Australia. As per the species' Conservation Advice, the estimated area of occupancy within Australia is >18,000 km^2 however this may be overstated given the mapping methodology used by the Commonwealth (2 km x 2 km grid).

Evaluation Criteria	Response
	Although the Project will result in a maximum loss of up to 269.6 ha of roosting and foraging habitat and 370.6 ha of foraging and dispersal habitat, habitat is likely to only be utilised temporarily while on migration. The quantum of habitat that will remain is likely to be sufficient to support the ecological requirements of populations of the size observed during field surveys (an important population). Furthermore, areas of suitable habitat are likely to occur extensively within the wider region. Given the aerial nature and high mobility of the species, as well as the broad habitat requirements and habitat availability in the broader region, the Project is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**No.** As described above, an important population of white-throated needletail may utilise the Study Area. The species is highly mobile, flying for thousands of kilometres during migration. It is known to occur within fragmented landscapes as well as over a range of habitat types. The Project has been strategically sited to maximise the use of cleared areas, minimising additional habitat fragmentation including within roosting and foraging habitat, which may be preferred habitat while a population is present in the area. Given the aerial nature of the species, vegetation clearance associated with the Project is unlikely to reduce the mobility of the species and will not result in the fragmentation of a population. Once operational, wind turbines may present a barrier to movement. The turbine collision risk assessment identified the species as being of Very High risk for impacts. Predicted mortality rates determined through Collision Risk Modelling based on existing BBUS data and turbine specifications indicates collision events will be rare (i.e. 1 mortality every 5.9 years). The potential impact on this species would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. As such, it is unlikely the Project will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**No.** As described in **Section 2.2.5.5**, modelled roosting and foraging habitat is conservatively considered habitat critical to the survival of the species. Vegetation clearing required for construction of the Project will result in the loss of up to 269.6 ha of roosting and foraging habitat. However, clearing will be staged and occur only as strictly required. Hollow-bearing trees will be demarcated and avoided where possible via the micro-siting of Project infrastructure. The final clearing extents are anticipated to be lower, and the quantum of habitat that will be retained is likely to be sufficient to support the ecological requirements of any population that may occur. For these reasons, the Project is unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**No.** The species is a non-breeding migrant to Australia. As the species forages predominantly on insects, foraging resources are widely available and are not a limitation to building sufficient energy reserves required for their return migration to breeding grounds. Therefore, the Project is unlikely to disrupt the breeding cycle of a population of the species.

Evaluation Criteria	Response
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** As described above, vegetation clearing required for construction of the Project will result in direct impacts to a maximum of 269.6 ha of roosting and foraging habitat and 370.6 ha of foraging and dispersal habitat. However, the species is mostly aerial and likely to only utilise the potential habitat for a short period while on migration south or north. The species is known to utilise fragmented landscapes and will occur over cleared areas. Via micro-siting, hollow-bearing trees which may be important for roosting will be avoided where possible. The quantum of habitat, and habitat resources including hollow-bearing trees, that will remain following construction is expected to be sufficient to support any population present in the future. Although some minor fragmentation impacts are anticipated, it is highly unlikely these will impact the species or limit its mobility. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Therefore, the Project is unlikely to 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	**No.** Invasive species are not known to be a threat to the white-throated needletail. Nonetheless, the Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Introduce disease that may cause the species to decline	**No.** There are no known diseases affecting the species. The Project will employ best practice biosecurity protocols during construction and operation; therefore, introduction of a disease that may cause the species to decline is unlikely.
Interfere substantially with the recovery of the species	**No.** As identified on SPRAT, a recovery plan for the white-throated needletail is not required as the necessary information is provided in the species' Conservation Advice. This document identifies the primary conservation actions for the species as the protection of breeding habitat in East Asia and the protection of important habitat in Australia. There is currently no evidence to suggest that the species relies on the habitat of the Study Area while in Australia or on migration. No roosting locations were identified during the field survey program, however potential roosting habitat has been identified based on the topography of the site and presence of hollow-bearing trees. Following construction of the Project, large and extensive areas of potential roosting and foraging habitat will remain which are of sufficient scale to support any individuals that may occur. Infrastructure including wind turbines are recognised as potential collision threats to the species, and the improvement of knowledge surrounding the species and wind farms is identified as an information and research priority. Monitoring will be completed as part of the BBAMP as required and allow additional data on the white-throated needletail to be collected. Given the above, it is unlikely that Project will interfere with recovery of the species.

Table 2.13 Significant Impact Assessment (Migratory Criteria) – White-throated Needletail

Evaluation Criteria	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** As described above, the species is a non-breeding migrant to Australia which may persist within the Study Area as transient populations. Modelled habitat within the Study Area may be suitable for roosting, foraging and dispersal, however has already been modified through historical clearing, weeds and pests. Nonetheless, potential habitat is considered to comprise important habitat. Impact area thresholds for the species are not outlined in the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act*. Up to 370.6 ha of foraging and dispersal habitat and 269.6 ha of roosting and foraging habitat will be directly impacted via vegetation clearing for construction of the Project. However, clearing will be completed only as strictly necessary and impact areas are anticipated to be reduced in the detailed design phase and through micro-siting. Direct impacts to habitat have been minimised through considered siting and design of the Disturbance Footprint, ensuring the use of existing cleared areas has been maximised. No fragmentation impacts are anticipated due to the species high mobility capacity. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Based on the above, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No.** As above, invasive species are not known to be a threat to the white-throated needletail. Nonetheless, the Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	**No.** As described in **Section 2.2.5.8**, the Study Area is considered to support an ecologically significant proportion of the national population and potentially international population. However, based on the species aerial nature and broad habitat requirements, it is unlikely the population will rely on the potential habitat within the Study Area for any part of its lifecycle. Home ranges and territories are not maintained while the birds are in Australia. Therefore, utilisation will be limited to short periods within the migratory season (October to March). This species has been subject to a turbine collision risk assessment and collision modelling, as already described. Potential operational impacts on the species will be managed by the Project's BBAMP. A single white-throated needletail death is considered a reportable incident to DCCEEW and will result in follow-up actions to further understand impacts. Given the predicted size and wide-ranging distribution of the global population and implementation of the BBAMP, it is considered unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the population.

2.2.6 Greater Glider (Central and Southern) (*Petauroides volans*)

2.2.6.1 Description and Status under the EPBC Act

Greater glider (southern and central) is an arboreal nocturnal species, largely restricted to eucalypt forest and woodlands. As of July 2022, the greater glider (southern and central) is listed Endangered under the EPBC Act. However, at the time of the Project's referral decision (7/3/2022), the greater glider (southern and central) was listed Vulnerable and is therefore considered Vulnerable for the purpose of this assessment.

2.2.6.2 Distribution and Habitat Requirements

Based on the findings of McGregor et al. (2020), at least two species of greater glider are recognised to occur within Queensland: *Petauroides volans* (southern and central) and *Petauroides minor* (northern). As suggested by the common name, *Petauroides minor* is restricted to a relatively small area of northern Queensland from Townsville to the Windsor Tablelands and has a highly disjunct distribution. Relative to the northern species, the southern and central species (*Petauroides volans*) has a broad and mostly continuous distribution from Proserpine in Queensland, south through NSW and the ACT, to Wombat State Forest in central Victoria (DCCEEW 2022).

Greater gliders are typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. During the day, this species spends most of its time denning in hollowed trees, with each animal inhabiting up to twenty different dens within its home range. Hollows are therefore an important and limiting habitat resource. As described in the species' Conservation Advice (DCCEEW 2022), the species' probability of occurrence is positively correlated with the availability of tree hollows.

Greater gliders are primarily folivorous, with a diet mostly comprising the leaves and flowers of Myrtaceae (e.g. eucalypt) trees. The species favours forests with a diversity of eucalypt species due to seasonal variation in its preferred foraging tree species. Within the Brigalow Belt Bioregion, a number of tree species have been identified as dominant or co-dominant species in greater glider (southern and central) associated REs, including (in descending order of extent): *Eucalyptus crebra, Corymbia citriodora, Eucalyptus tereticornis, Corymbia clarksoniana, Eucalyptus moluccana, Corymbia intermedia, Eucalyptus acmenoides, Lophostemon suaveolens* and *Corymbia trachyphloia* (Department of the Environment and Science 2022).

Habitat Suitability in Queensland

The *Guide to greater glider habitat in Queensland* (DES 2022) defines habitat for the species as:

- **Habitat** which includes:
    - Regional ecosystems with confirmed greater glider records.
    - Habitat attributes (but not necessarily all attributes), such as live and dead hollow-bearing trees for denning, feed trees, large trees, habitat connectivity across the landscape.
- **Potential habitat** which includes:
    - Regional ecosystems that do not have confirmed greater glider records but are identified by experts as potential greater glider habitat.

- Contains habitat attributes (but not necessarily all attributes), such as live and dead hollow-bearing trees for denning, feed trees, large trees, habitat connectivity across the landscape.

- **Not habitat** which includes:
  - Regional ecosystems with no confirmed records of greater gliders and identified by experts as non-habitat.
  - Does not contain habitat attributes such as live and dead hollow-bearing trees for denning, feed trees, large trees, habitat connectivity across the landscape.

This document also defines the importance of the size of trees for greater gliders, 'with trees >30 cm diameter at breast height (DBH) preferentially selected for foraging and >50 cm DBH for denning. Certain tree species are favoured by greater gliders for foraging and contribute the bulk of the diet in any one area. Young foliage is selected if available and this can alter the pattern of forage tree selection at different times of the year (DES 2022). For example, Comport (1996) found that foraging on *Eucalyptus tereticornis* and *Eucalyptus crebra* was variable, with gliders favouring the species in some months and avoiding them in others. Studies in the Brigalow Belt Bioregion found that favoured feed tree species included *Eucalyptus fibrosa, Eucalyptus moluccana* and *Corymbia citriodora*. However, this list may reflect bias in survey, localised effort and species availability and is not considered a complete list.

Hollow-bearing trees are an essential structural element, that provide foraging and sheltering resources for greater gliders, and their presence or absence may be used to indicate habitat suitability for greater gliders. Selection of some tree species over others for denning by greater gliders will depend on the age and senescence stage of the tree and the species inherent propensity to form hollows. For example, species such as *Eucalyptus latisinensis* (white mahogany) as well as the bloodwoods such as *Corymbia intermedia* (pink bloodwood) tend to develop hollows at a younger age / smaller DBH than does *Corymbia citriodora* and ironbark species (noting that *Corymbia citriodora* and *Eucalyptus crebra* were abundant throughout the Study Area).

A brief review of studies on ground-based estimates of hollows in trees concludes that there is high variability and low reliability among observers. This can lead to inconsistent reporting of greater glider habitat or potential habitat if used as a habitat-defining indicator. The demonstrated correlation between tree DBH (i.e. to determine 'large trees' which may be selected for sheltering) and presence of hollows is well established and is increasingly used across Australia as a surrogate of tree habitat value. The advantage of using DBH thresholds (i.e. for large trees) as an indicator is that it can be directly and precisely measured. Therefore, it has been recommended that assessors use tree size rather than presence or absence of hollow-bearing tree s to determine greater glider habitat (DES 2022).

In Queensland, the assessment of RE tree diameter thresholds to determine when a tree is 'large' is an ongoing, state-wide program undertaken by the Queensland Herbarium (The *Guide to greater glider habitat in Queensland* (DES 2022)). To determine what constitutes a 'large tree' in Queensland, and hence suitability for greater glider shelter habitat, the *Guide to greater glider habitat in Queensland* (DES 2022) suggests using the benchmark 'large tree' DBH threshold from the BioCondition framework for the relevant REs which are considered habitat for greater gliders. This estimate concords well with observed average den tree sizes from specific studies of greater glider.

In less productive forests and woodlands, typical of the Brigalow Belt, densities of large trees per hectare was lower than found in other bioregions. The *Guide to greater glider habitat in Queensland* (DES 2022) suggests that density of trees less than the average found in BioCondition benchmarks, should still be considered as important to greater gliders and would ensure greater protection of the range of tree sizes that constitute current habitat.

Home Range and Patch Size

Home ranges of this species are typically relatively small (<3 ha) but are larger in lower productivity forests and more open woodlands (up to 19.3 ha has been recorded in the Brigalow Belt Bioregion (DES 2022). They are larger for males than for females, with male home ranges being largely non-overlapping. Other factors that potentially influence home range size include life history parameters (age, polygamy, pregnancy or lactation), vegetation type, bioregion and habitat quality factors (such as geographic features, tree density, foliage quality and, tree species composition) and disturbance (DES 2022). Generally, home range size is expected to increase with a decrease in hollow availability and quality of leaf nutrition. The generally low forest productivity in the Brigalow Belt Bioregion, has been found to influence the larger home range sizes observed (DES 2022). Consequently, greater glider population density, as a function of home range size, is closely related to the spatial arrangement and extent of productive habitat ((Department of the Environment and Science 2022). For example it is estimated that in forests with lower productivity, up to 85% of the original tree basal area needs to be retained during logging operations to maintain populations (DES 2022).

Patch size is likely to influence greater glider occupancy of habitat. Large patches of suitable habitat have a higher probability of occupancy and persistence of greater glider populations (DES 2022). However, smaller patches (e.g. <20 ha) should not be dismissed as important habitat particularly if connected to other patches which increases the likelihood that greater gliders will utilise smaller patches. If patches are sufficiently close together then gliders will be able to glide between (the species can volplane for distances up to 100 m however they usually glide approximately 30 m and have a steeper trajectory than other species of glider (NSW Scientific Committee 2016)), but they are also known to come to ground, although this is not a preferred method of dispersal. Tracking studies of greater glider suggest that the species may be able to occupy small patches of suitable habitat (<3 ha), however they have also been tracked over reasonable distances, suggesting potential dispersal capacity through fragmented habitat, and even crossing a highway in one study (Wormington et al. 2002).

Recent surveys in Queensland are also confirming the presence of greater gliders persisting in small, but connected, patches of remnant habitat, indicating some dispersal capacity as identified by the home range studies of the species. A review of the literature on greater glider distribution in fragmented landscapes provides evidence that the species complex does occupy small patches of suitable habitat, even when disconnected. Taking the precautionary principle, it is suggested that any RE that has been identified as greater glider habitat, no matter how fragmented, will have value for greater gliders if hollow-bearing trees are present, either now or in the future with restoration.

2.2.6.3 Threats

As outlined in the species' Conservation Advice (DCCEEW 2022), key threats to the greater glider (southern and central) are habitat loss, fragmentation and modification (via inappropriate fire regimes, land clearing and timber harvesting), barbed wire fencing, climate change, hyper-predation by owls and predation by introduced species including feral cats and foxes.

The species is considered particularly sensitive to habitat fragmentation as a result of their low dispersal ability, relatively small home ranges and reliance on large hollow-bearing trees. The greater glider (southern and central) is absent from cleared areas and has little dispersal ability to move through cleared areas between fragments (DCCEEW 2022).

Hollows develop extraordinarily slowly in Australian eucalypts, with figures most often quoted as minimum lag times of 150–360 years from germination to the beginning of hollow development (Gibbons & Lindenmayer 2002). A fall in the number of hollows below a minimum critical threshold for greater gliders could cause a decline in any local population and compromise population viability in the longer term if there is not a new cohort of hollow trees available to replace trees lost (Lindenmayer, Cunningham & Donnelly 1997).

It was identified in 2016 that the species requires a Recovery Plan, however one has not yet been developed. Although taxonomically different, the related mahogany glider (*Petaurus gracilis*) has very similar key threats and a developed Draft Recovery Plan (Jackson & Diggins 2020). The draft Recovery Plan states that “direct observations of Mahogany Gliders have found them able to glide over gaps in their habitat including tracks, roads and powerline corridors, as long as the trees on each side of the gap are tall enough to allow a complete glide and landing”. Based on this, a widening of existing gaps between habitat areas may not significantly impede the species mobility should tall trees remain on either side that facilitate movement and clearing widths do not exceed volplane distances.

2.2.6.4 Occurrence and Potential Habitat within the Study Area

The greater glider (southern and central) is known to occur within the Study Area, recorded three times during spotlighting surveys. In June 2020, one individual was recorded in a *Eucalyptus moluccana* tree 18 m above ground level (AGL) within RE 11.3.26 in an area directly adjacent to the Study Area. In November 2020, another individual was recorded near the June 2020 record within the same patch of *Eucalyptus moluccana* woodland. Targeted nocturnal surveys undertaken in October 2021 resulted in the identification of one further individual within *Eucalyptus moluccana* woodland (RE 11.11.3c) in the north-western portion of the Study Area.

