Overhead Transmission Line Interim Offset Area Management Plan

Prepared for:
ACCIONA Energy Australia Global Pty Ltd

21 December 2021

Document Information

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1.0 Introduction

1.1 Background

The Overhead Transmission Line Project (the Project) forms part of the MacIntyre Wind Energy Precinct and will include the construction and operation of a 64 km, high-voltage (330 kV) overhead transmission line (OHTL), two switching stations and associated ancillary works.

The Project is proposed over 26 freehold lots, as well as road reserves and easements, traversing the Southern Downs Regional Council, Goondiwindi Regional Council and Toowoomba Regional Council local government areas, approximately 40 km west of the township of Warwick, see **Figure 1.1**. The region is predominantly rural land use and used for stock grazing with large tracts of land cleared of vegetation.

The OHTL will be located within a nominally 60 m wide easement, with a total disturbance footprint of approximately 393 ha. Approximately 27 km of the OHTL traverses the separately proposed Karara Wind Farm (KWF) and MacIntyre Wind Farm (MIWF) areas. The three projects (MIWF, KWF and the OHTL) are being progressed as separate projects due to current or likely future ownership arrangements.

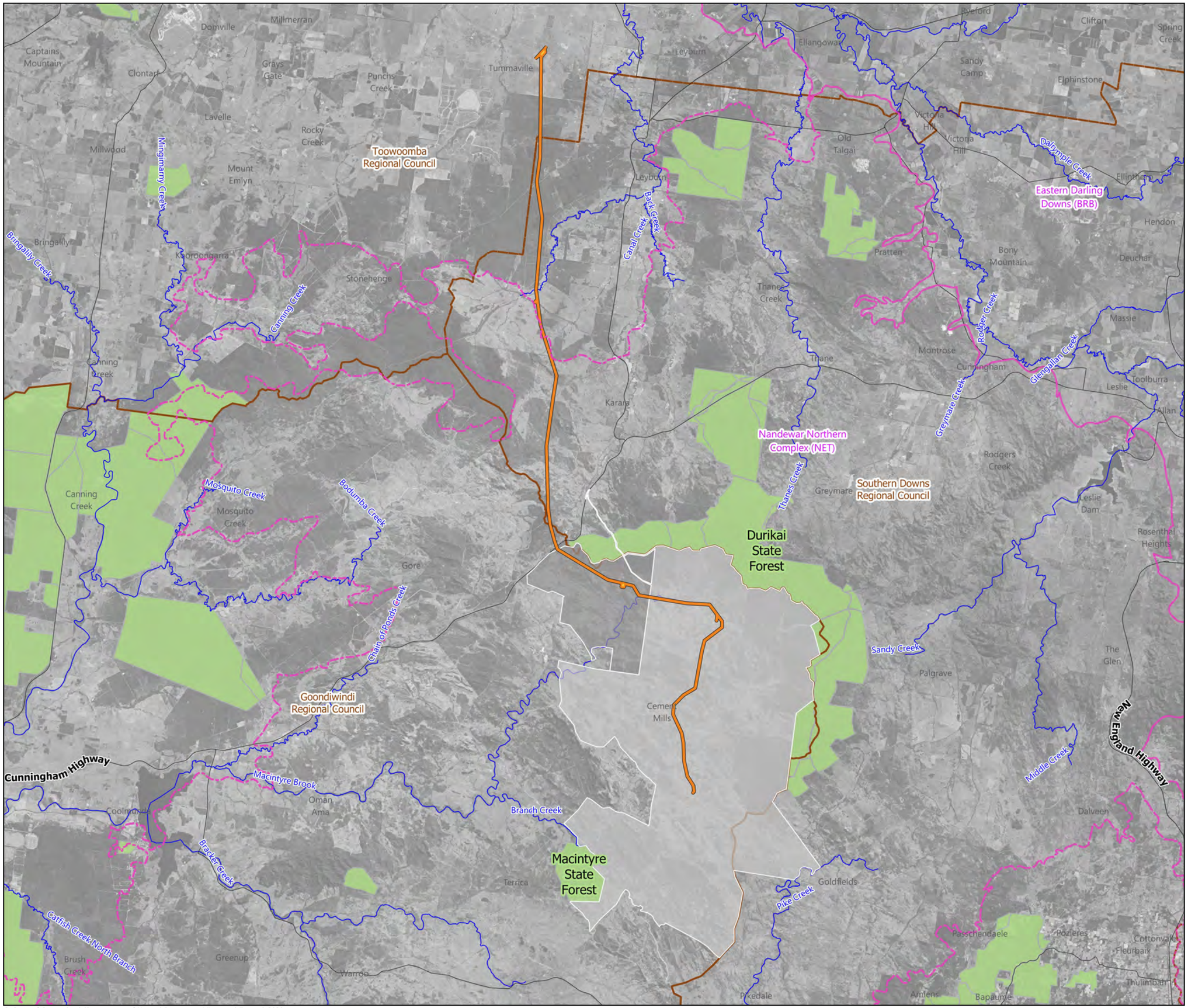
The Project will require approval under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral was submitted to the Commonwealth Department of Agriculture, Water and the Environment (DAWE), assessing the Project's potential to have a significant impact on matters of national environmental significance (MNES). Detailed ecology studies have been completed to identify and assess the type and extent of MNES potentially impacted by the Project and these informed the assessment and quantification of potential impacts to MNES.

Where unavoidable impacts to MNES, these impacts are proposed to be offset in accordance with the EPBC Act Environmental Offsets Policy (DSEWPC 2012). The quantification and approach to providing direct land-based offsets has been presented in the Environmental Offsets Strategy for the Project and submitted as part of the Preliminary Documentation material presented during the public notification period for the Project.

1.2 Purpose and Scope

In accordance with advice provided by DAWE, Offset Area Management Plans (OAMPs) will be prepared for approval by the minister prior to the commissioning of the Project. Prior to this approval, an Interim OAMP (this document) is required to set out offset management actions proposed to be undertaken from the commencement of the action up to the approval of the final OAMPs.

This Interim OAMP relates only to the OHTL; separate Interim OAMPs are being prepared for the MIWF and KWF.



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Overhead Transmission Line
Project Area

Figure 1.1

- Overhead Transmission Line
- Karara Wind Farm
- MacIntyre Wind Farm
- Major Road
- Watercourse
- Local Government Area Boundary
- Biogeographic Subregion
- Protected Area

Date: 2021-12-21
Author: TOD
Reviewed: JC
Project: ACC-005

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Data Source(s):
DCDB - Department of Natural Resources, Mines and Energy (2020)
Queensland Imagery Whole Of State Satellite Public Basemap Service

2.0 Project Environmental Offset Requirements

2.1 Ecological Values of the Project Area

The Project traverses a mix of open sheep grazing and several large intact remnants of complex Eucalypt woodland that provide habitat for a range of flora and fauna including conservation significant species. The Project area is immediately adjacent to the Durikai State Forest which also retains large stands of Eucalypt woodland.

Desktop analysis and ecological field assessments have been completed for the Project between 2011 and 2020 to support an understanding of the environmental values that are present. These studies informed a likelihood of occurrence assessment (GHD 2020) that returned the following EPBC Act listed species and communities known or considered likely to occur in the Project area:

- One threatened ecological community (TEC) – white box-yellow box-Blakely's red gum grassy woodland and derived native grassland (critically endangered);
- Three flora species – *Eucalyptus infera* (Durikai mallee) (vulnerable), *Macrozamia conferta* (vulnerable) and *Vincetoxicum forsteri* (endangered);
- Seven bird species – regent honeyeater (*Anthochaera phrygia*) (critically endangered), squatter pigeon (southern) (*Geophaps scripta scripta*) (vulnerable), painted honeyeater (*Grantiella picta*) (vulnerable), swift parrot (*Lathamus discolor*) (critically endangered), white-throated needletail (*Hirundapus caudacutus*) (vulnerable, migratory), rufous fantail (*Rhipidura rufifrons*) (migratory) and fork-tailed swift (*Apus pacificus*) (migratory);
- Three mammal – koala (*Phascolarctos cinereus*) (vulnerable), greater glider (*Petauroides volans*) (vulnerable) and grey-headed flying-fox (*Pteropus poliocephalus*) (vulnerable).