Eucalypt woodlands and forests dominate the Study Area and comprise a number of REs identified as ‘habitat’ or ‘potential habitat’ consistent with DES (2022) (see **Section 2.2.6.2**). The relevant REs and their habitat categorisation as per the guidelines are:

- 11.3.4 (Habitat)
- 11.3.4a (Habitat)
- 11.3.25 (Habitat)
- 11.11.3 (Habitat)
- 11.11.3c (Habitat)
- 11.11.4 (Habitat)
- 11.11.4a (Potential habitat)
- 11.11.4b (Potential habitat)
- 11.11.4c (Habitat)
- 11.12.6 (Habitat)
- 11.12.6a (Habitat)
- 11.11.15 (Habitat)
- 11.12.1 (Habitat).

Hollow-bearing trees and stags did not occur consistently across the communities listed above. Based on the findings of the field survey program, the greatest abundance of hollows and occurrence of medium or large sized hollows was limited to select patches of 11.3.25b, 11.3.4, 11.12.6, 11.11.3, 11.11.3c, 11.11.4a and 11.11.4b. Excluding the *Eucalyptus moluccana* woodland communities, hollows were generally uncommon reflecting the steep terrain, shallow soils and low water availability in the area. Within the access road corridor, suitable hollows were found to be occasional to common in some communities.

However, based on advice from DCCEEW and in response to potential concerns with observer bias in identifying hollow-bearing trees (DES 2022), denning habitat has been identified based on the presence of 'large trees' which are considered as likely to contain or to develop hollows. The *Guide to greater glider habitat in Queensland* (DES 2022) details that trees > 50 cm DBH are preferentially selected for denning and that large tree DBH thresholds for greater glider REs averages 46 cm DBH (range of between 35 and 61 cm DBH). As DBH thresholds vary between REs, the most suitable DBH threshold to be used as a proxy for hollow bearing trees is considered to be the large tree DBH for each relevant RE present. As such, areas of the ground-truthed REs listed above which contained trees which met or exceeded the DBH threshold for the RE were considered likely or current breeding and denning habitat. Where a benchmark for the vegetation community type has not yet been developed by the Queensland Herbarium, the next best available benchmark (same land zone and Broad Vegetation Group (BVG)) was adopted.

To account for the protection of future breeding and denning habitat which may develop with continued growth and senescence of trees, an additional category for breeding and denning habitat has also been mapped. Potential or future breeding and denning habitat has been identified where suitable habitat REs are present and support appropriate tree species with a DBH greater than 30 cm, but less than the RE threshold for large trees.

The remaining areas of connected eucalypt forest and woodland in relevant REs are considered suitable for foraging and dispersal where locally important foraging trees are present however they do not exceed a DBH of 30 cm.

The extent of greater glider (southern and central) habitat within the Study Area Development Corridor and Disturbance Footprint is provided in **Table 2.14**. Greater glider (southern and central) records and modelled habitat within the Study Area are shown on Figure 7.9.

Table 2.14 Habitat Extent and Justification for Greater Glider (Central and Southern)

Habitat Criteria	Mapping Justification	Area (ha)			
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint	Within Enclosed Areas without Mitigation
Likely or Current Denning Habitat					
Eucalypt forests and woodlands in Queensland REs considered habitat or potential habitat as per the Species Specific Guidance – Greater Glider habitats in Queensland (DES, 2022) containing appropriate tree species with a diameter at breast height greater than the RE threshold for large trees.	All areas of the following REs which contained trees that met the DBH threshold for large trees in the BioCondition benchmark: 11.3.25; 11.3.4, 11.3.4a, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.15, 11.12.1, 11.12.6, 11.12.6a.	2,713	454.7	244.7	-
Likely or Current Denning Habitat Impact				**244.7**	

Habitat Criteria	Mapping Justification	Area (ha)			
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint	Within Enclosed Areas without Mitigation
Potential or Future Denning Habitat					
Eucalypt forest and woodlands in Queensland REs considered habitat or potential habitat as per the Species Specific Guidance – Greater Glider habitats in Queensland (DES, 2022) containing appropriate tree species with a diameter at breast height greater than 30 cm, but less than the RE threshold for large trees.	All areas of the following REs which contained trees that had a DBH of 30 cm or greater but less than the DBH threshold for large trees in the BioCondition benchmark: 11.3.25; 11.3.4, 11.3.4a, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.15, 11.12.1, 11.12.6, 11.12.6a.	4,359.0	266.1	175.1	0.7
Potential or Future Denning Habitat Impact				**175.8**	
Foraging and Dispersal Habitat					
Eucalypt forest and woodlands where locally important tree species for foraging are dominant/co-dominant AND in Queensland REs considered habitat or potential habitat as per the Species Specific Guidance – Greater Glider habitats in Queensland (DES, 2022).	All areas of the following REs where trees present did not have a DBH greater than 30 cm and/or did not meet the DBH threshold for large trees in the BioCondition benchmark: 11.3.25; 11.3.4, 11.3.4a, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.15, 11.12.1, 11.12.6, 11.12.6a	5,653.7	333.2	206.0	1.4
Foraging and Dispersal Habitat Impact				**207.4**	
Total Impact Area		**12,725.5**	**1,054**	**627.9**	

2.2.6.5 Habitat Critical to the Survival of the Species

Habitat critical to the survival of the greater glider (southern and central) is defined in the species' Conservation Advice (DCCEEW 2022) as:

- Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region.

- Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonisation.
- Cool microclimate forest/woodland areas (e.g. protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes).
- Areas identified as refuges under future climate changes scenarios.
- Short-term or long-term post-fire refuges (i.e. unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.

Greater glider (southern and central) habitat occurs extensively within the Study Area. Modelled habitat primarily comprises large, connected patches which in places also occur at elevation and have a cool microclimate. Approximately 39% of the total modelled habitat that would be impacted by the Project is identified as likely or current breeding and denning habitat and contains suitably large trees to develop hollows, albeit hollows were observed in low abundance. Although greater glider (southern and central) habitat in the northern Study Area is fragmented, movement pathways to and from the Ulam Range State Forest and to a lesser extent Bouldercombe Gorge Reserve are provided. Based on this, all modelled habitat within the Study Area is considered habitat critical to the survival of the species.

2.2.6.6 Important Populations

When the species was listed Vulnerable, 'important populations' of the greater glider (southern and central) were not identified (DAWE, 2022). As described above, the species status under the EPBC Act was revised in early 2022. As the species is prone to localised extinctions and does not readily recolonise, the Conservation Advice now describes all populations as being 'important'. Further, coastal populations may be important for maintaining genetic diversity as they are geographically distinct from inland populations.

The Study Area is located in a region that has been largely developed for agriculture purposes. Although habitat within the Study Area has a high degree of connectivity to areas to the north and south, it is still possible individuals utilising this habitat are genetically distinct. It is also unclear what impact the 2019–2020 bushfires had on populations in the wider local area. As such, any individuals within the Study Area are conservatively considered an important population.

2.2.6.7 Potential Impacts and Key Mitigation Measures

Potential impacts on this species as a result of the Project include habitat loss, fragmentation and degradation, loss of key habitat resources and exacerbation of pest populations. Vegetation clearing required for the construction of the Project would result in direct impacts of up to 244.7 ha of likely or current denning habitat, 175.8 ha of potential or future denning habitat and 207.4 ha of foraging or dispersal habitat. The Project is linear in nature and has been designed and sited within the Study Area to maximise the use of existing cleared areas and minimise overall habitat fragmentation.

However, some clearing widths within the Disturbance Footprint will be greater than the greater glider (southern and central) is able to volplane. Within the access road corridor, connectivity will be largely maintained as clearing widths will not exceed this volplane distance (post-construction clearing widths of approximately 8 m for the majority of the access road corridor – the current road footprint is approximately 4–5 m) within mapped potential habitat. The loss of habitat is expected to be the impact with the greatest potential consequences.

Enclosed Areas

In some areas, the Disturbance Footprint creates habitat fragments by enclosing potential habitat with roads or other infrastructure (i.e. electrical reticulation and associated clearing) of which, widths exceeds the volplane distance of the species. Although the *Guide to Greater Glider Habitat in Queensland* (DES 2022) states that any RE that has been identified as greater glider habitat, no matter how fragmented, will have value for greater gliders if hollow-bearing trees are present, it is recognised that the species is sensitive to fragmentation (DCCEEW 2022b) and has low viability in small remnants. With consideration of this guidance, any fragments, irrespective of area, may not be viable to sustain greater gliders. Although larger enclosed areas (i.e. >20 ha) may be able to support the ecological requirements of a population of the species, these areas may still contribute to reduced genetic variation and ultimately impact the viability of any population present.

Where greater glider (southern and central) habitat has been enclosed, fragmentation mitigation measures have been considered including glide poles and pinch points. In some cases, enclosed areas are small and fragmentation mitigation measures are not viable. These areas have been included in impact calculations.

Despite the fragmentation impacts that would be sustained, suitable habitat would remain in adjacent areas and the Project would not result in a number of small patches being retained in a broadly cleared landscape.

Pinch Points

Nineteen 'pinch points' are proposed within the Disturbance Footprint associated with areas of greater glider (southern and central) modelled habitat to maintain movement opportunities and minimise fragmentation impacts on the species. Pinch points describe locations of the Disturbance Footprint which are reduced in width to the extent that individuals can readily disperse across (i.e. based on usual volplane distances, the clearing will have a width no greater than 1.2 times the average canopy height at that location). The access road corridor has been designed to minimise fragmentation impacts for greater glider. Additional pinch points have not been identified in this area, as the road access corridor does not exceed the volplane distance of the species within suitable habitat, and as such it effectively serves as a pinch point throughout. A total of 19 pinch points has been proposed for the Project (Figure 9.2).

Glide Poles

Glide poles will be established in areas where mapped greater glider (southern and central) habitat is intersected by the Disturbance Footprint. Areas prioritised for glide poles include sections of the Disturbance Footprint where the species is known to occur, areas which intersect with likely or current denning habitat, or areas of any habitat type which occur along enclosed sections of the Disturbance Footprint.

Glide poles were strategically placed to maximise movement options for greater glider (southern and central), particularly in areas where the Disturbance Footprint may present a barrier to movement. These locations were selected in consideration of potential movement pathways for the species (creek lines or eucalypt gullies) particularly where high value habitat such as likely or current denning occurs on either side of the Development Corridor. It should be noted that in areas under the 275 kV line where clearing widths are up to 70 m–100 m, glide poles are likely to be ineffective and hence pinch points have been preferenced wherever they are feasible.

Where glide poles were placed around enclosed areas, consideration was given to the movement options for individuals once they have exited the enclosed area. For example, glide pole placement was prioritised to facilitate movement into high value habitat including likely or current denning habitat.

The highest density of glide poles will be placed within these areas to afford maximum dispersal opportunity for any individuals which may occur within enclosed areas, and where the highest abundance of individuals is expected to occur (within likely or current denning habitat and where the species has been previously observed). While in areas of foraging and dispersal habitat where no enclosed areas occur along the Disturbance Footprint, a lower density of glide poles is proposed. A total of 38 glide poles have been proposed for the Project (Figure 9.2). Glide poles will be 15 m high throughout the Disturbance Footprint, with the exception of 5 locations beneath 33 kV line where 8 m glide poles are proposed to account for clearance requirements. At these locations, clearing widths are up to 30 m (Figure 9.2).

As there is still some uncertainty around the use of glide poles by greater glider (southern and central), a glide pole monitoring program will be developed to determine the efficacy of this mitigation measure.

Glide Pole Monitoring Program

To identify the effectiveness and utilisation of glide poles, a monitoring program will be developed. This monitoring program will determine if the fauna movement infrastructure is effective in aiding movement of the greater glider (southern and central) and maintaining connectivity across habitat areas. The monitoring program will include the following:

- Regular monitoring over an appropriate period of time (up to 5 years) in areas where the species has been previously recorded and where habitat may be fragmented. This includes monitoring glide poles for utilisation, as well as general population monitoring. This will identify if glide poles are being used and if the species is dispersing or persisting in all areas of potential habitat.
- Monitoring would likely include the use of camera traps, spotlighting and scat surveys. The camera traps would be set up to view the glide poles such that it can be determined if gliders are utilising these poles to disperse, as well as to determine use of habitat within and outside of potentially fragmented areas.

Greater monitoring effort will be undertaken in areas where the species has been previously recorded and habitat is of the highest quality. This will be the most effective way to identify if the greater glider (southern and central) is persisting within habitat adjacent to the Disturbance Footprint and/or dispersing across the Project using the glide poles or natural vegetation.

If within two years there is no evidence available to demonstrate adequate use of glide poles for dispersal across the Disturbance Footprint, corrective actions will be identified and implemented to provide movement opportunity for this species. Dispersal by use of glide poles will be considered adequate if there are multiple observations of the species utilising glide poles during a 12 month period of the monitoring program. If other methods for fauna movement cannot be developed or do not support movement for the greater glider (southern and central) within a subsequent two years of monitoring post implementation, supplementary offsets for the resulting fragmentation impacts for the isolated population will be developed.

Supplementary Offsets

Where pinch points are included in design and provide suitable dispersal opportunities to adjacent habitat, habitat fragments are considered to be functionally connected and maintain their viability as habitat in the long-term. However, as there is still some uncertainty around the utilisation of glide poles by greater glider (southern and central), habitat fragments which only include glide poles and no pinch points may require supplementary offsetting if glide poles are not found to be effective during the glide pole monitoring program. Areas which may require supplementary offsets are presented in Figure 9.2. The magnitude of supplementary offsets is presented in **Table 2.15** below.

Table 2.15 Enclosed areas potentially requiring supplementary offsets

Habitat Category	Enclosed area (ha) potentially required supplementary offsets
Likely or current denning habitat	4.1 ha
Potential or future denning habitat	2.3 ha
Foraging or dispersal habitat	34.4 ha
Total	**40.8 ha**

Mitigation Measures

In addition to the general mitigation and management measures outlined in Section 9.3.1 which include pest monitoring, the following species-specific mitigation measures will be implemented:

- Where clearing is proposed for areas of greater glider (southern and central) denning habitat, pre-clearance surveys must include canopy searches and inspections of suitably sized hollows (>8 cm diameter). Where inspection of hollows cannot be safely undertaken prior to felling, the hollow-bearing tree will be slow felled to minimise the chances of injury or death and will be inspected by a qualified fauna spotter to confirm presence or absence of greater glider. If an individual is found to be present, it will be inspected for injury and if healthy, relocated to an adjacent area of mapped breeding and denning habitat after dusk. If the individual is injured it will be transported to a local wildlife carer and rehabilitated prior to releasing in a suitable area adjacent to the location in which it was found.

- Every effort will be made to retain suitable hollow bearing trees (those containing hollows >8 cm diameter) within areas identified as denning habitat including *Eucalyptus moluccana* woodlands.
The retention of trees >30 cm DBH on patch edges will be prioritised next in areas of potential greater glider (southern and central) habitat. Trees to be retained within the Disturbance Footprint must be clearly demarcated and avoided. If deemed necessary, a Tree Protection Zone (TPZ) may be established.

- In areas of habitat where greater gliders (southern and central) are known to occur (i.e. the far northern Study Area), cleared suitable hollows (>8 cm diameter) will be replaced at a 1:2 ratio with a suitable nest box, to be installed in adjacent suitable habitat (i.e. two nest boxes for every hollow removed). A nest box is considered suitable if it is a design known to be used by the greater glider.

- Glide poles are proposed to be installed at 38 locations within the Disturbance Footprint to provide movement opportunities between areas of suitable habitat in the landscape (Figure 9.2). The proposed glide pole locations represent areas important for dispersal and where ongoing connectivity is required to avoid isolation of patches and retention of possible high use areas (i.e. riparian corridors and *Eucalyptus moluccana* woodlands). Glide pole locations will be finalised during the detailed design phase of the Project. To identify the effectiveness and utilisation of glide poles, a monitoring program will be developed.

- Nineteen 'pinch points' (excluding the access road corridor which is acts as a pinch point throughout) are proposed within the Disturbance Footprint associated with areas of greater glider (southern and central) modelled habitat to maintain movement opportunities and minimise fragmentation impacts on the species (Figure 9.2). Pinch points locations will be finalised during the detailed design phase of the Project.

- No barbed wire fencing will be installed as part of the Project within the Study Area unless strictly necessary (i.e. substation).

- In the unlikely event that a greater glider (southern and central) or yellow-bellied glider (south-eastern) is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.

2.2.6.8 Significant Impact Assessment

The significant impact assessment for the species is presented in **Table 2.16** below. Although using the criteria for Vulnerable species, this assessment still considers the latest species information presented in the *Guide to Greater Glider Habitat in Queensland* (Department of the Environment and Science 2022) and the species' Conservation Advice (Department of Climate Change Energy the Environment and Water 2022).

In line with the *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment 2013a), only the adverse impacts on the species that may arise as a result of the Project have been considered (and not potential beneficial impacts). Although included in the broader discussion of potential impacts below, it is acknowledged that rehabilitation (which may be considered a beneficial impact) does not negate or offset the loss of habitat. The assessment of significance has been made independent of these measures and applies the precautionary principle as appropriate.

In summary, the assessment found that the Project **is likely to result in a significant impact** on the greater glider (southern and central).

Table 2.16 Significant Impact Assessment – Greater Glider (Central and Southern)

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**No.** Greater glider was recorded at two locations during the field survey program; once in the far north adjacent to the Disturbance Footprint and twice at a location immediately west of the Study Area. As described in **Section 2.2.6.8**, any individuals present are considered to constitute an important population as they may be important for maintaining genetic diversity. A number of REs identified to comprise greater glider 'habitat' or 'potential habitat' as per DES (2022) occur within the Disturbance Footprint and wider Study Area. Apart from the *Eucalyptus moluccana* woodland community however, findings from the field surveys determined that suitable hollow-bearing trees are generally absent or in low abundance, with the exception of several areas within the access road corridor where they were found to be occasional to common. Despite this, based on recent advice from DCCEEW, denning habitat has been mapped based on the DBH of trees within the community and their potential to bear hollows, rather than the physical presence of hollows themselves. On this basis, large areas of vegetation communities with trees which exceeded the DBH threshold have been included in denning habitat mapping which were found not to bear suitable hollows. As such it is likely that the modelled extent of denning habitat which is being utilised by the species is overstated. A maximum of 627.9 ha of greater glider habitat would be directly impacted for construction of the Project, including 244.7 ha currently suitable for denning, 175.8 ha which may be suitable for denning in the future and 207.4 ha suitable for foraging and dispersal. Suitable habitat for the greater glider dominates the Study Area and is not considered unique or high quality due to the rocky substrate and low water availability (resulting in stunted tree growth and low hollow abundance), historical clearing for agricultural works and ongoing disturbance from weeds and pests. Habitat fragmentation impacts have been considered in the design and siting of the Disturbance Footprint. Through the use of pinch points and the installation of glide poles at select locations, movement opportunities for the species will be provided across the Disturbance Footprint. Habitat availability is expected to be high in the wider local area. There are several protected areas adjacent to the Study Area including Gelobera State Forest and Don River State Forest which are likely to provide a greater abundance of important habitat resources including hollow bearing trees or stags. Modelled habitat has a relatively high degree of connectivity both internally and to external areas including the State Forests, and this connectivity will be largely maintained following the construction of the Project. Potential indirect impacts on the species as a result of the Project are expected to be limited but will be actively managed via the Project management plans which will include specific measures for the greater glider including pre-clearance survey requirements. Based on the above, a long-term decrease in the size of an important population is unlikely to result from the Project.

Evaluation Criteria	Response
Reduce the area of occupancy of an important population	**No.** The greater glider has a large distribution extending across the majority of the east coast of Australia. The species area of occupancy is estimated at 15,316 km^2, however this may be overstated given the low resolution in the mapping methodology used by the Commonwealth (2 km x 2 km grid). An important population of the species is considered potentially present within the Study Area. Direct impacts via vegetation clearing will occur to a maximum of 244.7 ha of likely or current denning habitat, 175.8 ha of potential or future denning habitat and 207.4 ha of foraging or dispersal habitat. The Project is linear in nature and clearing will be minimised wherever possible. Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges. Through the installation of glide poles and the inclusion of pinch points within the Disturbance Footprint, movement within and to adjacent areas will be facilitated. Large tracts of connected habitat will remain following the construction of the Project and no significant patch isolation will occur. Furthermore, the Study Area does not occur near the limit of the species distribution. Based on this, Project works are considered unlikely to materially reduce the availability or quality of habitat for the species to the point where the occupancy of an important population would be reduced.
Fragment an existing important population into two or more populations	**No.** As described above, the Study Area potentially supports an important population of greater gliders (southern and central). The species is known to have limited dispersal capacity and is sensitive to habitat fragmentation. Modelled habitat within the Disturbance Footprint (and wider Study Area) generally has low to moderate levels of existing fragmentation as a result of historical clearing and ongoing agricultural practices. The Study Area is also functionally connected to adjacent protected areas and large tracts of suitable habitat for the species. Through considered design and siting of the Disturbance Footprint, internal connectivity within and to adjacent protected areas will be largely maintained. The use of existing cleared areas has been maximised and no significant patch isolation will occur. Nineteen pinch points will also be maintained within the Disturbance Footprint and glide poles will be installed at 38 locations to facilitate ongoing movement. To ensure suitability for the dispersal of the greater glider, the clearing width at pinch points will be determined based on the canopy height at those locations and the usual greater glider volplane distances. These fragmentation mitigation measures have been strategically placed to maximise movement options. Glide poles, pinch points or a combination of the two have been sited where habitat fragments have been created by enclosing potential habitat with roads or other infrastructure. Where glide poles/pinch points were placed around enclosed areas, consideration was given to the movement options for individuals once they have exited the enclosed area. For example, glide pole placement was prioritised to facilitate movement into high value habitat including likely or current denning habitat. As a priority, clearing will be minimised at watercourse crossings noting that riparian vegetation may present important movement corridors for the species. This includes design measures which have sought to cross watercourses at as close as possible to 90 degrees. Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges.

Evaluation Criteria	Response
	Once constructed, the Project itself will only create localised barriers to movement, however these barriers will not to be of the extent that they would fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely.** As described in **Section 2.2.6.5** above, all suitable greater glider (southern and central) habitat within the Study Area has been conservatively considered to meet the definition of habitat critical to the survival of the species. Modelled greater glider (southern and central) habitat generally comprises large, contiguous patches with high connectivity to the surrounding landscape including to protected areas. Up to 627.9 ha of suitable habitat will be directly impacted via vegetation clearing for construction of the Project, including 244.7 ha of likely or current denning habitat, 175.8 ha of potential or future denning habitat and 207.4 ha of foraging or dispersal habitat. Although micro-siting efforts will aim to retain hollow-bearing trees, the loss of some will be unavoidable and it is noted these are a limited feature in the landscape. While large areas of suitable habitat will remain following the construction of the Project, this removal of habitat and key habitat features is likely to be of the magnitude to be considered an 'adverse effect' on habitat critical as per the Conservation Advice.
Disrupt the breeding cycle of an important population	**Likely.** An important population of greater gliders (southern and central) is potentially present within the Study Area. The species is reliant on hollow-bearing trees for breeding and has a low reproductive rate. Females give birth to a single young between March – June (McKay 2008). Clearing may occur within areas of potential breeding and denning habitat during the species' breeding season. Pre-clearance surveys will be conducted in areas of habitat to be cleared and include searches for denning individuals. Active animal breeding places will not be tampered with without an approved DES SMP. Micro-siting will aim to retain hollow-bearing trees where possible. However as stated above, it is anticipated that some suitable hollow-bearing trees will require removal. In areas of known greater glider habitat (i.e. the far northern Study Area), for every suitable hollow that is removed two suitable nest boxes will be installed. While this measure is anticipated to limit the chances of a net loss of suitable hollows, it is noted that this habitat resource is already limited in the landscape and individuals may not inhabit nest boxes for unknown reasons. Based on this, it is considered likely the Project would disrupt the breeding cycle of an important population.

Evaluation Criteria	Response
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**No.** A maximum of 627.9 ha of greater glider (southern and central) habitat will be directly impacted for construction of the Project, including 244.7 ha of likely or current denning habitat, 175.8 ha of potential or future denning habitat and 207.4 ha of foraging or dispersal habitat. As described earlier, suitable habitat for the greater glider dominates the Study Area and is not considered unique or high quality due to the rocky substrate and low water availability (resulting in stunted tree growth and low hollow abundance), historical clearing for agricultural works and ongoing disturbance from weeds and pests. The Project is linear in nature and clearing will only be completed as strictly required. Habitat fragmentation impacts will be minimised through the use of pinch points and the installation of glide poles at select locations, ensuring movement opportunities for the species are provided across the Disturbance Footprint. Modelled habitat has a relatively high degree of connectivity both internally and to external areas including the State Forests, and this connectivity will be largely maintained following the construction of the Project. No significant isolation of patches will occur. Potential indirect impacts on the species as a result of the Project are expected to be limited but will be actively managed via the Project management plans. Specific measures for the greater glider (southern and central) will be implemented including pre-clearance survey requirements. Based on the above, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability 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	**No.** Europea fox and feral cats are invasive species that are known to predate upon the greater glider (central and southern). While feral cat was recorded during the field survey program, European red fox was not, however, this species is likely to occur within the Study Area and wider region. It is unlikely the Project will result in the establishment of further feral species, or exacerbate current populations within greater glider habitat. Nonetheless, the Project will employ best practice control methods for weeds and pests which includes monitoring and adaptive management.
Introduce disease that may cause the species to decline	**No.** The species is not known to be vulnerable to disease directly. Phytophthora root fungus (*Phytophthora cinnamomic*) has the potential to indirectly impact the species via the infection of eucalyptus trees. The Project will implement best practice biosecurity protocols therefore, introduction of a disease that may cause the species to decline is unlikely.

Evaluation Criteria	Response
Interfere substantially with the recovery of the species	**Possibly.** There is no recognised recovery plan for the species, however one is required to stop decline and abate threats. The recently published Conservation Advice (DCCEEW, 2022) includes conservation and management priorities which are grouped into four key themes including habitat loss, disturbance and modification (including fire), climate change, invasive species (including threats from predation, grazing, trampling) and ex-situ recovery actions. Habitat loss, disturbance and modification is a recognised threat to the species. Whilst the final impact area to suitable habitat will be smaller than the area currently represented in the Disturbance Footprint, the loss of hollow-bearing trees will still occur and the Project will impact known habitat types where the species was recorded during field surveys (i.e. *Eucalyptus moluccana* woodland). Modelled habitat may also be of regional significance to the species due to its role in providing connectivity and dispersal opportunities along the Ulam Range. The Project may interfere with the recovery of the species by reducing the availability of habitat in the regional context, albeit to a limited extent.

2.2.7 Grey-headed Flying-fox (*Pteropus poliocephalus*)

2.2.7.1 Description and Status under the EPBC Act

The grey-headed flying-fox is Australia's only endemic flying-fox. The grey-headed flying-fox is listed Vulnerable under the EPBC Act.

2.2.7.2 Distribution and Habitat Requirements

The grey-headed flying-fox is endemic to Australia and occurs from Ingham in Queensland to Adelaide in South Australia. They are usually found on the coastal lowlands and slopes of eastern Australia below altitudes of 200 m (Department of Environment and Water 2021). The species is widespread throughout their range in summer, whilst in autumn it occupies coastal lowlands and is uncommon inland. The grey-headed flying-fox is highly mobile and considered 'highly adaptable' given its proclivity to occupy urbanised environments.

The grey-headed flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. The primary food source is blossom from *Eucalyptus* and related genera but in some areas it also utilises a wide range of rainforest fruits. None of the vegetation communities used by the grey-headed flying-fox produce continuous foraging resources throughout the year. As a result, the species has adopted complex migration traits in response to ephemeral and patchy food resources and only a small proportion of its' wide range is used at any one time.

The grey-headed flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of *Melaleuca*, mangroves and riparian vegetation.

Grey-headed flying-foxes commute daily to foraging areas, usually within 15 km of the day roost site. They are capable of nightly flights of up to 50 km from their roost to different feeding areas as food resources change. At most times of the year there is a complete exodus from the colony site at dusk.

2.2.7.3 Threats

The *National recovery plan for the Grey-headed flying-fox Pteropus poliocephalus* (Department of Environment and Water 2021) identifies the key threats to the species as:

- Habitat loss, particularly:
  - Clearing of winter foraging resources.
  - Loss of rooting habitat.
- Camp disturbance via conflict with humans.
- Mortality in commercial fruit crops – animals being killed from crop management practices including shooting by orchardists.
- Heat stress.

- Entanglement in netting and barbed wire fencing – animals can become entangled in netting over fruit trees and thousands of animals die or face permanent injury from entanglement in barbed wire.
- Climate change – has the potential to affect food availability and heat-related mortality.
- Bushfires – resulting in the loss of foraging habitat and resources leading to mortalities.
- Electrocution on powerlines.
- Zoonotic diseases.

2.2.7.4 Occurrence and Potential Habitat within the Study Area

No records of the species were observed during the field survey program which included 62 person hours of spotlighting. Database records indicate that several historical records occur surrounding Rockhampton, the most recent of which (1995) occurs approximately 42 km from the northern boundary of the Study Area. Other records in the wider local area include a number of observations surrounding Gladstone (including records from 2002, 2007 and 2019), approximately 60 km east of the Study Area. Although potential habitat is identified within the Study Area (as described further below), the species was determined to have a low likelihood of occurrence within the Study Area due to the lack of nearby records.

Based on the quarterly data from the National Flying-fox Monitoring Program (contained within the National Flying-fox Monitoring Viewer), the nearest regularly occupied camps are in Bundaberg, approximately 200 km southeast of the Study Area. However, grey-headed flying-fox have been observed roosting in Wowan (approximately 11 km northwest of the Study Area), Kabra, near Rockhampton (approximately 32 km northeast of the Study Area) and Keppel Sands (approximately 49 km northeast of the Study Area). The most recent observations of grey-headed flying-foxes roosting in these camps are from 2019 in Keppel Sands (1–499 individuals – camp #367) and Wowan (1–499 individuals – camp #755) and 2017 in Kabra (1–499 individuals – camp #362). Individuals have been identified in all camps on only one occasion since the beginning of the National Flying-fox Monitoring Program. None of these camps constitute ‘Nationally important camps’ (Department of Environment and Water 2021) as they have not contained ≥ 10,000 individuals in more than one year in the last 10 years, or have been occupied by more than 2,500 grey-headed flying-foxes permanently or seasonally every year for the last 10 years.

The locations of flying-fox camps are generally stable through time, although pattens of camp occupation vary. Given the paucity of grey-headed flying-fox camps within proximity to the Study Area, and no camps being observed during field surveys despite extensive effort, it is considered that roosting habitat is absent from the Study Area.

The majority of the Study Area (with the exception of the western extent of the access road corridor) falls outside of the typical nightly foraging commute (20 km) for the species and is outside of the indicative extent of foraging habitat as per Map 1 of the *National Recovery Plan for the Grey-headed Flying-fox* (Department of Environment and Water 2021). However, two camps (Wowan and Kabra) do occur within the maximum distance grey-headed flying-foxes have been known to fly to forage (40 km). Although movements of these distances are rare, it is considered possible that the species could sporadically forage in *Eucalyptus* woodlands in the Study Area which contain known important foraging species (RE 11.3.4a, RE 11.12.1, 11.12.6, 11.11.3. 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.3.4, 11.3.25 and 11.3.25b). Known important foraging species in these vegetation communities include *Eucalyptus crebra*, *Eucalyptus tereticornis* and *Corymbia citriodora*. If used by grey-headed flying-fox, it is likely to be infrequent, given the distance from known camps and the sporadic occupation of these camps.

The extent of modelled habitat within the Study Area, Development Corridor and Disturbance Footprint is provided in **Table 2.17**. Grey-headed flying-fox records (ALA), the nearest known roost and potential habitat within the Study Area is shown on Figure 7.10.