Additional detailed information is available in the OHTL MNES Assessment Report (GHD 2021).

2.2 Assessment of Significant Impacts

The design and layout of the Project has been refined through the iterative application of the mitigation hierarchy to minimise potential impacts as far as practicable. Nevertheless, the construction and operation of the Project will result in the removal of vegetation and the disturbance of existing ground conditions on either a temporary or permanent basis. The assessment of impacts to MNES determined that the following impacting processes are those most likely to result in a significant impact to one or more MNES:

- Loss of habitat;
- Injury or mortality;
- Fragmentation of habitat and loss of connectivity;
- Disturbance to habitat from noise, light and vibration;
- Habitat degradation and increased erosion;
- Spread of invasive species.

As part of the impact assessment process, a significance of impacts assessment was undertaken of the Project's potential impacts on MNES that were confirmed present or considered likely to occur within the Project area. The assessment determined that the Project is likely to result in significant residual impacts on the following listed species:

- *Macrozamia conferta* (vulnerable) – due to direct impacts the species;

- Koala (*Phascolarctos cinereus*) (vulnerable) – due to the impact on habitat critical to the survival of the species and potential for injury or mortality during construction;
- Grey-headed flying-fox (*Pteropus poliocephalus*) (vulnerable) – due to the magnitude of impact on winter foraging habitat that represents habitat critical to the survival of the species;
- Regent honeyeater (*Anthochaera phrygia*) (critically endangered) – due to a localised loss of habitat critical to the survival of the species;
- Central greater glider (*Petauroides armillatus*) (vulnerable) – due to the impact on habitat critical to the survival of the species;
- Squatter pigeon (southern) (*Geophaps scripta scripta*) (vulnerable) – due to the impact on habitat critical to the survival of the species.

2.3 MNES Offset Requirements

A summary of the MNES required to be offset under the EPBC Act is provided in **Table 2.1**.

Table 2.1 Offset requirements

MNES	Threat Status	Impacted Habitat Proposed to be Offset (ha)
Threatened Flora		
Macrozamia conferta	Vulnerable	164 individuals[1]
Threatened Fauna		
Koala (*Phascolarctos cinereus*)	Vulnerable	236.51
Grey-headed flying-fox (*Pteropus poliocephalus*)	Vulnerable	236.51
Regent honeyeater (*Anthochaera phrygia*)	Critically Endangered	4.66
Central greater glider (*Petauroides armillatus*)	Vulnerable	88.90
Squatter pigeon (southern) (*Geophaps scripta scripta*)	Vulnerable	126.65

[1] Offsets for this species are dealt with separately in the Translocation and Propagation Plan

3.0 Offset Sites

Two offset properties are currently proposed to acquit the Project's offset liabilities. **Figure 3.1** shows the location of these properties in relation to the Project. Note that these two properties will also be used to acquit offset liabilities for the OHTL Project. An offset options agreement has been executed for each of these properties.

The suitability of the offset sites were determined based on historical and/or recent records of MNES present within both the impact area and Offset Site 1 (see **Figure 3.3**) and Offset Site 2 (see **Figure 3.5**).

MNES presence or usage of the impact area are summarised as follows:

- Koala sighting at 3 sites and koala pellets from 14 sites within the impact area;
- Greater glider (scat) was found 800 m north of the impact area;
- The nearest historical record for regent honeyeater is approximately 3.5 km west of the impact area;
- No recent or historical records of grey-headed flying-fox within 20 km of the impact area;
- Squatter pigeon was recorded from 2 sites within the impact area.

The following section provides information on each of these offset sites, along with presence of MNES species and their potential habitat.

3.1 Offset Site 1

The proposed offset area of the Offset Site 1 is outlined on **Figure 3.2**. Offset Site 1 is located in the east of Goondiwindi Regional Council local government area, in the locality of Terrica. The proposed offset management area occurs in two discrete patches. The easternmost patch adjoins MacIntyre State Forest, occurs on lowland hills. The vegetation is a combination of small patches of remnant vegetation linked by larger areas of regrowth, dominated by woodlands to open woodlands of *Eucalyptus crebra, E. dealbata, E. albens* and woodlands of *E. melliodora*, *E. microcarpa* and *E. moluccana* (RE 13.11.3/13.11.8).

Offset site 1 contains habitat for all MNES values. **Table 3.1** presents the area of habitat available at the offset site for each MNES. The extent of habitat available will be confirmed during offset studies to be undertaken (as outlined in **Section 4.1**).

Table 3.1 Offset Site 1 MNES Habitat Areas

MNES	Habitat area present (ha)	Habitat Quality Score – Start Value	Habitat Quality Score – Future Value with Offset	% of Impact Offset
Koala (*Phascolarctos cinereus*)	221	5	7	23%
Grey-headed flying-fox (*Pteropus poliocephalus*)	221	5	7	29%
Regent honeyeater (*Anthochaera phrygia*)	185	6	8	277%
Central greater glider (*Petauroides armillatus*)	185	6	7	62%

MNES	Habitat area present (ha)	Habitat Quality Score – Start Value	Habitat Quality Score – Future Value with Offset	% of Impact Offset
Squatter pigeon (southern) (*Geophaps scripta scripta*)	221	6	7	22%

The proposed offset area provides an opportunity to improve connectivity between large areas of remnant and regrowth vegetation to the south and west of the property and Macintyre State Forest which is located to the east.

It is anticipated that the offset area will be managed for 20 years. Key management actions are likely to include:

- The installation of stock-exclusion fencing and its ongoing maintenance;
- Weed control and thinning of dense regrowth vegetation;
- Active revegetation such as seeding;
- Feral animal control (wild dogs are a known problem in the area);
- Establishment and maintenance of fire breaks;
- Fire management and controlled burns;
- Monitoring, evaluation and reporting.

3.1.1 Koala

Surveys recorded evidence of koala (scat) from one location within the offset site, see **Figure 3.3**. Koala faecal pellets were observed within the offset site at the base of relic trees within regrowth RE 13.11.3 along Macintyre Brook. This demonstrates that the offset currently provides suitable habitat for Koala.

3.1.2 Greater Glider

As with the Project area, the species was not recorded within the offset site. Evidence of a Greater Glider was recorded approximately 14 km northeast of the boundary of the offset site, see **Figure 3.3**. The offset contains suitable density of hollows (8-16 hollows per hectare) and mature trees (2-8 trees per hectare) to support the species and provide potential foraging and denning habitat (Eyre 2002). Higher density of hollow-bearing trees within the offset were concentrated along corridors of fringing communities of RE 13.3.4, see **Figure 3.3**. Connectivity within the offset is well established along these riparian corridors and areas of regrowth RE 13.11.8 with relic trees. Movement of greater glider within the offset and landscape is largely facilitated by these corridors and will be improved with management actions (see **Section 4.2**) that promote large tree and hollow development in regrowth vegetation and relic trees. Connectivity within the offset site will be further improved with revegetation of non-remnant areas and increasing stem density over time. This demonstrates that the offset currently provides suitable habitat for Greater Glider, which will be improved over time.

3.1.3 Regent Honeyeater

The species was not recorded within the offset site. However, there are several records of the species approximately 6 km northwest of the offset within vegetation along Macintyre Brook, see **Figure 3.3**. The offset site consists of high-quality habitat of *Eucalyptus melliodora* woodland and riparian zones with *Angophora floribunda*, as considered by the Commonwealth listing advice for regent honeyeater (DAWE 2021) and the National Recovery Plan for regent honeyeater (DoE 2016). This demonstrates that the offset provides suitable habitat to the impact area for Regent Honeyeater.

3.1.4 Grey-headed Flying-fox

As with the impact area, there are no recent or historical records of grey-headed flying-fox within 20 km of the offset site. The offset site is within proximity to three known nationally important flying-fox camps; two at Warwick approximately 35 km northeast and one approximately 45 km west in Inglewood. The proximity of these camps to the offset sites is approximately the same as the distance to the impact area. The offset site contains remnant and regrowth vegetation dominated by RE 13.11.3 and RE 13.11.8, which are the same dominant vegetation communities within the impact area. This demonstrates that the offset is likely to provide similar intermittent foraging habitat to the impact area.

3.1.5 Squatter Pigeon

The species was not recorded within the offset site. The species has been historically recorded <1 km from the north-eastern boundary along Branch Creek, see **Figure 3.3**. The offset site contains both areas of potential breeding habitat (RE 13.11.3 or 13.11.8) that occur within 1 km of permanent water, and potential foraging habitat (RE 13.3.4), as considered by the Commonwealth listing advice for squatter pigeon (DAWE 2021). The species is likely to sporadically occur throughout offset area as it contains suitable habitat.

3.2 Offset Site 2

The proposed Offset site 2 is presented on **Figure 3.4**. Regrowth areas generally comprise vegetation RE 13.11.3 and RE 13.11.5. A preliminary site visit has confirmed suitable habitat for koala and grey-headed flying fox. It is possible that the site could support regent honeyeater habitat. The proposed management area contains regrowth vegetation that includes advanced regrowth areas that are close to remnant, with other areas containing sparse and young regrowth.

Offset site 2 contains habitat for all MNES values. **Table 3.1** presents the area of habitat available at the offset site for each MNES. The extent of habitat available will be confirmed during offset studies to be undertaken (as outlined in **Section 4.1**).

Table 3.2 Offset Site 2 MNES Habitat Areas

MNES	Habitat area present (ha)	Habitat Quality Score – Start Value	Habitat Quality Score – Future Value	% of Impact Offset
Koala (*Phascolarctos cinereus*)	3,769	5	7	398%
Grey-headed flying-fox (*Pteropus poliocephalus*)	3,769	5	7	492%

MNES	Habitat area present (ha)	Habitat Quality Score – Start Value	Habitat Quality Score – Future Value	% of Impact Offset
Regent honeyeater (*Anthochaera phrygia*)	189	6	7	141%
Central greater glider (*Petauroides armillatus*)	3,363	6	7	332%
Squatter pigeon (southern) (*Geophaps scripta scripta*)	3,769	6	7	372%

Strategically, this property connections to large areas of remnant vegetation to the west.

It is anticipated that the offset area will be managed for 20 years. Key management actions are likely to include:

- The installation of stock-exclusion fencing and its ongoing maintenance;
- Weed control and thinning of dense regrowth vegetation;
- Active revegetation such as seeding;
- Feral animal control (wild dogs are a known problem in the area);
- Establishment and maintenance of fire breaks;
- Fire management and controlled burns;
- Monitoring, evaluation and reporting.

The proposed offset contains habitat that is currently, or will be in the future following management, the same or better than habitat being impacted for each MNES. The following sections provide information supporting the suitability of the offset site. In assessing the potential suitability of habitat for each MNES, the following hierarchy was applied:

- Was the species present through observation, either through sighting or signs of activity?
- Does the offset have known records within similar distance to the records located in proximity to the impact areas?
- Does the offset have existing suitable habitat for a species that will be improved over time to ensure that it provides habitat for the species?

3.2.1 Koala

Surveys recorded evidence of koala (scat) from thirteen locations within the offset site, see **Figure 3.5**. Koala faecal pellets were observed within both remnant and regrowth vegetation communities of RE 13.11.3, 13.11.8 and 13.11.5. This demonstrates that the offset currently provides suitable habitat for Koala.

3.2.2 Greater Glider

The species was not recorded within the offset site. Evidence of a Greater Glider was recorded approximately 3.6 km southeast of the boundary of the offset site, see **Figure 3.5**. The offset contains suitable density of hollows (4-196 hollows per hectare) and mature trees (2-64 trees per hectare) to support the species and provide potential foraging and denning habitat. Higher density of hollow-bearing trees within the offset were within remnant vegetation of both RE 13.11.8 and 13.3.4, see **Figure 3.5**. Connectivity within the offset is well established along these riparian corridors and areas of regrowth RE 13.11.8 with relic trees. Movement of greater glider within the offset and landscape is largely facilitated by these corridors and will be improved with management actions (see **Section 4.2**) that promote large tree and hollow development in regrowth vegetation and relic trees. Connectivity within the offset site will be further improved with re-vegetation of non-remnant areas and increasing stem density over time. This demonstrates that the offset currently provides suitable habitat for Greater Glider, which will be improved over time.

3.2.3 Regent Honeyeater

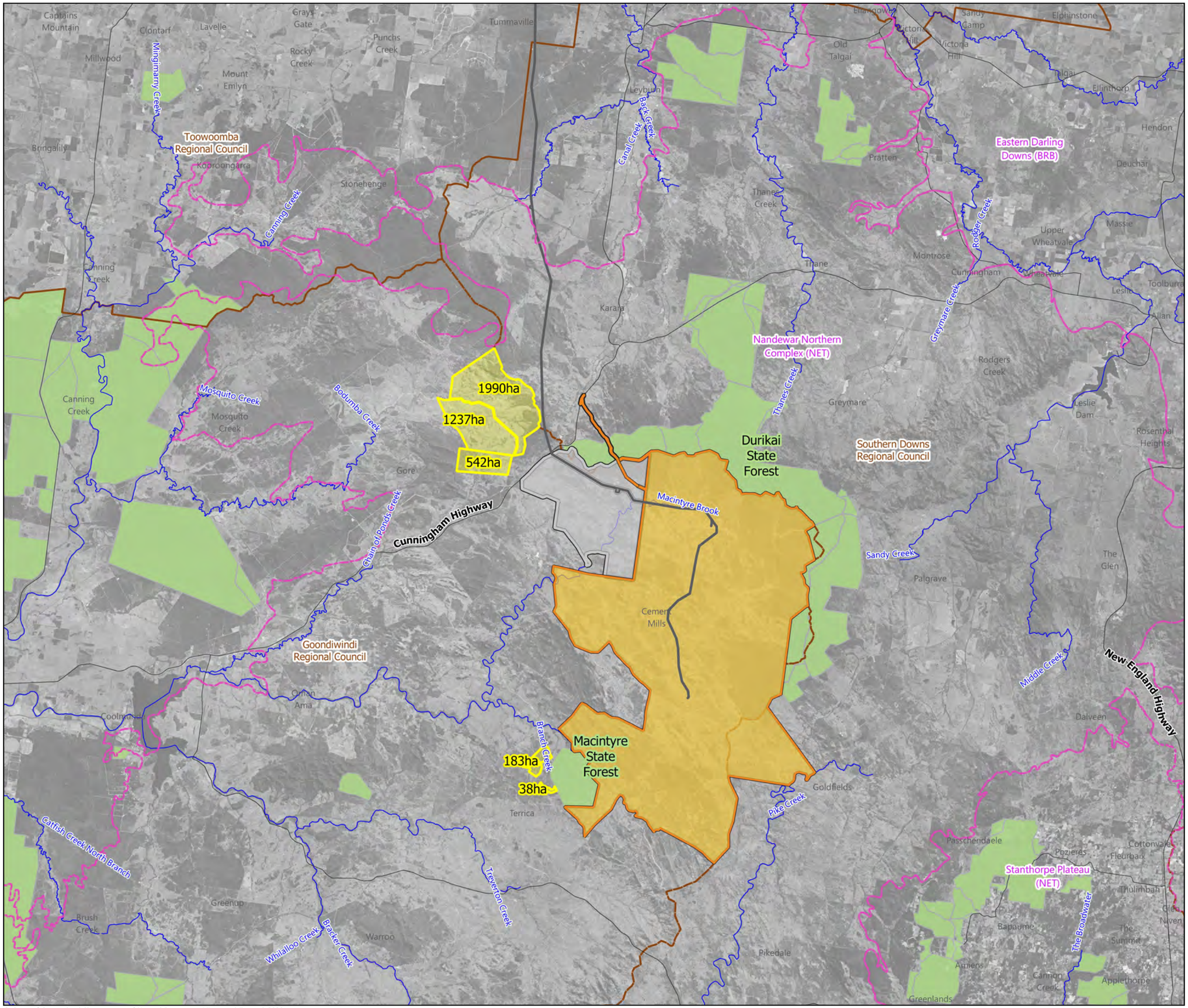
There is one historical record of regent honeyeater from the neighbouring property to the offset site, approximately 1 km (Atlas of Living Australia 2021). The offset provides key foraging and breeding habitat tree species such as *Eucalyptus melliodora, E. sideroxylon* and *E. fibrosa*, and a high abundance of mistletoe species including *Amyema cambageion, A. miquelii* and *A. pendula*. This demonstrates that the offset provides suitable habitat to the impact area for Regent Honeyeater.