Table 2.17 Habitat Extent and Justification for Grey-headed Flying-fox

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Foraging				
Any vegetation community (remnant or regrowth) which contains important winter/spring flowering species (as defined in the National Recovery Plan) within 40 km of known camps (Wowam camp #755 & Kabra camp #362).	The REs listed below where they occur within 40 km of a known camp and contained important winter/spring flowering species: REs 11.12.1, 11.12.6, 11.12.6a, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.4d, 11.3.4, 11.3.4a, 11.3.25 & 11.3.25b,	8,811.1	510.4	277.3
Roosting				
Any vegetation community (remnant and regrowth REs) located within a 20 km radius of a flying fox camp known to regularly support grey headed flying-foxes.	No camps (based on DCCEW's interactive flying-fox web viewer) that fit the habitat mapping criteria are known to occur. Further, no observations of flying-fox camps have been made during the extensive field survey effort. As such no roosting habitat has been mapped.	-	-	-
	Total	**8,811.1**	**510.4**	**277.3**

2.2.7.5 Habitat Critical to the Survival of the Species

Habitat critical to the survival of this species, as described in the *National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus* (Department of Environment and Water 2021) includes:

- Important winter and spring vegetation communities that contain the following species:
  - *Eucalyptus tereticornis, Eucalyptus albens, Eucalyptus crebra, Eucalyptus fibrosa, Eucalyptus melliodora, Eucalyptus paniculata, Eucalyptus pilularis, Eucalyptus robusta, Eucalyptus seeana, Eucalyptus sideroxylon, Eucalyptus siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora, Corymbia eximia, Corymbia maculata, Grevillea robusta, Melaleuca quinquenervia* or *Syncarpia glomulifera*.
  - Vegetation communities that contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May).
  - Vegetation communities that contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer.

- Vegetation communities that contain native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp as identified on the Department's interactive flying-fox web viewer.

Within the Study Area, vegetation communities which broadly meet the above definitions includes those which contain *Eucalyptus crebra*, *Eucalyptus tereticornis* and *Corymbia citriodora*. However, this only applies to areas in the north and west of the Study Area and along the access road corridor, which occur within the maximum extent of the foraging commute for the species from two camps which have historically supported small numbers of the species (1–499 individuals in 2017 (Kabra) and 2019 (Wowan)).

2.2.7.6 Important Populations

Important populations are not identified in the *National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus* (Department of Environment and Water 2021). As such the generic definition for important populations in the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (Department of the Environment 2013a) has been applied. This document defines an 'important population' as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity.
- Populations that are near the limit of the species range.

Nationally Important Camps have been identified on the DCCEEW interactive flying fox web viewer. Nationally Important Camps are flying fox camps that have contained ≥ 10,000 grey-headed flying-foxes in more than one year in the last 10 years or have been occupied by more than 2,500 grey-headed flying-foxes permanently or seasonally every year for the last 10 years (Department of Environment and Water 2021). No Nationally Important Camps are located within proximity to the Study Area, including within nightly foraging distances – the nearest is in Hervey Bay, approximately 265 km to the southeast.
Further, the nearest known camp is approximately 11 km northwest of the most western point of the access road corridor at Wowan, which has only recorded 1–499 grey-headed flying-foxes during a single survey event (2019). The low number of individuals which sporadically use camps in the region would not be sufficient to constitute a key source population for breeding or dispersal.

Although the species is spatially structured into colonies, there is constant genetic exchange and movement between camps throughout the species' entire geographic range. Given this ongoing movement between camps and the species high mobility capacity, no population or sub-population within the Study Area would be necessary for maintaining genetic diversity. Furthermore, the species is known to occur from Geelong in Victoria to Ingham in Far North Queensland and therefore the population is not near the limit of the species range.

Given the context above, any population which may utilise the Study Area is unlikely to represent an important population.

2.2.7.7 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a total of 277.3 ha of potential foraging habitat will be cleared for construction of the Project. However, as detailed above habitat within the Study Area and likely wider Study Area is unlikely to be relied upon by a population, given the large areas of potential habitat that are likely to occur in closer proximity to known roosts. The Study Area does not occur between known roosts or Nationally Important Camps, indicating it is unlikely to be used as a movement corridor.

Potential impacts on the grey-headed flying-fox as a result of the Project may occur during the operation phase. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the grey-headed flying-fox has a Moderate risk of turbine collision. While the species is likely to only occur rarely within the Study Area, it may fly at RSA height. Other Project related indirect impacts relevant to the grey-headed flying-fox include disturbance to unidentified roosts.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- In the event that a flying-fox congregation is identified within the Disturbance Footprint, an exclusion zone will be established. A suitably qualified person will refer to the *Interim Policy for Determining When a Flying-fox Congregation is Regarding as flying-fox Roost under Section 88C of the Nature Conservation Act 1991* (DES, 2021) to determine if the congregation could be considered a roost. If determined that the congregation constitutes a roost, impacts to the flying-fox congregation will be managed in accordance with the *Code of practice – Ecologically Sustainable Management of Flying-fox Roosts* (DES, 2020).
- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single grey-headed flying-fox death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to the grey-headed flying-fox are detailed in the Preliminary BBAMP.

2.2.7.8 Significant Impact Assessment

The significant impact assessment for the species is presented in **Table 2.18** below. This assessment considers the latest species information presented in the *National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus* (Department of Environment and Water 2021). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the grey-headed flying-fox.

Table 2.18 Significant Impact Assessment – Grey-headed Flying-fox

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**No**. The grey-headed flying-fox is considered to have a low likelihood of occurrence within the Study Area. This species was not recorded during the field survey program, however as per the National Flying Fox Monitoring program it is known from roosts in the wider region. The nearest camp with grey-headed flying-foxes occurs approximately 11 km northwest of the Study Area, however this camp does not meet the definition of a Nationally Important Camp. As described in **Section 2.2.7.6**, an important population is unlikely to utilise modelled potential habitat. Under worst-case scenario, a maximum of 277.3 ha of potential foraging habitat will be directly impacted via vegetation clearing required for construction of the Project. Given its location in the landscape (away from known roosts and at elevations predominantly above 200 m), potential habitat is likely to only be utilised occasionally by a small number of individuals under ideal conditions when canopy trees are in flower. Clearing will occur in phases, ensuring only a subset of the Disturbance Footprint is impacted at one time and allowing any individuals present to relocate. Final clearing areas are expected to be lower as clearing will only be completed as strictly necessary and will be minimised via micro-siting of Project infrastructure. The quantum of habitat that will remain following construction of the Project will be sufficient to maintain any individuals that may temporarily use the site. Furthermore, the State Forests and adjacent areas directly north and west are likely to contain large areas of suitable and higher quality habitat. These areas, and low-lying coastal areas to the east are anticipated to be preferred given their closer proximity to known camps. The turbine collision risk assessment identified the species as being of Moderate risk for impacts from the Project. The potential impact on this species during operation would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. Given that an important population does not occur and potential habitat is unlikely to be relied upon for any part of the species' life cycle, it is unlikely that the Project will lead to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**No**. The grey-headed flying-fox has a large distribution across eastern Australia. Patterns of occupancy and relative abundance within its distribution vary widely seasonally and temporally. Potential habitat within the Study Area occurs at the limit of the species nightly foraging distances and is largely at elevations greater than 200 m. Large areas of higher quality habitat are likely to occur in the wider area, including east in the coastal lowlands and within the State Forests north and west of the Study Area. Furthermore, the Study Area does not occur between known camps and therefore it is unlikely transiting individuals would occur within. No known roosts in the region comprise a Nationally Important Camp. An important population is unlikely to utilise the Study Area given an absence of a known population (as camps or individual) of this species. Given the above, the Project is unlikely to reduce the area of occupancy of an important population.

Evaluation Criteria	Response
Fragment an existing important population into two or more populations	**No**. As described above, the Study Area does not support an important population of grey-headed flying-fox. This species is highly mobile, travelling large distances across cleared and developed landscapes at night in search of suitable foraging habitat. It is adaptable and known to occur in high human use areas such as townships. The removal of habitat within the Disturbance Footprint is unlikely to limit this species capacity to travel between known roosts or other areas of foraging habitat, as clearing will be linear in shape and the species has extremely high mobility capacity. An increase in activity during construction is unlikely to disturb any individuals that may occur temporarily, noting that construction activity at night will likely be low to absent. During the operational phase, the wind turbines may pose a potential barrier to movement. The turbine collision risk assessment identified the species as being of Moderate risk for impacts from the Project. The potential impact on this species during operation would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. However, as described above the Study Area does not occur between known camps and it is therefore unlikely the Study Area occurs within a regular movement corridor. Given this, and the absence of an important population present, the proposed impact is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**No.** As described in **Section 2.2.8.5**, modelled potential foraging habitat broadly meets the definition of habitat critical to the species as it includes vegetation communities which contain *Eucalyptus crebra*, *Eucalyptus tereticornis* and *Corymbia citriodora*. The majority of this habitat (with the exception of smaller areas along the access road corridor) occurs at the maximum extent of the foraging commute for the species and at high elevation and is therefore unlikely to be used regularly or relied upon by any individuals or populations. Vegetation clearing required for the Project will result in the removal of a maximum of 277.3 ha of potential foraging habitat. However, clearing will be linear in nature and minimised where possible via micro-siting. The quantum of potential habitat that will remain should be sufficient to maintain any individuals that may occur. Furthermore, suitable foraging habitat is likely to occur extensively within the wider region, including in areas much closer to known camps. The Project is unlikely to lead to indirect impacts on the species or the species habitat. In the unlikely event that a flying-fox congregation is identified within the Development Corridor, an exclusion zone will be established. A suitably qualified person will refer to the *Interim Policy for Determining When a Flying-fox Congregation is Regarding as flying-fox Roost under Section 88C of the Nature Conservation Act 1991* (DES, 2021) to determine if the congregation could be considered a roost. If determined that the congregation constitutes a roost, impacts to the flying-fox congregation will be managed in accordance with the *Code of practice – Ecologically Sustainable Management of Flying-fox Roosts* (DES, 2020). DES will be contacted to ensure no unintentional impacts on a potential roost will occur. Based on the above, it is considered unlikely the Project will adversely affect habitat critical to the survival of the species.

Evaluation Criteria	Response
Disrupt the breeding cycle of an important population	**No.** This species breeds annually in camps with births occurring from October to December when foraging resources are generally most abundant. As per the National Flying-fox monitoring viewer, the closest known roost is 11 km northwest of the western extent of the access road corridor and the species was last recorded at this location in 2019 (1–499 individuals). Given the distance to the nearest known camp, clearing works required for construction of the Project are highly unlikely to disturb roosting individuals. In the unlikely event that a flying-fox congregation is identified within the Development Corridor, an exclusion zone will be established and no disturbance to that area permissible until the potential presence of a roost is determined in consultation with DES. Furthermore, as foraging resources during this period are likely to abundant in the wider area the maximum loss of 277.3 ha of foraging habitat is unlikely to materially reduce the availability of suitable foraging habitat required by any breeding individuals that may be temporarily utilising the area. As described above the Study Area is not considered to support an important population. The Project is therefore unlikely to 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	**No**. The maximum loss of 277.3 ha of potential foraging habitat is considered to have a low to negligible impact on the species given the landscape context which offers large, continuous patches of remnant vegetation in protected areas to the north and west, and in low-lying coastal areas to the east. This species is unlikely to rely on the potential habitat contained within the Study Area given its location relative to known roosts, occurring at a distance greater than the average nightly foraging commute (with the exception of small areas of potential habitat within the access road corridor). Further, this species is highly mobile and known to fly over cleared or modified environments and as such clearing associated with the Project would not result in isolation of habitat. The removal of habitat contained within the Disturbance Footprint is therefore unlikely to 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	**No.** Both weed and pest species were recorded throughout the field survey program. However, invasive species are not a known threat to the grey-headed flying-fox in any capacity. Nonetheless, the Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels. Therefore, the Project is unlikely to result in the establishment of invasive species in grey-headed flying-fox habitat.
Introduce disease that may cause the species to decline	**No.** There is very little information available on the impact of disease on Australian flying-fox populations, including grey-headed flying-foxes. Australian flying-foxes including the grey-headed flying-fox are natural reservoirs for at least three zoonotic diseases including Australian Bat Lyssavirus, Hendra virus and Menangle virus. The incidence of Lyssavirus in the species is low (<1 %).

Evaluation Criteria	Response
	The Project is highly unlikely to facilitate the spread of zoonotic diseases. In the unlikely event that an injured individual is located, an authorised and vaccinated wildlife rescuer will be engaged. The Project will employ best practice biosecurity measures during construction and operation. Based on this, it is considered unlikely the Project will introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**No.** As defined in the *National Recovery Plan for Grey-headed Flying-fox Pteropus poliocephalus*, recovery objectives for this species include: • development of a robust estimate of an increasing population trend • an improved understanding of habitat critical to the survival of the species • an increase in protection of habitat critical to the survival of the species and nationally important camp sites • implementation of effective habitat restoration projects • a reduction of conflict between people and flying-foxes in residential areas through • investment in household mitigation measures • greater uptake of crop netting under subsidy schemes • decrease in the number of licences issued to harm the species • an improved understanding of threats with as yet unquantified impacts on flying foxes, such as electrocution, entanglements and climate change. The Project is considered unlikely to impede on any of the above recovery objectives. Habitat loss and degradation, possibly the greatest threat to the species, is likely to occur to allow for construction of the Project. However, potential habitat to be impacted is highly unlikely to be relied upon by the species given its distance from known roosts and the availability of similar habitat in the region. Furthermore, large areas will be retained within the Study Area that are of sufficient size to maintain any individuals that may occur. Noting that higher quality habitat exists in closer proximity to known roosts north and west, the nature and scale of the impact is unlikely to have a material effect on the species persistence within the region or as a whole.

2.2.8 Yellow-bellied Glider (*Petaurus australis*)

2.2.8.1 Description and Status Under the EPBC Act

The yellow-bellied glider (south-eastern) is a medium-sized nocturnal arboreal marsupial, occurring in eucalypt-dominated woodland and forest (ACT Government, 2023). The sub-species is found across eastern Australia, including Queensland, New South Wales and Victoria. The yellow-bellied glider (south-eastern) was listed as Vulnerable under the EPBC Act on 2 March 2022 (DAWE 2022e).

2.2.8.2 Distribution and Habitat Requirements

In Queensland, the sub-species is distributed along the coast and eastern seaboard, from the north of Mackay extending southward through the NSW-QLD border. There are also some isolated smaller populations found inland within the Carnarvon Ranges and Blackdown in central Queensland.

The yellow-bellied glider (south-eastern) shows preference for large patches of mature old growth forest, particularly with winter-flowering and smooth-barked eucalypt species, that provide suitable foraging habitat and shelter (DAWE 2022e). The sub-species relies on hollows for shelter and denning purposes during the day; suitable hollows are generally found in large living trees usually >1 m in diameter. They live in family groups of two to six individuals within exclusive home ranges of approximately 50–65 ha. Because the trees used for foraging and shelter are dispersed and use may vary over time and space, large home ranges are needed (DAWE 2022e).

As detailed in the subspecies' Conservation Advice, yellow-bellied gliders (south-eastern) also require some level of floristic diversity to provide a year-round food supply, and they are unlikely to persist in forests dominated by only one or two tree species. Sap feed trees are a critical habitat feature and form an important component of the diet of the yellow-bellied glider (south-eastern), especially when alternative food sources are limited (DAWE 2022e). Smooth-barked eucalypts are important due to the range of foraging substrates (and therefore food resources) they provide, as loose bark hanging in strips from these trees provides shelter for insect prey. A 2005 study by J. Eyre identified 13 sap tree species in southern Queensland including *Corymbia citriodora*, *Eucalyptus biturbinata*, *E. longirostrata*, *E. major*, *E. melliodora*, *E. moluccana*, *E. tereticornis*, *E. racemosa*, *E. resinifera*, *E. laevopinea*, *E. sphaerocarpa*, *C. intermedia* and *Angophora leiocarpa*.

Linear shaped habitat patches can influence habitat suitability through reduced habitat function and disadvantaging glider socio-ecology. Linear patches have increased edge effects including weed and pest predator invasion, microclimate alteration and changes in floristic composition, which is particularly evident along high contrast edges (i.e. roadside vegetation remnants within an agricultural landscape) (Denyer et al. (2006) in Eyre (2007). Long, linear corridors of habitat provide suboptimal habitat for yellow-bellied gliders as they are territorial, central point foragers with large home ranges that rely on widely dispersed foraging resources, as travel distance and energy expenditure is maximised (Department of Agriculture Water and the Environment 2022d).

Yellow-bellied glider habitat suitability is based on the availability of the total set of attributes (i.e. presence of feed and shelter trees, connectivity) required by the sub-species to meet its' survival and feeding requirements. In consideration of this, yellow-bellied glider (south-eastern) habitat will often include:

- Mature forest, with live-hollow bearing trees for denning, preferably winter-flowering and smooth-barked eucalypt.