3.2.4 Grey-headed Flying-fox

As with the impact area, there are no recent or historical records of grey-headed flying-fox within 20 km of the offset site. The offset site is within proximity to three known nationally important flying-fox camps; two at Warwick approximately 35 km northeast and one approximately 45 km west in Inglewood. The proximity of these camps to the offset sites is approximately the same as the distance to the impact area. The offset site contains remnant and regrowth vegetation dominated by RE 13.11.3 and RE 13.11.8, which are the same dominant vegetation communities within the impact area. This demonstrates that the offset is likely to provide similar intermittent foraging habitat to the impact area.

3.2.5 Squatter Pigeon

Surveys recorded squatter pigeon from two locations within the offset site, see **Figure 3.5**.



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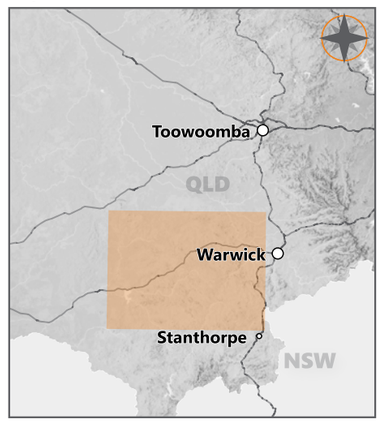
Overhead Transmission Line
Offset Site Context

Figure 3.1

- MacIntyre Wind Farm
- Karara Wind Farm
- Overhead Transmission Line
- Offset Management Area
- Major Road
- Watercourse
- Local Government Area Boundary
- Biogeographic Subregion
- Protected Area

Date: 2021-12-16
Author: TOD
Reviewed: JC
Project: ACC-005



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Data Source(s):
DCDB - Department of Natural Resources, Mines and Energy (2020)
Queensland Imagery Whole Of State Satellite Public Basemap Service

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Overhead Transmission Line

Proposed Offset Sites

Figure 3.2 Offset Site 1

- Offset Management Area
- Watercourse
- Easement
- Lot Type Parcel
- Bioregional Corridor
- Watercourse Vegetation Buffer

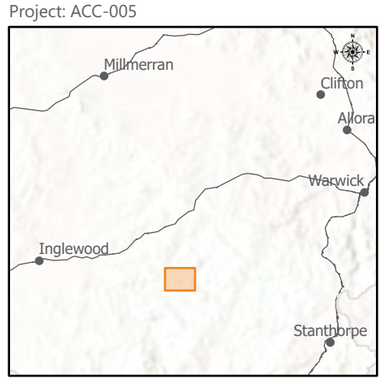
Vegetation Management Regional Ecosystem

- Remnant Vegetation Area containing endangered
- Remnant Vegeation Area containing of concern
- Remnant Vegetation Area that is least concern

Pre-clear Regional Ecosystems

- Pre-clear area containing endangered RE
- Pre-clear area containing of-concern RE
- Pre-clear area containing least-concern RE

Date: 8/10/2021
Author: DV
Reviewed: JC
Project: ACC-005



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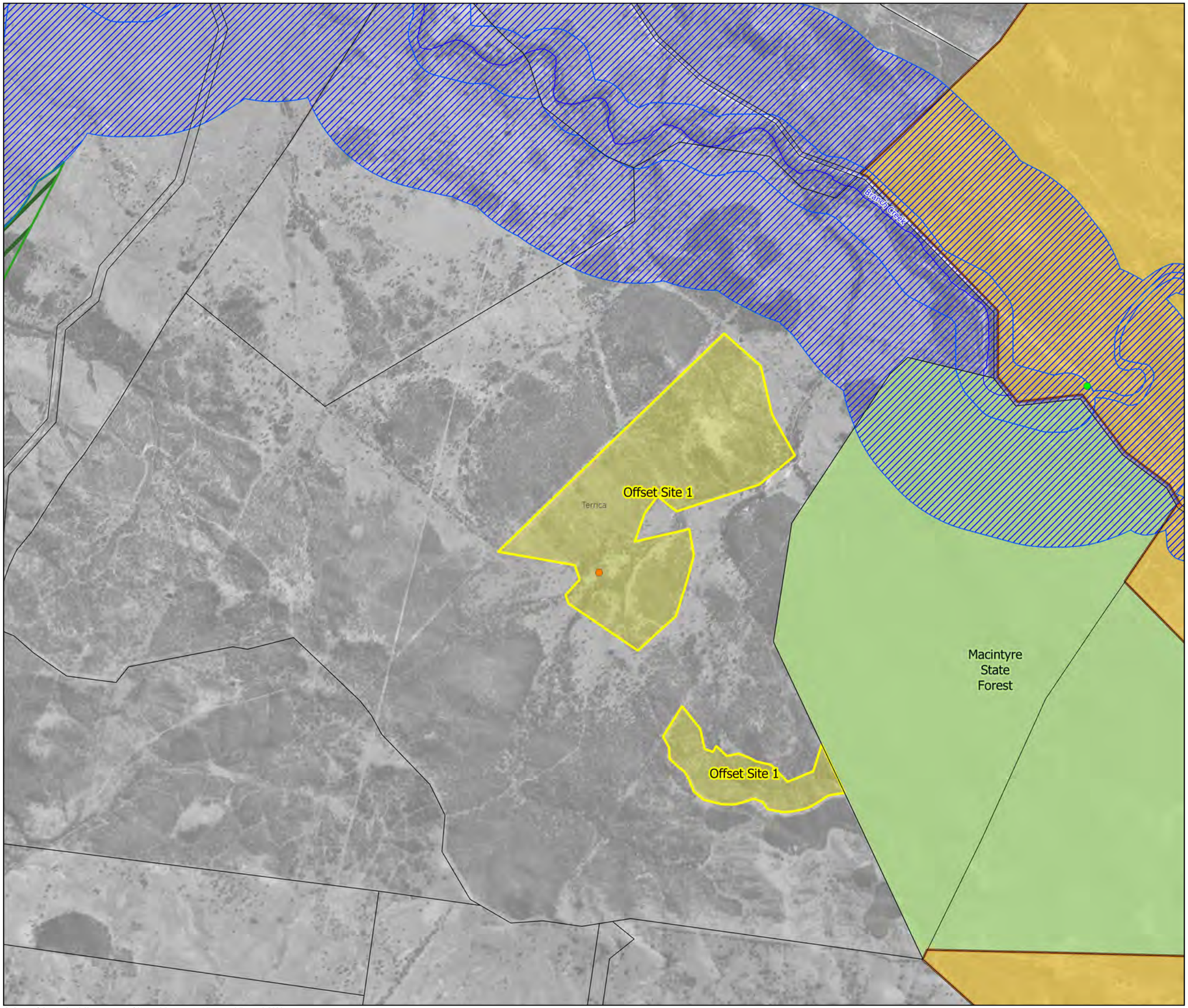

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Overhead Transmission Line

MNES within Offset Site 1

Figure 3.3

- MacIntyre Wind Farm
- Koala
- Squatter pigeon
- Offset Management Area
- Watercourse
- Protected Area

State Corridor Buffers

- Riparian
- Terrestrial
- Lot Boundary

Date: 2021-12-21
Author: TOD
Reviewed: JC
Project: ACC-005

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Data Source(s):
DCDB - Department of Natural Resources, Mines and Energy (2020)
Queensland Imagery Whole Of State Satellite Public Basemap Service

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Overhead Transmission Line

Proposed Offset Sites

Figure 3.4 Offset Site 2

- Offset Management Area
- Watercourse
- Easement
- Lot Type Parcel
- Bioregional Corridor
- Watercourse Vegetation Buffer

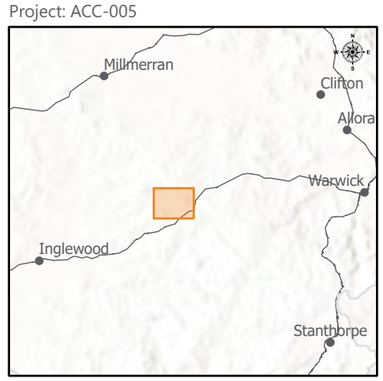
Vegetation Management Regional Ecosystem

- Remnant Vegetation Area containing endangered
- Remnant Vegeation Area containing of concern
- Remnant Vegetation Area that is least concern

Pre-clear Regional Ecosystems

- Pre-clear area containing endangered RE
- Pre-clear area containing of-concern RE
- Pre-clear area containing least-concern RE

Date: 8/10/2021
Author: DV
Reviewed: JC
Project: ACC-005



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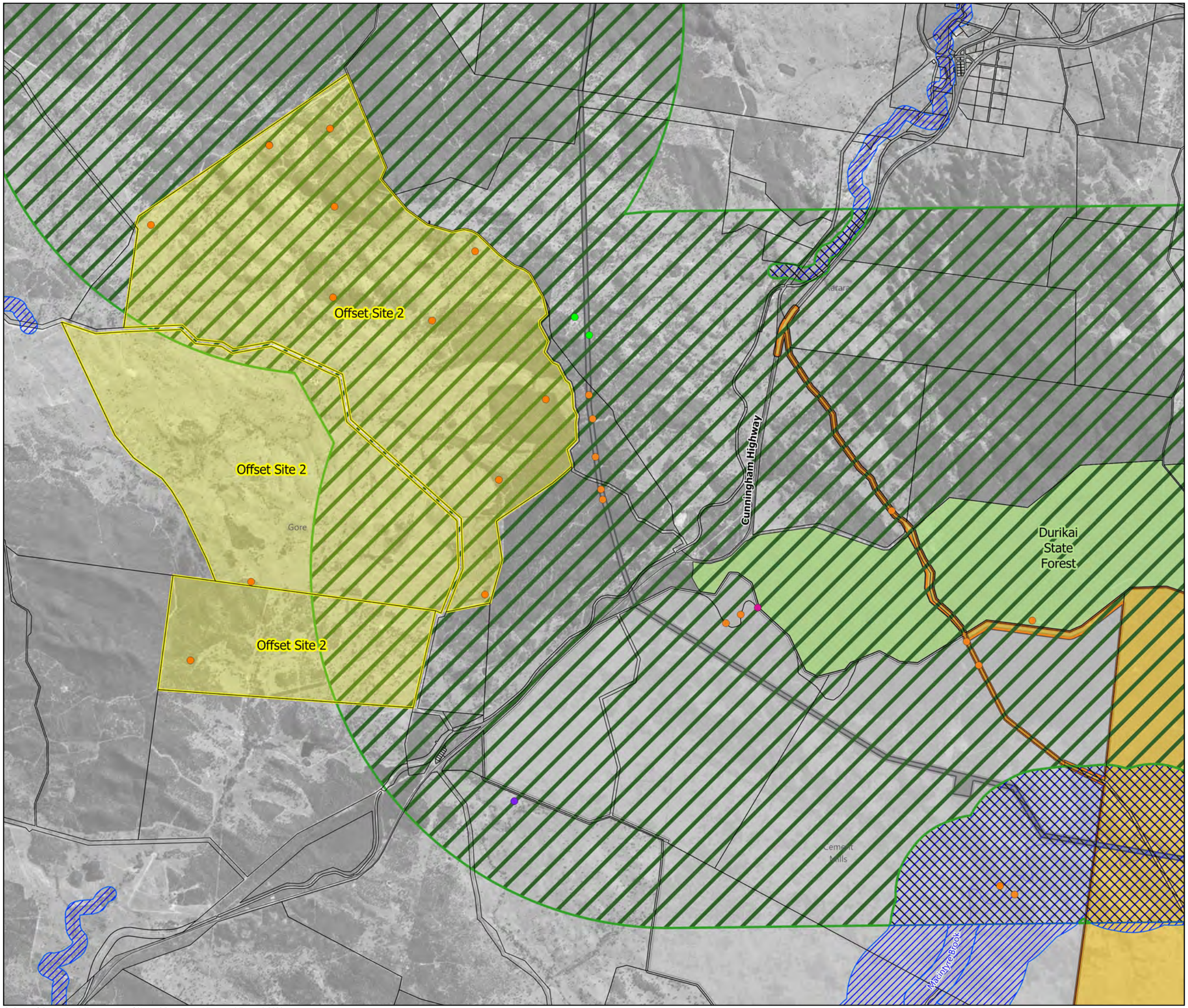

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Overhead Transmission Line

MNES within Offset Site 2

Figure 3.5

- MacIntyre Wind Farm
- Karara Wind Farm
- Overhead Transmission Line
- Koala
- Greater glider
- Squatter pigeon
- Offset Management Area
- Major Road
- Watercourse
- Protected Area

State Corridor Buffers

- Riparian
- Riparian/Terrestrial
- Terrestrial
- Lot Boundary

Date: 2021-12-21
Author: TOD
Reviewed: JC
Project: ACC-005

0 0.5 1 1.5 2 km

1:50000 @ A3

Data Source(s):
DCDB - Department of Natural Resources, Mines and Energy (2020)
Queensland Imagery Whole Of State Satellite Public Basemap Service

4.0 Offset Management Actions

To progress the development of appropriate environmental offsets that address approval conditions and the requirements of the EPBC Act Environmental Offsets Policy (DSEWPC 2012), a number of offset management actions are required to be undertaken. ACCIONA commits to undertake these offset management actions from the commencement of the Project, through to the approval of the final OAMPs.