- Sap feed trees with floristic diversity.
- Access to forest corridors to facilitate movement to habitat resources over time and space.

2.2.8.3 Threats

As outlined in the sub-species' Conservation Advice (DAWE 2022e), key threats to the yellow-bellied glider (south-eastern) are clearing of habitat, fragmentation and timber harvesting, fire disturbance, invasive species predation, mortality by barbed wire fencing and habitat degradation.

The sub-species is particularly sensitive to habitat fragmentation, primarily as a result of extensive land clearing for agriculture and development throughout the species' range. Yellow-bellied gliders (south-eastern) are vulnerable to fragmentation impacts due to their large, exclusive home ranges. They require large areas of forest for habitat and have an inability to cross cleared areas of land due to restrictions of gliding distances. Bushfires are also considered a significant threat to the survival of the sub-species, due to the potential loss of important habitat features and resources such as sap trees and live hollow-bearing trees. Timber harvesting presents a threat to the species as it results in decreasing areas of old growth forest containing hollow-bearing trees.

A National Recovery Plan has not been created for the sub-species, however one has been developed for NSW. The NSW Recovery Plan has particular focus on loss and fragmentation of habitat, providing actions for threats on mature forests with live-hollow bearing trees (NPWS, 2003).

2.2.8.4 Occurrence and Potential Habitat within the Study Area

The yellow-bellied glider (south-eastern) is known to the Study Area, having been recorded on four occasions, during nocturnal surveys in Autumn, 2021. One record was confirmed via vocalisation, during a call playback survey in October 2021, while the remaining individuals were observed visually during spotlight searches. All records occur in the far-northern extent of the Study Area where the sub-species was recorded utilising *Eucalyptus moluccana* woodland, ground-truthed as RE 11.11.3c.

Table 2.19 Habitat Extent and Justification for Yellow-bellied Glider

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Breeding and Denning				
Floristically diverse, mature eucalypt woodland and forest comprising intact and connected patches that contain live and large hollow-bearing trees. Habitat areas collectively (breeding and denning with foraging and dispersal) must form relatively large (>50 ha) tracts which may extend beyond the Study Area.	Select areas of seven REs (RE 11.3.4, 11.3.25b, 11.12.6, 11.11.3, 11.11.3c, 11.11.4a & 11.11.4b) were considered suitable for breeding and denning based on the presence of suitable hollow-bearing trees. Only vegetation in remnant condition contains suitable hollow-bearing trees as per the field validated data.	2,117.7	268.3	163.3

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Foraging and Dispersal				
Mature eucalypt woodlands and forests that are floristically diverse or contain known sap trees in large (> 50 ha) or connected intact patches but lack live and large hollow-bearing trees. Habitat areas collectively (breeding and denning with foraging and dispersal) must form relatively large (>50 ha) tracts which may extend beyond the Study Area.	Excluding areas found to provide breeding and denning habitat, as well as highly exposed and narrow roadside vegetation with limited connectivity in the broader area, remaining areas of floristically diverse, remnant eucalypt woodland were considered to comprise foraging and dispersal habitat (i.e. REs 11.3.4, 11.3.25b, 11.3.25, 11.12.6, 11.11.3, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c). Two eucalypt woodland communities were deemed unsuitable (RE 11.11.15 and 11.12.1) due to their lack of known sap trees and canopy species diversity.	4,115.7	263.3	158.7
	Total	**6,233.4**	**531.4**	**322.0**

2.2.8.5 Habitat Critical to the Survival of the Sub-species

Habitat critical to the survival of the yellow-bellied glider (south-eastern) is defined in the sub-species' Conservation Advice (DAWE 2022e) as:

- Large continuous areas of floristically diverse eucalypt forest, which are dominated by winter-flowering and smooth-barked eucalypts, including mature live hollow-bearing trees and sap trees.
- Areas identified as refuges under future climate change scenarios.
- Unburnt habitat adjacent to recently burnt habitat that allow the sub-species to persist, recover and recolonise burnt areas (short or long-term post-fire refuges).
- Habitat corridors that facilitate dispersal between fragmented habitat patches and/or enable recolonisation or movement away from threats. Yellow-bellied gliders have a glide ratio of 2.0. Corridor gaps larger than this distance may threaten their survival.
- Areas in which some trees have evidence of use for sap extraction by yellow-bellied glider (south-eastern).

Yellow-bellied glider (south-eastern) habitat is common within the Study Area, characterised by patches of eucalypt woodland and forest communities. These areas often support sap feeding trees such as *Corymbia citriodora, Eucalyptus tereticornis* and *Eucalyptus moluccana* (DAWE 2022e) which this species is known to utilise as a foraging resource These woodlands constitute large continuous areas with relatively low to moderate levels of fragmentation and provide connectivity to the surrounding landscape including to protected areas. Based on this, all modelled habitat within the Study Area is considered habitat critical to the survival of the species. However, this assessment is considered to be conservative, as large, live hollow-bearing trees were largely restricted to the northern extent of the Study Area.

2.2.8.6 Important Populations

The sub-species' Conservation Advice (DAWE 2022e) defines important populations as stronghold populations, ecologically or genetically distinct populations (e.g. those at the limits of the sub-species' range, outlying populations), research populations, and other populations where recovery actions are being implemented.

All known populations of this sub-species are also considered important populations including:

- Carnarvon Range (inland population; Qld).
- Blackdown Tableland (inland population; Qld).

As such the population of yellow-bellied glider (south-eastern) subsisting within the Study Area should therefore be considered an important population. Further, the Study Area exists within the northern extent of the yellow-bellied glider (south-eastern) distribution where the sub-species, or the sub-species habitat is known or likely to occur.

2.2.8.7 Potential Impacts and Key Mitigation Measures

Potential impacts on this sub-species as a result of the Project include habitat loss, fragmentation and degradation, loss of key habitat resources and exacerbation of pest populations. Vegetation clearing required for the construction of the Project will result in direct impacts of up to 163.3 ha of potential breeding and denning habitat and 158.7 ha of foraging and dispersal habitat. The Project is linear in nature and has been designed and sited within the Study Area to maximise the use of existing cleared areas and minimise overall habitat fragmentation. However, clearing widths in some Disturbance Footprint locations will be greater than the yellow-bellied glider (south-eastern) is able to volplane (given the 2:1 distance to height ratio applied to the average canopy height (DAWE 2022e)). Within the access road corridor, connectivity will be maintained as clearing widths do not exceed this volplane distance (post-construction clearing widths of approximately 8 m for the majority of the access road corridor – the current road footprint is approximately 4–5 m) within mapped potential habitat. The loss of habitat is expected to be the impact with the greatest potential consequences.

Enclosed Areas

In some areas, the Disturbance Footprint creates habitat fragments by enclosing habitat with roads or other infrastructure (i.e. electrical reticulation and associated clearing). Yellow-bellied glider (south-eastern) have large home ranges and as such, require large, connected habitat patches to maintain population viability (DAWE 2022). The suggested glide ratio (horizontal distance to vertical distance) for this species is 2:1 (DAWE 2022). As the width of the Disturbance Footprint generally exceeds this width, clearing required for the Project would present a barrier to dispersal. Where yellow-bellied glider (south-eastern) habitat has been enclosed, fragmentation mitigation measures have been considered including glide poles and pinch points.

Pinch Points

Seven 'pinch points' are proposed within the Disturbance Footprint associated with areas of yellow-bellied glider (south-eastern) modelled habitat to maintain movement opportunities and minimise fragmentation impacts on the species (Figure 9.3). Pinch points describe locations of the Disturbance Footprint which are reduced in width to the extent that individuals can readily disperse across (i.e. based on usual glide ratio, the clearing will have a width no greater than 2 times the average canopy height at that location). The access road corridor has been designed to minimise fragmentation impacts for yellow-bellied glider (south-eastern). Additional pinch points have not been identified in this area, as the road access corridor does not exceed the volplane distance of the species within suitable habitat, and as such it effectively serves as a pinch point throughout.

Glide Poles

The use of glide poles has been documented in yellow-bellied glider (south-eastern) on the Pacific Highway at Halfway Creek, north-east New South Wales (Taylor & Rohweder 2020) and as such is known to be an effective mitigation measure. Glide poles will be established in areas where mapped yellow-bellied glider (south-eastern) habitat is intersected by the Disturbance Footprint. Areas prioritised for glide poles include sections of the Disturbance Footprint where the species is known to occur, areas which intersect with breeding and denning habitat, or areas of foraging and dispersal habitat which occur along enclosed sections of the Disturbance Footprint.

Glide poles were strategically placed to maximise movement options for yellow-bellied glider (south-eastern), particularly in areas where the Disturbance Footprint may present a barrier to movement. These locations were selected in consideration of potential movement pathways for the species including large patches of mature, old growth vegetation, particularly where high value habitat such as breeding and denning occurs on either side of the Development Corridor. It should be noted that in areas under the 275 kV line where clearing widths are up to 70 m–100 m, glide poles are likely to be ineffective and hence pinch points have been preferenced wherever they are feasible.

Where glide poles were placed around enclosed areas, consideration was given to the movement options for individuals once they have exited the enclosed area. For example, glide pole placement was prioritised to facilitate movement into high values habitat including breeding and denning habitat.

The highest density of glide poles will be placed within these areas to afford maximum dispersal opportunity to any individuals which may occur within enclosed areas, and where the highest abundance of individuals is expected to occur (within breeding and denning habitat). While in areas of foraging and dispersal habitat where no enclosed areas occur along the Disturbance Footprint, a lower density of glide poles is proposed. A total of 38 glide poles have been proposed for the Project, of which 26 occur within mapped habitat for yellow-bellied glider (south-eastern) (Figure 9.3). Glide poles will be 15 m high throughout the Disturbance Footprint, with the exception of 1 location beneath 33 kV line where 8 m glide poles are proposed to account for clearance requirements. At this location, clearing width is a maximum of 30 m.

As glide poles are known to be utilised by the species (in contrast to greater glider (southern and central)), they are considered a suitable fragmentation mitigation measure and hence supplementary offsets have not been proposed for enclosed areas.

Mitigation Measures

In addition to the general mitigation and management measures outlined in Section 9.3.1 which include pest monitoring, the following species-specific mitigation measures will be implemented:

- Where clearing is proposed for areas of yellow-bellied glider (south-eastern) breeding and denning habitat, pre-clearance surveys must include canopy searches and inspections of suitably sized hollows (>8 cm diameter). Where inspection of hollows cannot be safely undertaken prior to felling, the hollow-bearing tree will be slow felled to minimise the chances of injury or death and will be inspected by a qualified fauna spotter to confirm presence or absence of yellow-bellied glider (south-eastern). If an individual is found to be present, it will be inspected for injury and if healthy, relocated to an adjacent area of mapped breeding and denning habitat after dusk. If the individual is injured it will be transported to a local wildlife carer and rehabilitated prior to releasing in a suitable area adjacent to the location in which it was found.

- Every effort will be made to retain suitable hollow bearing trees (those containing hollows >8 cm diameter) within areas identified as breeding and denning habitat including *Eucalyptus moluccana* woodlands. The retention of trees >30 cm DBH on patch edges will be prioritised next in areas of potential yellow-bellied glider (south-eastern) habitat. Trees to be retained within the Disturbance Footprint must be clearly demarcated and avoided. If deemed necessary, a Tree Protection Zone (TPZ) may be established.

- Glide poles are proposed to be installed at 26 locations within the Disturbance Footprint to provide movement opportunities between areas of suitable habitat in the landscape (Figure 9.3). The proposed glide pole locations represent areas important for dispersal and where ongoing connectivity is required to avoid isolation of patches and retention of possible high use areas. Glide pole locations will be finalised during the detailed design phase of the Project.

- Seven 'pinch points' (excluding the access road corridor which is acts as a pinch point throughout) are proposed within the Disturbance Footprint associated with areas of yellow-bellied glider (south-eastern) modelled habitat to maintain movement opportunities and minimise fragmentation impacts on the species (Figure 9.3). Pinch points locations will be finalised during the detailed design phase of the Project.

- In areas of habitat where yellow-bellied glider (south-eastern) are known to occur (i.e. the far northern Study Area), cleared suitable hollows (>8 cm diameter) will be replaced at a 1:2 ratio with a suitable nest box, to be installed in adjacent habitat (i.e. two nest boxes for every hollow removed). A nest box is considered suitable if it is a design known to be used by the yellow-bellied glider (south-eastern).
- No barbed wire fencing will be installed as part of the Project unless strictly necessary (i.e. substation).
- In the event that a yellow-bellied glider (south-eastern) is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.

2.2.8.8 Significant Impact Assessment

The significant impact assessment for the sub-species is presented in **Table 2.20** below. This assessment considers the latest sub-species information presented in the Conservation Advice for *Petaurus australis australis* (yellow-bellied glider (south-eastern) (DAWE 2022b). In summary, the assessment found that the Project is **likely to result in a significant impact** on the yellow-bellied glider (south-eastern).

Table 2.20 Significant Impact Assessment – Yellow-bellied Glider (south-eastern)

Evaluation Criteria	Response
Lead to a long-term decrease in the size of an important population of a species	**No.** Yellow-bellied glider (south-eastern) was recorded on four occasions in a small cluster in the far-northern extent of the Study Area, outside of the Disturbance Footprint. A maximum of 322.0 ha of yellow-bellied glider (south-eastern) habitat will be directly impacted for construction of the Project, including 163.3 ha suitable for breeding and denning and 158.7 ha suitable for foraging and dispersal. Suitable habitat for the yellow-bellied glider (south-eastern) is common within the Study Area and is not considered unique or high quality due to the rocky substrate and low water availability (resulting in stunted tree growth and low hollow abundance), historical clearing for agricultural works and ongoing disturbance from weeds and pests. Habitat fragmentation impacts have been considered in the design and siting of the Disturbance Footprint. Through the use of pinch points and the installation of glide poles at select locations, movement opportunities for the sub-species will be provided within the Disturbance Footprint. Furthermore, habitat availability is expected to be high in the wider local area. There are several protected areas adjacent to the Study Area including Gelobera State Forest and Don River State Forest which are likely to provide a greater abundance of important habitat resources including hollow bearing trees or stags. Modelled habitat has a relatively high degree of connectivity both internally and to external areas including the State Forests, and this connectivity will be largely maintained following the construction of the Project. Potential indirect impacts on the sub-species as a result of the Project are expected to be limited but will be actively managed via the Project management plans which will include specific measures for the yellow-bellied glider (south-eastern) including pre-clearance survey requirements. Based on the above, a long-term decrease in the size of an important population is unlikely to result from the Project.
Reduce the area of occupancy of an important population	**Possibly.** The modelled distribution of the yellow-bellied glider (south-eastern) extends inland approximately 250–500 km from the coastal Victoria, along the east-coast to central Queensland. The sub-species area of occupancy is estimated at 12,724 km^2, however this may be overstated given the low resolution in the mapping methodology used by the Commonwealth (2 km x 2 km grid). This population occurs at the northern extent of the sub-species documented range. Direct impacts via vegetation clearing will occur to a maximum 163.3 ha suitable for breeding and denning and 158.7 ha suitable for foraging and dispersal. Based on the reduction of 322.0 ha (3.218 km^2) of habitat from this species current national area of occupancy of 12,724 km^2, a reduction of 0.025% is anticipated. The Project is linear in nature and clearing will be minimised wherever possible. Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges. Through the installation of glide poles and the inclusion of pinch points within the Disturbance Footprint, movement within and to adjacent areas will be facilitated. Large tracts of connected habitat will remain following the construction of the Project and no significant patch isolation will occur. Despite this, given that this important population is present at the northern extent of the sub-species distribution, and the area of occupancy will be reduced based on Project impacts, it is considered possible that the Project will reduce the availability of habitat for the sub-species to the point where the area of occupancy of an important population would be reduced.

Evaluation Criteria	Response
Fragment an existing important population into two or more populations	**No**. As described above, the Study Area supports an important population of yellow-bellied gliders (south-eastern). The sub-species is known to have limited dispersal abilities and is sensitive to habitat fragmentation, preferring large patches of continuous woodland habitat. Modelled habitat within the Disturbance Footprint (and wider Study Area) generally has low to moderate levels of existing fragmentation. Existing fragmentation is a result of historical clearing and ongoing agricultural practices. Connectivity to adjacent protected areas is high. Through considered design and siting of the Disturbance Footprint, internal connectivity within and to adjacent protected areas will be largely maintained. The use of existing cleared areas has been maximised and no significant patch isolation will occur. Seven pinch points will also be maintained within the yellow-bellied glider (south-eastern) habitat and glide poles will be installed at 26 locations to facilitate ongoing movement. To ensure suitability for the dispersal of the yellow-bellied glider (south-eastern), the clearing width at pinch points will be determined based on the canopy height at those locations and the ratio of 1.2:1 clearing distance to height, such that, the clearing distance will not be more than 1.2 times the height of the adjacent canopy (maintaining volplane capacity for the species as well as greater glider (southern and central)). As a priority, clearing will be minimised at watercourse crossings noting that riparian vegetation may provide important movement corridor for the species. This includes design measures which have sought to cross watercourses at as close as possible to 90 degrees. Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges. Once constructed, the Project itself will only create localised barriers to movement, however these barriers will not to be of the extent that they would fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely.** As described above, all suitable yellow-bellied glider (south-eastern) habitat within the Study Area has been conservatively considered to meet the definition of habitat critical to the survival of the species. Modelled yellow-bellied glider (south-eastern) habitat generally comprises large, contiguous patches of eucalypt woodland with high connectivity to the surrounding landscape including to protected areas. Up to 321.8 ha of suitable habitat will be directly impacted via vegetation clearing for construction of the Project, including 163.3 ha suitable for breeding and denning habitat and 158.7 ha suitable for foraging and dispersal habitat. Although micro-siting efforts will aim to retain hollow-bearing trees, the loss of some will be unavoidable and it is noted these are a limited feature in the landscape. While large areas of suitable habitat will remain following the construction of the Project, this removal of habitat and key habitat features is likely to be of the magnitude to be considered an 'adverse effect' on habitat critical as per the Conservation Advice.
Disrupt the breeding cycle of an important population	**Likely.** An important population of yellow-bellied glider (south-eastern) is present within the Study Area. The sub-species has low breeding potential, with a single offspring produced per year, or every second year (NPWS 2003). Clearing may occur within areas of potential breeding and denning habitat during the species' breeding season. Pre-clearance surveys will be conducted in areas of habitat to be cleared and include searches for denning individuals. Active animal breeding places will not be tampered with without an approved DES SMP.

Evaluation Criteria	Response
	Micro-siting will aim to retain hollow-bearing trees where possible. However as stated above, it is anticipated that some suitable hollow-bearing trees will require removal. In areas of known yellow-bellied glider (south-eastern) habitat (i.e. the far northern Study Area), for every suitable hollow that is removed two suitable nest boxes will be installed. While this measure is anticipated to limit the chances of a net loss of suitable hollows, it is noted that this habitat resource is already limited in the landscape and individuals may not inhabit nest boxes for unknown reasons. Based on this, it is considered that the Project has the potential to 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	**No.** A maximum of 322.0 ha of suitable habitat will be directly impacted via vegetation clearing for construction of the Project, including 163.3 ha suitable for breeding and denning habitat and 158.7 ha suitable for foraging and dispersal habitat. As discussed previously, suitable habitat for the yellow-bellied glider (south-eastern) is common in the Study Area and is not considered unique or high quality due to the rocky substrate and low water availability (resulting in stunted tree growth and low hollow abundance), historical clearing for agricultural works and ongoing disturbance from weeds and pests. The Project is linear in nature and clearing will only be completed as strictly required. Habitat fragmentation impacts will be minimised through the use of pinch points and the installation of glide poles at select locations, ensuring movement opportunities for the species are provided across the Disturbance Footprint. Modelled habitat has a relatively high degree of connectivity both internally and to external areas including the State Forests, and this connectivity will be largely maintained following the construction of the Project. No significant isolation of patches will occur. Potential indirect impacts on the species as a result of the Project are expected to be limited but will be actively managed via the Project management plans. Specific measures for the yellow-bellied glider (south-eastern) will be implemented including pre-clearance survey requirements. Based on the above, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability 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	**No.** European fox and feral cats are invasive species that may predate upon the yellow-bellied glider (south-eastern). While feral cat was recorded during the field survey program, European red fox was not, however, this species is likely to occur within the Study Area and wider region. It is unlikely the Project will result in the establishment of further feral species, or exacerbate current populations within yellow-bellied glider (south-eastern) habitat with the successful implementation of best practice control methods for weeds and pests which includes monitoring and adaptive management.
Introduce disease that may cause the species to decline	**No.** The species is not known to be vulnerable to disease directly. Phytophthora root fungus (*Phytophthora cinnamomic*) has the potential to indirectly impact the species via the infection of eucalyptus trees. The Project will implement best practice biosecurity protocols therefore, introduction of a disease that may cause the species to decline is unlikely.

Evaluation Criteria	Response
Interfere substantially with the recovery of the species	**Possibly.** There is no recognised national recovery plan for the species, however one is required to stop decline and abate threats. The recently published Conservation Advice (DCCEEW, 2022) includes conservation and management priorities which are grouped into three key themes including habitat loss, climate change and invasive species (including threats from predation, grazing, trampling). Habitat loss is a recognised threat to the species. Whilst the final impact area to suitable habitat will be smaller than the area currently represented in the Disturbance Footprint, the loss of hollow-bearing trees will still occur and the Project will impact known habitat types where the species was recorded during field surveys (i.e. *Eucalyptus moluccana* woodland). Modelled habitat may also be of regional significance to the species due to its role in providing connectivity and dispersal opportunities for the species along the Ulam Range. The Project may interfere with the recovery of the species by reducing the availability of habitat in the regional context, albeit to a limited extent.

3.0 Migratory Species

3.1 Fork-tailed Swift (*Apus pacificus*)

3.1.1.1 Status under the EPBC Act

The fork-tailed swift is listed Migratory under the EPBC Act.

3.1.1.2 Distribution and Habitat Requirements

The fork-tailed swift is found across a range of habitats in Australia, from inland open plains to wooded areas, where it is exclusively aerial (Department of the Environment 2015b). It spends most of the year at high altitudes, feeding on invertebrates carried aloft in the air column known as aerial plankton (Birdlife International, 2022b). The fork-tailed swift comes down, near to the ground during bad weather.

The species migrates to Australia during the warmer months of the year from breeding habitat in South-east Asia, where it nests in colonies on cliffs. No breeding habitat is known in Australia.

3.1.1.3 Occurrence and Potential Habitat within the Study Area

Despite the high likelihood of occurrence rating for this species, the fork-tailed swift was not identified during the field survey program. The air space above remnant and regrowth woodlands, open pasture grassland and non-remnant vegetation communities all have the potential to be used by this species for foraging and dispersal within the Study Area. Desktop records occur in scattered locations in the wider area. The nearest record is from 2019 and is located approximately 20 km north of the Study Area near the Bouldercombe Forge Conservation Park.

The extent of suitable habitat within the Study Area, Development Corridor and Disturbance Footprint is detailed in **Table 3.1**. Desktop records and modelled habitat for the species within the Study Area are shown on Figure 7.14.

Table 3.1 Habitat Extent and Justification for Fork-tailed Swift

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Foraging and dispersal				
The air space above remnant and regrowth woodlands, open pasture grassland and non-remnant vegetation communities.	All remnant and non-remnant vegetation communities included.	16,976.0	1,583.1	883.6
	Total	**16, 976.0**	**1,583.1**	**883.6**

3.1.1.4 Important Habitat

Important habitat for fork-tailed swift is defined in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015) as a range of habitat, from inland open plains to wooded areas. This broadly includes all habitat within the Study Area, although utilisation of this habitat by the fork-tailed swift is limited to the airspace above the Study Area due to its exclusively aerial nature in Australia.

There are no defined area thresholds for important habitat which may constitute a significant impact to the species in the referral guidelines (Department of the Environment, 2015).

3.1.1.5 Ecologically Significant Proportion of the Population

The upper (1%) and lower (0.1%) thresholds for ecologically significant proportions of the population of this species are estimated at 1,000 and 100 respectively. The species is likely to be a seasonal visitor to the Study Area when in transit from breeding grounds in south-east Asia. The Study Area does not support breeding habitat for this species and where foraging and dispersal habitat is present, the species is exclusively aerial. The species is known to feed in flocks of up to 1,000 birds (Higgins 1999b) and as such, if foraging conditions are suitable and birds are utilising the region, there is a potential for an ecologically significant proportion of the population to use the air space above the Study Area.

3.1.1.6 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a total of 883.4 ha of foraging and dispersal habitat will be cleared for construction of the Project. However, as described above the species is almost exclusively aerial and highly mobile, constantly moving in search of food. Potential habitat within the Disturbance Footprint (or the wider Study Area) is unlikely to be regularly inhabited or necessary for supporting any part of the species lifecycle. This loss of habitat is likely to be inconsequential to the species success within Queensland.

Potential impacts on the fork-tailed swift as a result of the Project are anticipated to occur primarily during the operational phase. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the fork-tailed swift has a Moderate risk of turbine collision. The species is likely to occur within the Study Area between October and April and a high proportion of their flight activity is at RSA height.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single fork-tailed swift death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to fork-tailed swift are detailed in the Preliminary BBAMP.

3.1.1.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 3.2** below. This assessment reflects the guidance for determining potential significant impacts provided in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the fork-tailed swift.

Table 3.2 Significant Impact Assessment – Fork-tailed Swift

Evaluation Criteria	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** The species is a non-breeding migrant to Australia which may persist within the Disturbance Footprint (and the wider Study Area) as transient populations. Its movements are often influenced by prevailing weather conditions and the presence of foraging resources. Potential habitat within the Disturbance Footprint (and wider Study Area) has already been modified through historical clearing, weeds and pests. Nonetheless, potential habitat is considered to comprise important habitat. Impact area thresholds for the species are not outlined in the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act*. Up to 883.6 ha of foraging and dispersal habitat will be directly impacted via vegetation clearing for construction of the Project. However, clearing will be completed only as strictly necessary and impact areas are anticipated to be reduced in the detailed design phase and through micro-siting. Direct impacts to habitat have been minimised through considered siting and design of the Disturbance Footprint, ensuring the use of existing cleared areas has been maximised. No fragmentation impacts are anticipated due to the species high mobility capacity. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Based on the above, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No.** As per SPRAT, there are no significant threats to the fork-tailed swift in Australia however potential threats include habitat destruction and predation by feral animals. Invasive species including feral animals, were recorded throughout the field survey program, however their impact is negligible given the species aerial nature. Across the Study Area, existing cleared areas created for fences, tracks, roads or for grazing purposes are likely to act as conduits for pest movement. Clearing for the Project is therefore unlikely to further facilitate the movement of any pests that occur. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	**No.** As described in **Section 3.1.1.5**, it is possible an ecologically significant proportion of the national population may occur within the Study Area during the life of the Project. However, based on the species aerial nature and broad habitat requirements, it is unlikely the population will rely on the potential habitat within the Study Area for any part of its lifecycle. Utilisation will be limited to the migratory period (October to April), while flocks are completing local movements and/or foraging. The turbine collision risk assessment identified the species to have a Moderate risk rating, reflecting the relatively low consequence that blade strike in the Study Area is likely to have on this species overall. Further detail on the species collision risk is provided in Appendix A of the BBAMP. The potential impact on this species during operation of the Project as a result of disruptions to migration will be managed by the Project's BBAMP, which governs the operational response following a confirmed mortality event. A single fork-tailed swift death is considered a reportable incident to DCCEEW and will result in follow-up actions to further understand impacts.

Evaluation Criteria	Response
	Given the predicted size and wide-ranging distribution of the global population and implementation of the BBAMP, it is considered unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the population.

3.2 Oriental Cuckoo (*Cuculus optatus*)

3.2.1.1 Status under the EPBC Act

The oriental cuckoo is listed Migratory under the EPBC Act.

3.2.1.2 Distribution and Habitat Requirements

Oriental cuckoo is found in a range of vegetation types including rainforest, vine-thicket and wet sclerophyll forests. It also inhabits open communities such as *Casuarina*, *Acacia* and *Eucalyptus* woodland, favouring edges or ecotones between forest types (Department of the Environment, 2015). While on passage, this species has been recorded occupying plantations, cleared areas and gardens, typically at lower elevations (Birdlife International, 2022a).

A non-breeding migrant to Australia, oriental cuckoo transits to northern and eastern Australia in summer reaching as far south on the east coast as Bega, NSW (Birdlife International, 2022a).

3.2.1.3 Occurrence and Potential Habitat within the Study Area

Oriental cuckoo was not recorded within the Study Area during the field survey program despite the extensive targeted fauna and bird utilisation surveys. This species was conservatively assessed as having a moderate likelihood of occurring within the Study Area due to the presence of scattered records in the wider local area and suitable habitat. The nearest desktop record is located approximately 20 km north of the Study Area near the Bouldercombe Forge Conservation Park and is undated with 9000 m spatial uncertainty.

While no breeding habitat occurs within the Australia, large tracts of eucalypts woodlands and vine-thickets throughout the Study Area may be suitable for foraging and dispersal purposes. Habitat suitable for foraging and dispersal was identified as:

- Semi-evergreen vine thicket.
- Remnant alluvial eucalypt woodland.
- Eucalypt woodland with open understory and grassy ground layer.

The extent of suitable habitat within the Study Area, Development Corridor and Disturbance Footprint is detailed in **Table 3.3**. Desktop records and modelled habitat for the species within the Study Area are shown on Figure 7.15.

Table 3.3 Habitat Extent and Justification for Oriental Cuckoo

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Foraging and Dispersal				
Remnant semi-evergreen vine thicket and eucalypt woodlands	All vegetation communities are regarded as suitable, where they exist in remnant condition.	7,309.1	639.1	348.1
Total		**7,309.1**	**639.1**	**348.1**

3.2.1.4 Important Habitat

Important habitat for oriental cuckoo is defined in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment 2015b) as:

- Monsoonal rainforest.
- Vine thickets.
- Wet sclerophyll forest.
- Open *Casuarina*, *Acacia* or *Eucalyptus* woodlands.
- Edges or ecotones between habitat types.
- All potential foraging and dispersal habitat in the Study Area meets this broad definition.

Based on the referral guidelines, the area thresholds for important habitat likely to result in a significant impact are 250,000 ha (international significance) and 25,000 ha (national significance).

3.2.1.5 Ecologically Significant Proportion of the Population

The upper (1%) and lower (0.1%) thresholds for ecologically significant proportions of the population of this species are estimated at 10,000 and 1,000 respectively. The species is likely to be a seasonal visitor to the Study Area when in transit between its northern hemisphere breeding habitat and northern and eastern Australia. This species may transit through the Study Area in low densities, utilising available foraging and dispersal habitat, given this, it is unlikely that it would support the ecological requirements of an ecologically significant proportion of the population.

3.2.1.6 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a maximum of 348.1 ha of foraging and dispersal habitat will be cleared for construction of the Project. However, the species is not known to occur within the Study Area and tends to be solitary. Potential habitat is therefore likely to only be used by a small number of individuals, temporarily while completing local migrations. As described above, potential habitat is unlikely to support an ecologically significant proportion of the population.

Although unlikely, the species may be directly impacted during the operational phase of the Project via turbine collision. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the oriental cuckoo has a Minor risk of turbine collision, reflecting the species likely flight patterns and occurrence within the Study Area.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single oriental cuckoo death will be a reportable incident to DCCEEW and trigger further investigation regarding causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to oriental cuckoo are detailed in the Preliminary BBAMP.

3.2.1.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 3.4** below. This assessment reflects the guidance for determining potential significant impacts provided in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the oriental cuckoo.

Table 3.4 Significant Impact Assessment – Oriental Cuckoo

Evaluation Criteria	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** The species is a regular non-breeding migrant to Australia in small numbers. While in Australia, it migrates south for the autumn and north for the spring. Modelled potential habitat within the Disturbance Footprint (and the wider Study Area) has already been modified through historical clearing, weeds and pests. Nonetheless, potential habitat is considered to comprise important habitat. Table 4 of the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* indicates that a significant impact on the oriental cuckoo may occur if 25,000 ha of important habitat is cleared. Up to 348.1 ha of foraging and dispersal habitat will be directly impacted via vegetation clearing for construction of the Project. This area is below the clearing threshold. Nonetheless, clearing will be completed only as strictly necessary and impact areas are anticipated to be reduced in the detailed design phase and through micro-siting. Habitat fragmentation impacts have been minimised through considered siting and design of the Disturbance Footprint, ensuring the use of existing cleared areas is maximised and no patches are isolated. Although some minor fragmentation impacts are anticipated, it is highly unlikely these will impact the species or limit its mobility given its capacity for long flights. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Based on the above, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat.