Committed offset management actions have been developed in two phases; offset studies, and on-ground offset management. Offset studies will be undertaken to further assess the suitability of offset sites, collect baseline data, undertake habitat quality scoring and offset calculator scoring to develop appropriate offset management measures, milestones, monitoring, risk assessments and reporting requirements. Immediately following the completion of offset studies, on-ground offset management will commence. Information from these two phases will be used to develop the final OAMP for approval by the Minister, with approval required prior to commissioning of the Project.

The approval holder commits to undertake the following offset management actions:

- Offset studies:

  Undertake BioCondition and habitat quality assessments

  Prepare habitat quality scoring

  Complete EPBC Act offsets calculator

  Develop management measures for each assessment unit along with appropriate completion criteria

  Develop monitoring methodology, interim milestones and reporting schedule

  Undertake risk assessments for management measures proposed and develop triggers for corrective actions

- On-ground offset management:

  General offset management measures

  Fencing

  Weed control

  Stem density

  Hollow development

  Fire and fuel load management

  Pest animal control.

The following sections present additional information on each of these offset management actions.

4.1 Offset Studies

4.1.1 BioCondition and Habitat Quality Assessments

Field-based habitat quality assessments have been undertaken at impact sites. A range of site-based habitat quality data has been collected, principally based on the Queensland *BioCondition Assessment Manual Version 2.2* (Eyre et al 2015) and the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (DES 2017). Additionally, the approach has

incorporated draft guidance provided by DAWE on using modified habitat quality assessment (MHQA) to better reflect the requirements of the EPBC Act Environmental Offsets Policy.

This method is aimed at defining the appropriate field data to be collected during field habitat assessments to allow comparative analysis between sites and subsequently support area calculations for the purposes of acquitting offset requirements for the MNES identified as being impacted by the Project.

BioCondition Assessment requires a condition benchmark for each regional ecosystem (RE) represented to allow scoring of the assessment. Although the Government has only published BioCondition benchmarks for a subset of REs affected by the project, the Queensland Herbarium has provided the project with benchmark information for all affected REs. In order to do this, the Queensland Herbarium utilised data provided by the project from nine local reference sites established by the project within the adjoining Durikai State Forest. These reference sites were established as per the *Method for the Establishment and Survey of Reference Sites for BioCondition, Queensland Herbarium Version 3* (Eyre et al 2017).

The following sections describe the data collection approach for each of the MNES requiring offsets. The habitat quality scoring is then discussed further in **Section 4.1.2**.

It is first necessary to assign assessment units and survey zero points for each plot for each MNES at a desktop level, as prescribed in the BioCondition Assessment Manual. This allows navigation and the ability to ground-truth the desktop information for accuracy and relevance to the MNES to be assessed prior to progressing with the collection of more detailed field data. The following steps were undertaken at a desktop level, prior to mobilising for field surveys:

- Spatially locate suitable candidate sites including both remnant and non-remnant vegetation based on pre-clear mapping of REs (where there are known associations between REs and the MNES in question), with reference to historical records, soil types, protected areas, bioregional habitat corridors and/or any other landscape features that might provide additional habitat value to an area.
- Where possible, conduct aerial interpretation of vegetation health and cover, and the accuracy of mapping.
- Assign assessment units based on vegetation, health, cover and any other influences such as weediness, erosion, fire, grazing, clearing etc., that can be inferred from imagery.
- Assign sufficient survey plot locations based on initial assessment units according to Section 3.2 of the BioCondition Assessment Manual, noting that these may require fine tuning in the field.

4.1.1.1 Field

Field assessment steps are described below, specific to each MNES. More information on habitat quality scoring indicators for each species is presented in **Appendix A**.

4.1.1.2 Koala

- Navigate to the plot survey locations;
- Rapid vegetation assessment to be conducted using Quaternary plot assessment as per Nelder et al (2019). Reference the number of koala preferred canopy species and condition at site.
- Initial site verification of habitat suitability:

Are koalas present?

Is there evidence of habitation?

Conduct a koala SAT.

If no evidence, assess whether the site can be managed such that koala will ultimately use the site?

If no koalas are using the site and it is agreed that management will increase the likelihood of koala use, there will be a need to provide evidence that koalas use habitat nearby (within the species' documented home range) and that management of the site will increase the inhabited size or provide connectivity between known koala habitats.

- If it is not likely that koala will use the site with management, look for another site;
- Where necessary, modify assessment unit boundaries based on field interpretation;
- Develop habitat quality scores for the relevant assessment units as per the MHQA;
- As per the guide, habitat notes at each site should be made to address direct threats and developing threats.

4.1.1.3 Grey-headed Flying-fox

- Navigate to the plot survey locations;
- Rapid vegetation assessment to be conducted using Quaternary plot assessment as per Neldner et al 2019. Reference the number of preferred canopy feed species and their condition at site.
- Initial site verification of habitat suitability:

Are grey-headed flying-fox feed trees present?

Is there evidence of habitation?

Where are the closest roosts?

What is the likelihood of ongoing grey-headed flying-fox utilisation given that they are mobile feeders with seasonally nomadic roosting depending on food availability (i.e. the site may be significant even though there is no current activity)?

- Where necessary, modify assessment unit boundaries based on field interpretation;
- Calculate habitat quality scores for the relevant assessment units as per the MHQA.

4.1.1.4 Regent Honeyeater

- Navigate to plot locations using GPS;
- Rapid vegetation assessment to be conducted using Quaternary plot assessment as per Neldner et al (2019). Reference the number of preferred canopy feed species and condition at site;
- Initial site verification of habitat suitability:

Are regent honeyeater food sources present?

Regent honeyeaters preference larger trees at wetter, more fertile locations. Those trees tend to grow larger and provide more nectar. Key tree and mistletoe species for the regent honeyeater include:

  - Mugga (or red) ironbark, *Eucalyptus sideroxylon*;
  - Thin-leaved stringybark, *Eucalyptus eugenioides*;

- Yellow box, *E. melliodora*;
- Blakely's red gum, *E. blakeyi*;
- Grey box, *E. microcarpa*;
- Broad-leaved ironbark, *E. fibrosa*;
- White box, *E. albens*;
- Yellow gum, *E. leucoxylon*;
- Spotted gum, *Corymbia citriodora subsp.. variegata*;
- Needle-leaf mistletoe, *Amyema cambagei* on river sheoak, *Casuarina cunninghamiana*;
- *Amyema miquelii*;
- *A. pendula*;
- Box mistletoe, *A. miquelii*;
- Long-flower mistletoe, *Dendropthoe vitellina*.

- If the site isn't suitable regent honeyeater habitat move to the next site. Note: that while the site may not suit regent honeyeater it may be suitable for offsetting other matters;
- Where necessary, modify assessment unit boundaries based on field interpretation;
- Collect site data at sufficient number of plots and calculate habitat quality scores for the relevant assessment units as per the MHQA.

4.1.1.5 Central Greater Glider

- Navigate to the plot survey locations;
- Rapid vegetation assessment to be conducted using Quaternary plot assessment as per Neldner et al 2019. Reference the number of preferred canopy feed species and their condition at site;
- Initial site verification of habitat suitability:

Is there evidence of moderate to high abundance of large, live hollow-bearing trees?