Evaluation Criteria	Response
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No.** There is no evidence to suggest the oriental cuckoo is vulnerable to impacts relating to invasive species. Invasive species, particularly weeds, were recorded throughout the field survey program. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	**No.** As described in **Section 3.2.1.5**, modelled habitat within the Disturbance Footprint is unlikely to support an ecologically significant proportion of the national or international population. The species tends to be solitary and has broad habitat requirements. It is unlikely the population will rely on the potential habitat within the Disturbance Footprint for any part of its lifecycle. Utilisation will be limited to the migratory period (November to March), while individuals or small flocks are completing local movements and/or foraging. The turbine collision risk assessment identified the species to have a Minor risk rating. This rating reflects the anticipated regular occurrence within the Disturbance Footprint (and the wider Study Area), predicted low flight behaviour (below RSA) and minor rating for consequence based on their very large population size, capability to replace lost individuals and non-threatened status at the state and national scale. Further detail on the species collision risk is provided in Appendix A of the BBAMP. The potential impact on this species during operation of the Project as a result of disruptions to migration will be managed by the Project's BBAMP, which governs the operational response following a confirmed mortality event. Although highly unlikely to occur, a single oriental cuckoo death is considered a reportable incident to DCCEEW and will result in follow-up actions to further understand impacts. Given the predicted size and wide-ranging distribution of the global population and implementation of a BBAMP, it is considered unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the population.

3.3 Black-faced Monarch (*Monarcha melanopsis*)

3.3.1.1 Status under the EPBC Act

The black-faced monarch is listed Migratory under the EPBC Act.

3.3.1.2 Distribution and Habitat Requirements

The black-faced monarch inhabits humid gullies, coastal scrub, eucalyptus woodlands, and rainforests. When migrating, it can occur in more open forest across its range (BirdLife Australia 2022a). This species is mainly associated with wet forests, primarily wet sclerophyll forests and rainforests, particularly in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs (Department of the Environment 2015a).

The black-faced monarch is distributed across eastern Australia along the coastal regions becoming less common towards the southern extent of its range. This species flies between their breeding grounds in eastern Australia and their wintering habitats in southern New Guinea across the Torres Strait. Individual birds can occur outside of their typical range with vagrants being observed in Western Australia and New Zealand. Individuals have also been recorded in northern and western Victoria and in southern South Australia (BirdLife Australia 2022a).

The black-faced monarch feeds on insects foraging amongst foliage catching prey on the wing. Their nest consists of a deep cup that is typically made from casuarina needles, bark, roots, moss and spider web and placed in the fork of a tree between 3 and 6 m above the ground. Females build the nest and both sexes incubate the eggs (BirdLife Australia 2022a).

3.3.1.3 Occurrence and Potential Habitat within the Study Area

Black-faced monarch was not observed within the Study Area during the field survey program. It is conservatively considered to have a moderate likelihood of occurrence due to the presence of suitable habitat and scattered desktop records in the wider local area. The nearest desktop record is located approximately 21 km north near Bouldercombe Gorge Conservation Park and is undated.

The Project is located within an area mapped as core breeding range for the species however, given that no rainforest or wet sclerophyll habitat types exist within the Study Area suitable habitat is predominantly limited to foraging and dispersal habitat. Semi-evergreen vine thicket associated with gullies and slopes may represent marginal breeding habitat and has been conservatively included.

Habitat suitable for foraging and dispersal was present within three habitat types for the species including:

- Semi-evergreen vine thicket.
- Remnant alluvial eucalypt woodland.
- Eucalypt woodland with open understory and grassy ground layer.

The species utilises the region on its’ migration and breeds in select parts of Queensland. As such, habitat within the Study Area may provide foraging, dispersal and marginal breeding opportunities. As outlined in the subsequent section, sheltered gullies with dense vegetation and semi-evergreen vine thicket communities suitable for foraging and potentially breeding constitute important habitat.

The extent of suitable habitat within the Study Area, Development Corridor and Disturbance Footprint is detailed in **Table 3.5**. Desktop records and modelled habitat for the species within the Study Area are shown on Figure 7.19.

Table 3.5 Habitat Extent and Justification for Black-faced Monarch

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Foraging and Marginal Breeding				
Semi-evergreen vine thicket associated with gullies and slopes.	Dense, semi-evergreen vine thicket vegetation as confirmed during the field surveys, associated with gullies and steep slopes. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	1,205.1	40.0	17.7
Foraging and Dispersal				
Eucalypt woodlands and forests.	Excluding areas considered foraging and marginal breeding, all vegetation communities in remnant condition. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	6,277.8	599.7	330.7
	Total	**7,482.9**	**639.7**	**348.4**

3.3.1.4 Important Habitat

Important habitat for the black-faced monarch has been identified in the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment 2015c) as:

- Rainforest.
- Wet sclerophyll forest.
- Sheltered gullies and slopes with a dense understorey of ferns and/or shrubs.

Eucalypt woodlands and semi-evergreen vine thicket provides foraging and dispersal habitat in the Study Area and meets this broad definition as it contains sheltered gullies and slopes which may be used during migration. Woodland communities may provide habitat for foraging and dispersal however, in the context of important habitat, these habitat types have been excluded.

Based on the referral guidelines (Department of the Environment 2015c), the area thresholds for important habitat likely to result in a significant impact are 2,600 ha (international significance) and 260 ha (national significance).

3.3.1.5 Ecologically Significant Proportion of the Population

The upper (1%) and lower (0.1%) thresholds for ecologically significant proportions of the population of this species are estimated at 4,600 and 460 respectively. The species is likely to be a seasonal visitor to the Study Area when in transit between breeding grounds in south-eastern Australia and wintering areas in northern Australia. Given the quantum of habitat available and the Disturbance Footprint (or wider Study Area) not supporting preferred habitat of rainforest and wet sclerophyll forest, it is unlikely that it would support the ecological requirements of an ecologically significant proportion of the population.

3.3.1.6 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a maximum of 348.2 ha of potential habitat will be cleared for construction of the Project, including 17.7 ha of foraging and marginal breeding habitat and 330.5 ha of foraging and dispersal habitat. However, the species is not known to occur within the Study Area and is widespread when in Queensland. As described above, potential habitat is unlikely to support an ecologically significant proportion of the population. Furthermore, potential habitat for the species is expected to occur extensively in the wider local area including within adjacent State Forests.

Although unlikely, the species may be directly impacted during the operational phase of the Project via turbine collision. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the black-faced monarch has a Minor risk of turbine collision, reflecting the species likely flight patterns and occurrence within the Study Area.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single blackfaced monarch death will be a reportable incident to DCCEEW and trigger further investigation regarding causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to black-faced monarch are detailed in the Preliminary BBAMP.

3.3.1.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 3.6** below. This assessment reflects the guidance for determining potential significant impacts provided in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the black-faced monarch.

Table 3.6 Significant Impact Assessment – Black-faced Monarch

Evaluation Criteria	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** The species is a widespread, spring-summer migrant to eastern Australia. It is considered a wet forest specialist, found mainly in rainforest and wet sclerophyll forest. Modelled potential habitat within the Disturbance Footprint (and the wider Study Area) does not comprise rainforest or wet sclerophyll forest, so is unlikely to be preferred habitat or important habitat. Areas identified as marginally suitable for breeding are included in the modelled habitat; this categorisation is considered conservative, noting that the Disturbance Footprint does not occur in south-eastern Australia where the species usually breeds. Furthermore, all potential habitat has already been modified through historical clearing, weeds and pests. Table 4 of the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* indicates that a significant impact on the black-faced monarch may occur if 260 ha of important habitat is cleared. Although up to 348.4 ha of potential habitat would be directly impacted via vegetation clearing for construction of the Project, this habitat is not considered to meet the important habitat definition as described above.

Evaluation Criteria	Response
	Furthermore, clearing will be completed only as strictly necessary and impact areas are anticipated to be reduced in the detailed design phase and through micro-siting. Habitat fragmentation impacts have been minimised through considered siting and design of the Disturbance Footprint, ensuring the use of existing cleared areas is maximised and no patches are isolated. Although some minor fragmentation impacts are anticipated, it is highly unlikely these will impact the species or limit its mobility given the species propensity for moving large distances. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Based on the above, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No.** The species is vulnerable to impacts associated with the black rat and invasive vine species such as rubber vine (*Cryptostegia grandiflora**). Invasive species, including black rat and rubber vine, were recorded throughout the field survey program. Given the nature and extent of agricultural works within the Disturbance Footprint and the wider Study Area, current population levels of black rat are likely to be high. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	**No.** As described in **Section 3.3.1.5**, modelled habitat is unlikely to support an ecologically significant proportion of the national or international population. The species is widespread when in Queensland and modelled potential habitat is unlikely to be preferred as it does not comprise rainforest or wet sclerophyll forest. It is unlikely the population will rely on the potential habitat within the Disturbance Footprint for any part of its lifecycle. Utilisation will be limited to the migratory period (February and May), while individuals or small flocks are completing local movements and/or foraging. The turbine collision risk assessment identified the species to have a Minor risk rating. This rating reflects the anticipated regular occurrence within the Disturbance Footprint and the wider Study Area, predicted low flight behaviour (below RSA) and minor rating for consequence based on their large population size, capability to replace lost individuals and non-threatened status at the state and national scale. Further detail on the species collision risk is provided in Appendix A of the BBAMP. The potential impact on this species during operation of the Project as a result of disruptions to migration will be managed by the Project's BBAMP, which governs the operational response following a confirmed mortality event. Although unlikely to occur, a single black-faced monarch death is considered a reportable incident to DCCEEW and will result in follow-up actions to further understand impacts. Given the predicted size and wide-ranging distribution of the global population and implementation of a BBAMP, it is considered unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the population.

3.4 Satin Flycatcher (*Myiagra cyanoleuca*)

3.4.1.1 Status under the EPBC Act

The satin flycatcher is listed Migratory under the EPBC Act.

3.4.1.2 Distribution and Habitat Requirements

The satin flycatcher inhabits heavily vegetated gullies in eucalypt forests and taller woodlands, often near wetlands or watercourses. They are mostly recorded in wet sclerophyll forests, however they also occur in eucalypt woodlands with open understorey and grassy ground cover (Department of the Environment 2019).

This species migrates to northern Australia and Papua New Guinea in autumn and returns to south-eastern Australia in spring however their movements are described as erratic. Their migration route appears to follow the Great Dividing Range but reported sightings have occurred in coastal NSW. Departure times vary dependant on location, but it is generally between February and early May. Timing for returning to south-eastern Australia to breed also varies dependant on location but ranges between August to November.

The satin flycatcher is primarily insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and subcanopy of trees, usually sallying for prey in the air or picking prey from foliage and branches of trees, flitting from one perch to another (Department of the Environment 2019).

3.4.1.3 Occurrence and Potential Habitat within the Study Area

The satin flycatcher was not observed within the Study Area during the field survey program. It is conservatively considered to have a moderate likelihood of occurrence due to the presence of suitable habitat and scattered desktop records in the wider local area. The nearest desktop record is from 1994 and is located approximately 12 km north near Bouldercombe Gorge Conservation Park although has a 20 km spatial uncertainty.

Habitat suitable for foraging and dispersal was present within two habitat types for the species:

- Remnant alluvial eucalypt woodland.
- Eucalypt woodland with open understory and grassy ground layer.

The species utilises this region on its’ migration and does not reside or breed in the area. As such habitat within the Study Area has been identified as suitable for foraging and dispersal only.

The extent of suitable habitat within the Study Area, Development Corridor and Disturbance Footprint is detailed in **Table 3.7**. Desktop records and modelled habitat for the species within the Study Area are shown on Figure 7.16.

Table 3.7 Habitat Extent and Justification for Satin Flycatcher

Habitat Criteria	Justification of Mapping Extent	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Breeding				
Wet sclerophyll forests and eucalypt woodland in south-eastern Australia	No breeding habitat has been mapped for this species as the Study Area is outside of the species' breeding range.	-	-	-
Foraging / Dispersal				
Eucalypt woodlands with open understory and grassy ground layer	All vegetation communities except two (REs 11.11.5a and 11.12.4) in remnant condition included. Regrowth and non-remnant vegetation not found to support suitable structure or connectivity.	6,978.2	618.1	339.7
	Total	**6,978.2**	**618.1**	**339.7**

3.4.1.4 Important Habitat

In understanding important habitat for this species, it is noted in the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment 2015c) that the diversity of occupied habitats expands during migration, with the species recorded in most wooded habitats. Wintering birds in northern Queensland will use the rainforest – gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.

Important habitat for the satin flycatcher has been identified in the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment 2015c) as:

- Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types.
- During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests.
- Wintering birds in northern Queensland will use rainforest – gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.

All potential foraging and dispersal habitat in the Study Area meets this broad definition as it contains wooded habitats which may be used during migration.

Based on the referral guidelines (Department of the Environment 2015c), the area thresholds for important habitat likely to result in a significant impact are 4,400 ha (international significance) and 440 ha (national significance).

3.4.1.5 Ecologically Significant Proportion of the Population

The upper (1%) and lower (0.1%) thresholds for ecologically significant proportions of the population of this species are estimated at 17,000 and 1,700 respectively. The species may be a seasonal visitor to the Study Area when in transit between breeding grounds in south-eastern Australia and wintering areas in northern Australia. It is unlikely the Development Corridor is of the magnitude that it could support the ecological requirements of a significant proportion of a population, even temporarily when on transit. This is supported by the absence of records, despite extensive survey including seasonal fauna surveys and bird utilisation surveys.

3.4.1.6 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a total of 339.7 ha of foraging and dispersal habitat will be cleared for construction of the Project. However, the species is not known to occur within the Study Area and is widespread but scattered when in Queensland. As described above, potential habitat is unlikely to support an ecologically significant proportion of the population. Furthermore, potential habitat for the species is expected to occur extensively in the wider local area including within adjacent State Forests.

Although unlikely, the species may be directly impacted during the operational phase of the Project via turbine collision. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the satin flycatcher has a Minor risk of turbine collision, reflecting the species likely flight patterns and occurrence within the Study Area.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single satin flycatcher death will be a reportable incident to DCCEEW and trigger further investigation regarding causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to satin flycatcher are detailed in the Preliminary BBAMP.

3.4.1.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 3.8** below. This assessment reflects the guidance for determining potential significant impacts provided in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the satin flycatcher.

Table 3.8 Significant Impact Assessment – Satin Flycatcher

Evaluation Criteria	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** The species is a winter migrant to northern Queensland. While on passage their habitat preferences expand. Movements are made singly or in pairs or small loose groups through the tree-tops. Due to the location of the Disturbance Footprint, modelled potential habitat is likely to be used only by a small number of individuals for foraging and dispersal while on passage. Potential habitat within the Disturbance Footprint (and wider Study Area) has already been modified through historical clearing, weeds and pests. Despite this, potential habitat is considered to comprise important habitat. Table 4 of the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* indicates that a significant impact on the satin flycatcher may occur if 440 ha of important habitat is cleared. Up to 339.7 ha of foraging and dispersal habitat will be directly impacted via vegetation clearing for construction of the Project, which is below the clearing threshold. Furthermore, clearing will be completed only as strictly necessary and impact areas are anticipated to be reduced in the detailed design phase and through micro-siting. Habitat fragmentation impacts have been minimised through considered siting and design of the Disturbance Footprint, ensuring the use of existing cleared areas is maximised and no patches are isolated. Although some minor fragmentation impacts are anticipated, it is highly unlikely these will impact the species or limit its mobility given its capacity to move large distances. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Based on the above, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No.** The species is vulnerable to impacts associated with the black rat and invasive vine species such as rubber vine (*Cryptostegia grandiflora**). Invasive species, including black rat and rubber vine, were recorded throughout the field survey program. Given the nature and extent of agricultural works within the Disturbance Footprint and the wider Study Area, current population levels of black rat are likely to be high. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.

Evaluation Criteria	Response
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	**No.** As described in **Section 3.4.1.5**, modelled habitat is unlikely to support an ecologically significant proportion of the national or international population. The species is only likely to inhabit the Disturbance Footprint temporarily while on passage (April to May). When on passage the species has broad habitat requirements and as such, it is likely that suitable habitat occurs extensively in the wider local area, including within adjacent State Forests. It is unlikely the population will rely on the potential habitat within the Disturbance Footprint for any part of its lifecycle. The turbine collision risk assessment identified the species to have a Minor risk rating. This rating reflects the anticipated regular occurrence within the Study Area, predicted low flight behaviour (below RSA) and minor rating for consequence based on their large population size, capability to replace lost individuals and non-threatened status at the state and national scale. Further detail on the species collision risk is provided in Appendix A of the BBAMP. The potential impact on this species during operation of the Project as a result of disruptions to migration will be managed by the Project's BBAMP, which governs the operational response following a confirmed mortality event. Although highly unlikely to occur, a single satin flycatcher death is considered a reportable incident to DCCEEW and will result in follow-up actions to further understand impacts. Given the predicted size and wide-ranging distribution of the global population and implementation of a BBAMP, it is considered unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the population.

3.5 Rufous Fantail (*Rhipidura rufifrons*)

3.5.1.1 Status under the EPBC Act

The rufous fantail is listed Migratory under the EPBC Act.

3.5.1.2 Distribution and Habitat Requirements

In east and south-east Australia, the rufous fantail mainly inhabits wet sclerophyll forests, usually with a dense shrubby understorey often including ferns. They are found in rainforest, dense wet eucalypt and monsoon forest, paperbark and mangrove swamp and riparian vegetation (Morcombe 2004). When on passage, a wider range of habitats are used including dry eucalypt forests and woodlands and brigalow shrublands. Breeding habitat occurs in dense wet forests – rainforests, mangroves, the wet fern gullies in eucalypt forests and other dense vegetation (Morcombe 2004).

This species occurs as solitary birds or in pairs or small parties. The rufous fantail is found in northern and eastern coastal Australia, being more common in the north. This species migrates to south-east Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Department of the Environment 2015a).

3.5.1.3 Occurrence and Potential Habitat within the Study Area

The rufous fantail was recorded within the Study Area on four occasions:

- One individual observed actively foraging within a narrow gully, comprising a structurally complex lower tree and shrub layer. The gully was situated adjacent to steep sloping Eucalypt woodland.
- One individual observed within vine thicket vegetation, comprising structurally complex shrub layer over ground microhabitat of fallen logs and course litter.
- Two individuals were recorded on separate occasions on steep slopes, dispersing through eucalypt woodland in close proximity to vine thicket vegetation and in areas invaded by *Lantana camara*.

On all occasions, the rufous fantail was using lower portions of habitat, occupying the ground and mid-stratum vegetation layers.

Semi-evergreen vine-thicket and eucalypt woodlands throughout the Study Area may be utilised for foraging and dispersal when on passage to breeding habitat in south-eastern Australia. It is unlikely that the species breeds in the area due to the geographical location and the lack of wet forest and rainforest.

The extent of suitable habitat within the Study Area, Development Corridor and Disturbance Footprint is detailed in **Table 3.9**. Records (Umwelt and ALA) and modelled habitat for the species within the Study Area are shown on Figure 7.17.

Table 3.9 **Habitat Extent and Justification for Rufous Fantail**

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Breeding				
Dense wet forests – rainforests, mangroves, the wet fern gullies in eucalypt forests and other dense vegetation in south-eastern Australia	No breeding habitat has been identified as the Study Area is outside of the breeding range and does not support preferred habitat.	-	-	-
Foraging and Dispersal				
Dry eucalypt forest and woodlands and including semi-evergreen vine-thicket	All vegetation in remnant condition. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	7,309.1	639.2	348.1
	Total	**7,309.1**	**639.2**	**348.1**

3.5.1.4 Important Habitat

The *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment 2015a) defines important habitat for the species as:

> *"Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands".*

As any individuals using the Study Area would likely be on passage to or from winter breeding grounds, the definition of what constitutes important habitat is the context of the region is very broad. Based on this definition, the foraging and dispersal habitat modelled within the Study Area can be classified as important habitat.

Based on the referral guidelines (Department of the Environment 2015a), the area thresholds for important habitat likely to result in a significant impact (north-eastern rufous fantail) are 3,400 ha (international significance) and 340 ha (national significance).

3.5.1.5 Ecologically Significant Proportion of a Population

The upper (1%) and lower (0.1%) thresholds for ecologically significant proportions of the population of this species are estimated at 48,000 and 4,800 respectively (combined for all three subspecies). Given the geographical location, the subspecies inhabiting the Study Area is likely to be the north-eastern rufous fantail (*Rhipidura rufifrons intermedia*) which has an upper threshold of 15,000 and a lower threshold of 1,500 individuals.

The species is likely to be a seasonal visitor to the Study Area when in transit to breeding grounds in south-eastern Australia. It is unlikely the Development Corridor is of the magnitude that it could support the ecological requirements of a significant proportion of a population, even temporarily when on transit.

This is supported by the infrequency of records, despite extensive survey including seasonal fauna surveys and bird utilisation surveys.

3.5.1.6 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a maximum of 348.1 ha of foraging and dispersal habitat will be cleared for construction of the Project. However, the species inhabits a wide range of habitats while on passage and is considered common and the population secure. As described above, potential habitat is unlikely to support an ecologically significant proportion of the population. Furthermore, potential habitat for the species is expected to occur extensively in the wider local area including within adjacent State Forests.

Although unlikely, the species may be directly impacted during the operational phase of the Project via turbine collision. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the rufous fantail has a Minor risk of turbine collision, reflecting the species likely flight patterns and occurrence within the Study Area.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single rufous fantail death will be a reportable incident to DCCEEW and trigger further investigation regarding causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to rufous fantail are detailed in the Preliminary BBAMP.

3.5.1.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 3.10** below. This assessment reflects the guidance for determining potential significant impacts provided in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the rufous fantail.

Table 3.10 Significant Impact Assessment – Rufous fantail

Evaluation Criteria	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** The rufous fantail is considered a common and secure species. It is a non-breeding migrant to northern Australia in winter. Modelled potential habitat within the Disturbance Footprint (and wider Study Area) is suitable for foraging and dispersal only, and has already been modified through historical clearing, weeds and pests. Nonetheless, potential habitat is considered to comprise important habitat. Table 4 of the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* indicates that a significant impact on the rufous fantail may occur if 340 ha of important habitat is cleared. Up to 348.1 ha of foraging and dispersal habitat will be directly impacted via vegetation clearing for construction of the Project. This area is slightly above the clearing threshold, however clearing will be completed only as strictly necessary and impact areas are anticipated to be reduced in the detailed design phase and through micro-siting.

Evaluation Criteria	Response
	Habitat fragmentation impacts have been minimised through considered siting and design of the Disturbance Footprint, ensuring the use of existing cleared areas is maximised and no patches are isolated. Although some minor fragmentation impacts are anticipated, it is highly unlikely these will impact the species or limit its mobility given the species capacity to move large distances. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Furthermore, suitable habitat is likely to occur extensively in the wider area. Based on the above, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No**. The species is vulnerable to impacts associated with the black rat and invasive vine species such as rubber vine (*Cryptostegia grandiflora**). Invasive species, including black rat and rubber vine, were recorded throughout the field survey program. Given the nature and extent of agricultural works within the Study Area, current population levels of black rat are likely to be high. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	**No.** As described in **Section 3.5.1.5**, modelled habitat is unlikely to support an ecologically significant proportion of the national or international population. The species is only likely to inhabit the Disturbance Footprint temporarily while on passage to and from its breeding grounds. When on passage the species has broad habitat requirements and as such, it is likely that suitable habitat occurs extensively in the wider local area, including within adjacent State Forests. It is unlikely the population will rely on the potential habitat within the Disturbance Footprint for any part of its lifecycle. The turbine collision risk assessment identified the species to have a Minor risk rating. This rating reflects the anticipated regular occurrence within the Disturbance Footprint, predicted low flight behaviour (below RSA) and minor rating for consequence based on their large population size, capability to replace lost individuals and non-threatened status at the state and national scale. Further detail on the species collision risk is provided in Appendix A of the BBAMP. The potential impact on this species during operation of the Project as a result of disruptions to migration will be managed by the Project's BBAMP, which governs the operational response following a confirmed mortality event. Although highly unlikely to occur, a single rufous fantail death is considered a reportable incident to DCCEEW and will result in follow-up actions to further understand impacts and causation. Given the predicted size and wide-ranging distribution of the global population and implementation of a BBAMP, it is considered unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the population.

3.6 Spectacled Monarch (*Symposiarchus trivirgatus*)

3.6.1.1 Status under the EPBC Act

The spectacled monarch is listed Migratory under the EPBC Act.

3.6.1.2 Distribution And Habitat Requirements

The spectacled monarch is found in dense vegetation, mainly in rainforest but also in moist forest or wet sclerophyll and occasionally in other dense vegetation such as mangroves, drier forest and woodlands. These habitats are considered important habitats (Department of the Environment 2015a).

The spectacled monarch is distributed across eastern Australia along the coastal regions where it is a resident in the north of its distribution and a summer breeding migrant to coastal south-eastern Australia. This species begins its southern migration in September and returns north in March. Spectacled monarch also occupies coastal islands from Cape York in Queensland to Port Stephens in New South Wales (BirdLife Australia 2022b). This species is also thought to migrate to Papua New Guinea, the Moluccas and Timor during the autumn and winter months (Museum Australian 2022; BirdLife Australia 2022b).

The spectacled monarch is insectivorous, foraging primarily in the foliage beneath the canopy and on tree trunks or vines. The spectacled monarch constructs a tiny cup nest of fine bark, plant fibres, moss, and spider web 1 m to 6 m above the ground, frequently close to water, in a tree fork or in hanging vines (BirdLife Australia 2022b).

3.6.1.3 Occurrence and Potential Habitat within the Study Area

The spectacled monarch was recorded within the Study Area twice in June 2020, once in the central portion and once in the north-eastern portion. Numerous records, including recent records, exist for this species in the surrounding region (ALA, 2022).

Habitat suitable for foraging and dispersal was present within the Study Area and included the following:

- Semi-evergreen vine thicket.
- Gullies in eucalypt woodlands where dense vegetation occurs.

The species utilises this region on its' migration and does not reside or breed in the region. As such habitat within the Study Area has been identified as foraging and dispersal only.

The extent of suitable habitat within the Study Area, Development Corridor and Disturbance Footprint is detailed in **Table 3.11**. Records (Umwelt and ALA) and modelled habitat for the species within the Study Area are shown on Figure 7.18.

Table 3.11 Habitat Extent and Justification for Spectacled Monarch

Habitat Criteria	Mapping Justification	Area (ha)		
		Within the Study Area	Within the Development Corridor	Within the Disturbance Footprint
Foraging and Dispersal				
Forests, woodlands where dense vegetation occurs in gullies and semi-evergreen vine thicket.	Dense vegetation as confirmed during the field surveys, associated with gullies and steep slopes. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	1,205.1	40.0	17.9
	Total	**1,205.1**	**40.0**	**17.9**

3.6.1.4 Important Habitat

Important habitat for the spectacled monarch has been identified in the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment 2015c) as dense vegetation, generally comprising:

- Rainforest.
- Moist or wet sclerophyll forest.
- Dense vegetation including mangroves.
- Drier forest and woodlands.

Foraging and dispersal habitat in the Study Area meets this broad definition and has been considered as important habitat for the purpose of this assessment.

Based on the referral guidelines (Department of the Environment 2015c), the area thresholds for important habitat likely to result in a significant impact are 1,300 ha (international significance) and 130 ha (national significance).

3.6.1.5 Ecologically Significant Proportion of the Population

The upper (1%) and lower (0.1%) thresholds for ecologically significant proportions of the population of this species are estimated at 6,500 and 650 respectively (all three subspecies combined). Given the geographical location, the subspecies inhabiting the Study Area is likely to be the southern spectacled monarch (*Symposiachrus trivirgatus gouldii*) which has an upper threshold of 4,100 and a lower threshold of 410 individuals.

The species is likely to be a seasonal visitor to the Study Area when in transit between breeding grounds in south-eastern Australia and wintering areas in northern Australia. Given the quantum of habitat available and the Study Area not supporting preferred habitat of rainforest and wet sclerophyll forest, it is unlikely that it would support the ecological requirements of an ecologically significant proportion of the population.

3.6.1.6 Potential Impacts and Key Mitigation Measures

Under the worst-case scenario, a maximum of 17.9 ha of foraging and dispersal habitat will be cleared for construction of the Project. Modelled habitat is likely to only be used by a small number of individuals while on passage. Relative to the area of suitable habitat that will remain, this loss of habitat is considered minor and inconsequential to the success of any population present. As described above, potential habitat is unlikely to support an ecologically significant proportion of the population.

Although unlikely, the species may be directly impacted during the operational phase of the Project via turbine collision. As outlined in Appendix A of the Preliminary BBAMP (Attachment G of the Preliminary Documentation), the spectacled monarch has a Minor risk of turbine collision, reflecting the species likely flight patterns and occurrence within the Study Area.

In addition to the general mitigation and management measures outlined in Section 9.3.1, the following species-specific mitigation measures will be implemented:

- As detailed in the Preliminary BBAMP (Attachment G of the Preliminary Documentation), a single spectacled monarch death will be a reportable incident to DCCEEW and trigger further investigation regarding causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised.
- Other operational measures relevant to spectacled monarch are detailed in the Preliminary BBAMP.

3.6.1.7 Significant Impact Assessment

The significant impact assessment for the species is present in **Table 3.12** below. This assessment reflects the guidance for determining potential significant impacts provided in the *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015). In summary, the assessment found that the Project is **unlikely to result in a significant impact** on the spectacled monarch.

Table 3.12 Significant Impact Assessment – Spectacled Monarch

Evaluation Criteria	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	**No.** The species is a summer breeding migrant to coastal south-eastern Australia. Due to the location of the Study Area in the region, modelled potential habitat is likely to be used only by a small number of individuals for foraging and dispersal while on passage. Potential habitat within the Disturbance Footprint (and wider Study Area) has already been modified through historical clearing, weeds and pests. Despite this, potential habitat is considered to comprise important habitat. Table 4 of the *Draft referral guidelines for 14 birds listed as migratory species under the EPBC Act* indicates that a significant impact on the spectacled monarch may occur if 130 ha of important habitat is cleared. Up to 17.9 ha of foraging and dispersal habitat will be directly impacted via vegetation clearing for construction of the Project, which is below the clearing threshold.

Evaluation Criteria	Response
	Nonetheless, clearing will be completed only as strictly necessary and impact areas are anticipated to be reduced in the detailed design phase and through micro-siting. Habitat fragmentation impacts have been minimised through considered siting and design of the Disturbance Footprint, ensuring the use of existing cleared areas is maximised and no patches are isolated. Although some minor fragmentation impacts are anticipated, it is highly unlikely these will impact the species or limit its mobility due to its capacity to undergo long flights. The Project will not lead to the further degradation of retained habitat, as potential indirect impacts such as altered fire regimes, edge effects, weeds and pests will be actively managed via Project management plans. Based on the above, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	**No**. The species is vulnerable to impacts associated with the black rat and invasive vine species such as rubber vine (*Cryptostegia grandiflora**). Invasive species, including black rat and rubber vine, were recorded throughout the field survey program. Given the nature and extent of agricultural works within the Disturbance Footprint and wider Study Area, current population levels of black rat are likely to be high. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	**No.** As described in **Section 3.6.1.5**, modelled habitat is unlikely to support an ecologically significant proportion of the national or international population. The species is only likely to inhabit the Study Area temporarily while on passage to and from its breeding grounds. It is unlikely the population will rely on the potential habitat within the Disturbance Footprint for any part of its lifecycle. The turbine collision risk assessment identified the species to have a Minor risk rating. This rating reflects the anticipated regular occurrence within the Disturbance Footprint, predicted low flight behaviour (below RSA) and minor rating for consequence based on their large population size, capability to replace lost individuals and non-threatened status at the state and national scale. Further detail on the species collision risk is provided in Appendix A of the BBAMP. The potential impact on this species during operation of the Project as a result of disruptions to migration will be managed by the Project's BBAMP, which governs the operational response following a confirmed mortality event. Although highly unlikely to occur, a single spectacled monarch death is considered a reportable incident to DCCEEW and will result in follow-up actions to further understand impacts. Given the implementation of a BBAMP and the likely secure population sizes of the species in Australia, it is considered unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the population.

4.0 References

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