- If the site is not suitable greater glider habitat move to the next site. Note: that while the site may not suit greater gliders it may be suitable for offsetting other matters;
- Where necessary, modify assessment unit boundaries based on field interpretation;
- Collect site data at sufficient number of plots and calculate habitat quality scores for the relevant assessment units as per the MHQA.

4.1.1.6 Squatter Pigeon

- Navigate to plot locations using GPS;

- Rapid vegetation assessment to be conducted using Quaternary plot assessment as per Neldner et al. (2019). Reference the number of preferred dominant canopy species and condition at site;
- Initial site verification of habitat suitability:

Are preferred dominant canopy species of *Eucalyptus*, *Corymbia*, *Acacia*, or *Callitris*, remnant and/ or regrowth present?

Is there permanent water in the area and is the distance to nearest permanent water body within 3 km of survey site?

- If the site is not suitable squatter pigeon habitat move to the next site. Note: that while the site may not suit the squatter pigeon it may be suitable for offsetting other matters;
- Where necessary, modify assessment unit boundaries based on field interpretation;
- Collect site data at sufficient number of plots and calculate habitat quality scores for the relevant assessment units as per the MHQA.

4.1.2 Habitat Quality Scoring

DAWE's modified habitat quality assessment (MHQA) is an adaptation of the Queensland Government's *Guide to determining terrestrial habitat quality v1.2* (EHP 2017). The MHQA better reflects the requirements of the *EPBC Act Environmental Offsets Policy* (DSEWPC 2012) for determining habitat quality, including consideration of **site condition, site context** and **species stocking rate**.

The MHQA can be used to value the quality of habitat at the impact and offset sites. Scores from the MHQA can be transferred into the quality score fields of the EPBC calculator. As a general rule, proposed offset areas in very good condition are unlikely to be useful as offsets as there is little scope for a gain in habitat quality. For this reason, properties with large areas of regulated vegetation and little regrowth have generally not been proposed as prospective offset areas. Equally, proposed offset areas in very poor condition may require too much time and active management to be able to confidently demonstrate the necessary conservation gains within the maximum time horizon of 20 years. Therefore, if it is expected that a field site scores close to 8 or less than 3 for habitat quality or BioCondition, the site will not be prioritised as a potential offset.

The proposed data inputs for the habitat quality scoring of the impact and offset sites for the Project area are listed in **Table 4.2**.

Table 4.1 Data input for scoring

Attribute	Methodology	Notes
Site Condition		
Site-based attributes: • Recruitment of woody perennial species in the ecologically dominant layer (EDL) • Native plant species richness – trees, shrubs, grasses and forbes • Tree canopy height • Tree canopy cover • Shrub canopy cover • Native grass cover • Organic litter • Large native trees • Coarse woody debris • Non-native plant cover	Raw data column: *Guide to determining terrestrial habitat quality* • Section 5.1.1 How to measure field based attributes *BioCondition Assessment Manual* (Eyre et al 2015) • Chapter 3 The assessment unit and site selection • Chapter 5 Assessment of site-based attributes Benchmarks column: *Guide to determining terrestrial habitat quality* • Section 5.1.1 How to measure field based attributes, Table 2 Guide for site condition scoring sheet *BioCondition benchmarks* (DES 2019) Each attribute scores 0, 3 or 5 according to the *Guide to determining terrestrial habitat quality*	Benchmarks are specific to the Regional Ecosystem present in the assessment unit (AU).
Species habitat attributes: • Quality and availability of food and foraging habitat • Quality and availability of shelter	*Guide to determining terrestrial habitat quality* – Section 7.2 Undertaking a species habitat index assessment, Table 4 Species habitat index scoring guide Each attribute scores 1, 5 or 10 according to the *Guide to determining terrestrial habitat quality*	These attributes are scored by determining species-specific indicators and developing a rating scale for each indicator.
Site Context		
Landscape-scale attributes: • Size of patch • Connectedness • Context	*Guide to determining terrestrial habitat quality* • Section 6.2 Undertaking a site context assessment, Table 3 Site context scoring sheet guide • Patch size scores 0, 2, 5, 7 or 15 • Connectedness scores 0, 2, 4 or 5 • Context scores 0, 2, 4 or 5 *BioCondition Assessment Manual* (Eyre et al 2015) • Chapter 6 Assessment of landscape-scale attributes (Section 6.1 Fragmented landscapes)	**Apply procedure for fragmented landscapes:** The *Guide to determining terrestrial habitat quality* includes instructions for intact and fragmented landscapes. To score these for the MHQA, apply the procedure for fragmented landscapes. **Include all habitat:** The *Guide to determining terrestrial habitat quality* includes only remnant or regrowth vegetation in these measurements. To score these for the MHQA, measurements must include *all* habitat for the protected matter. E.g. koala habitat includes any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees as defined in the *EPBC*

Attribute	Methodology	Notes
		Act referral guidelines for the vulnerable koala (DoE 2014). **Assess at AU scale:** The *Guide to determining terrestrial habitat quality* states that measurements should be conducted at the overall site level. To score these for the MHQA, measurements should be conducted at the Assessment Unit (AU) level. **Connectivity and absence of barriers to movement:** The *Guide to determining terrestrial habitat quality* measures connectivity based on adjacency to vegetation. To score this for MHQA, connectivity includes any boundaries where the protected matter can move into adjacent habitat (e.g. a boundary adjacent to a narrow strip of cleared land/track which koalas would use to move into adjacent habitat would be considered to be 'connected' to adjacent habitat). **Context buffer:** The *BioCondition Assessment Manual* measures context using a 1 km buffer. To score this for MHQA, the following buffers should be used: • TECs, plants, Collared Delma – 1 km • koala, Greater Glider, Squatter Pigeon – 20 km • South-eastern Long-eared Bat – 10 km • Painted Honeyeater, Australian Painted Snipe – 30 km • Dunmall's Snake, Yakka Skink, Ornamental Snake – 5 km
Landscape-scale attributes: • Ecological Corridors	*Guide to determining terrestrial habitat quality* • Section 6.2 Undertaking a site context assessment, Table 3 – Site context scoring sheet guide • Scores 0, 4 or 6	**Shared boundary and absence of barriers to movement:** Similar to Connectivity above, to score this for MHQA, 'sharing a common boundary with' an ecological corridor includes any boundaries where the protected matter can move into adjacent corridors (e.g. a boundary adjacent to a narrow strip of cleared land/track which koalas would use to move into adjacent corridors would be considered to be a shared common boundary).
Species habitat attributes: • Threats to the species	*Guide to determining terrestrial habitat quality*	This attribute is scored by identifying and scoring species-specific and site-specific threat factors.

Attribute	Methodology	Notes
	• Section 6.2 Undertaking a site context assessment, Table 4 Species habitat index scoring guide • Scores 1, 7 or 15	*Proposed threat factors and scoring must be provided, supported by peer reviewed literature, with references provided, or expert opinion.*
Species habitat attributes: • Species mobility capacity	*Guide to determining terrestrial habitat quality* • Section 6.2 Undertaking a site context assessment, Table 4 Species habitat index scoring guide • Scores 1, 4, 7 or 10	This attribute is not relevant to plants or TECs. This attribute is scored by determining species-specific indicators and developing a rating scale for each indicator. *Proposed scoring and species-specific indicators must be supported by peer reviewed literature, with references provided, or expert opinion.*
Species habitat attributes: • Role of site location to overall population	*Guide to determining terrestrial habitat quality* • Section 7.2 Undertaking a species habitat index assessment, Table 4 Species habitat index scoring guide • Scores 1, 4 or 5	This attribute relates to the likelihood that the site contains habitat critical to the survival of the species or community.
Species Stocking Rate (SSR)		
Species presence and usage attributes: • Presence detected on or adjacent to site (neighbouring property with connecting habitat) • Species usage of the site (habitat type & evidenced usage) • Approximate density (per ha)	MHQA spreadsheet provides a suggested scoring matrix	**Species usage:** To score this attribute, consider whether there are different definitions for habitat used for dispersal, foraging and/or breeding – refer to SPRAT profiles, conservation advices, recovery plans or other relevant EPBC policy documents. **Approximate density:** For species with sufficient population data, density ranges can be calculated based on local survey records/ sightings; or if comprehensive targeted surveys have been done on the impact and offset sites, ranges could be devised based on the results. Needs to consider species abundance in the same habitat type and carrying capacity. For cryptic species and data-deficient species, calculating density may not be possible, which would also mean that an increase in stocking rate is not feasible.
Role/importance of species population on site*	Score derived from SSR supplementary table (see below)	This attribute is not relevant to TECs.
***SSR Supplementary Table**		
Attribute	Methodology	Notes
Key source population for breeding	Refer to available literature on the species (including SPRAT profiles, conservation	
Key source population for dispersal		

Attribute	Methodology	Notes
Necessary for maintaining genetic diversity	advices, recovery plans or other relevant EPBC policy documents).	Scoring for these attributes must be supported by scientific evidence, surveys or studies, and species distribution mapping.
Near the limit of the species range		

Instructions on scoring are provided in Section 8 of the *Queensland Government Guide to Determining Terrestrial Habitat Quality v1.2*, Steps 2-6. These are listed in **Table 4.2**.

Table 4.2 Scoring calculations

Score	Methodology	Notes
Site Condition		
MAX Site Condition Score	Total the maximum scores for each attribute for Site Condition	For site-based attributes, maximum scores are provided in the relevant scoring tables in the: • *Guide to determining terrestrial habitat quality* (Step 2) and/or • *BioCondition Assessment Manual*
Score for sampling site	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score, Step 3	For each sampling site: • Total all site condition attribute scores • Divide by *MAX Site Condition Score*
Score for assessment unit	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score, Step 4	For each assessment unit: • Total all *scores for sampling sites* • Divide by number of sampling sites in the assessment unit
Area-weighted score for assessment unit	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score, Step 5	For each assessment unit: • Multiply *Score for assessment unit* by area (ha) of assessment unit • Divide by total site area (ha)
Score for the site	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score, Step 6	For the total site (matter area): • Add the *area-weighted scores for the assessment units*
Site Condition Score - out of 3	Convert the score for the site to a score out of 3	To convert the score for the site to a score out of 3: • Multiply *score for the site* by 3
Site Context		
Score	Methodology	Notes
MAX Site Context Score	Total the maximum scores for each attribute for Site Context	• For Size of patch, Connectedness and Context, maximum scores are provided in the relevant scoring tables in the *BioCondition Assessment Manual*

Score	Methodology	Notes
		• For Ecological corridors, maximum score is provided in Table 3 of the *Guide to determining terrestrial habitat quality* • For Role of site location to species overall population in the state, Threats to the species and Species mobility capacity, maximum scores are provided in Table 4 of the *Guide to determining terrestrial habitat quality*
Score for sampling site	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score	For each sampling site: • Total all site context scores • Divide by *MAX Site Context Score*
Score for assessment unit	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score	For each assessment unit: • Total all *scores for sampling sites* • Divide by number of sampling sites in the assessment unit
Area-weighted score for the assessment unit	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score	For each assessment unit: • Multiply *Score for assessment unit* by area (ha) of assessment unit • Divide by total site area (ha)
Score for the site	*Guide to determining terrestrial habitat quality* – Section 8 Determine the final habitat quality score	For the total site (matter area): • Add the *area-weighted scores for the assessment units*
Site Context Score – out of 3	Convert the score for the site to a score out of 3	To convert the score for the site to a score out of 3: • Multiply *score for the site* by 3
Species Stocking Rate		
Score	Methodology	Notes
Score assigned	Scored using scoring table in MHQA spreadsheet	
Total SRR score – out of 70	Total *Score assigned* column	
Total SRR score – out of 4	Convert to score out of 4	To convert the score to a score out of 4: • Divide score by 70 • Multiply score by 4
Final Habitat Quality Score (weighted)		
Score	Methodology	Notes
Average/Final	Transfer scores for Site Condition, Site Context and Species Stocking Rate	

Score	Methodology	Notes
Habitat Quality score - out of 10	Total *Average/Final* column	This score can be transferred into the Quality score fields of the *Offsets Assessment Guide* (DAWE) spreadsheet

If any of the attributes are not applicable for the species, remove the row from the spreadsheet (ensuring that the value for MAX Site Condition/Context Score updates accordingly).

Proposed habitat scoring indicators for each of the five MNES are presented in **Appendix A**. Habitat quality scoring is not relevant to the *Macrozamia conferta* offset as the offset calculator relies on the total number of individual plants impacted.

4.1.3 EPBC Act Offsets Calculator

Results from habitat quality scoring of the impact site will be entered into the EPBC Act offsets calculator for each species. Additional inputs will include; the area for each matter, the predicted final score at the offset site after the application of proposed management measures, the confidence in achieving the scoring change, the background risk of loss for the region and the EPBC Act status for each matter. The results of the calculator will be used to assess the total area required to be managed at the offset site, with the aim of achieving 100% of the impact offset for each matter.

4.1.4 Offset Management Measures and Completion Criteria

Offset management measures and completion criteria will be developed for each separate assessment unit within the offset sites. Management measures will be developed to be adaptive and respond to changing climatic conditions.

4.1.5 Monitoring, Milestones and Reporting

Monitoring of the management actions will be ongoing to assess their efficacy and the results documented in progress reporting. In addition to completion criteria, interim milestones will be developed for each management measure. Interim milestones will be developed for years 5, 10 and 15. Based on the results of monitoring, and comparison against interim milestones, management actions will be reassessed, as required, to specifically target offset values and help drive achievement of the offset outcomes within the target timeframes. The management actions and monitoring will be implemented until all completion criteria are achieved.

4.1.6 Risk Assessment and Corrective Actions

In developing habitat quality scores and offset management measures, a risk assessment will be undertaken in line with the risk assessment processes provided by DAWE in the template OAMP. Risk assessments will be undertaken in the following format:

Risk Analysis Matrix (DAWE 2021)

RISK MATRIX	
Likelihood (L): A qualitative measure of likelihood how likely is it that this event/circumstances will occur both before and after management activities are implemented	
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project

Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances
Consequence (C): Qualitative measure of what will be the consequence/result if the issue does occur	
Minor	Minor incident of environmental damage that can be reversed (*e.g. short-term delays to achieving strategy objectives, implementing low-cost, well-characterised corrective actions*)
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts (*e.g. short-term delays to achieving strategy objectives, implementing well-characterised, high cost/effort corrective actions*)
High	Substantial instances of environmental damage that could be reversed with intensive efforts (*e.g. medium-long term delays to achieving objectives, implementing uncertain, high-cost/effort corrective actions*)
Major	Major loss of environmental amenity and real danger of continuing (*e.g. strategy objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies*)
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage (*e.g. strategy objectives are unable to be achieved, with no evidenced mitigation strategies*)

Final Risk Rating (R): A function of multiplying Likelihood (L) and Consequence (C)

		Consequence				
Likelihood		Minor	Moderate	High	Major	Critical
	Highly Likely	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Table 4.3 Risk Analysis Table General Format

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Management Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
Force Majeure Events												
Drought	Extreme weather event	Likely	Moderate	Medium		Likely	Moderate	Medium				
Cyclones / Severe tropical lows / flooding	Extreme weather event	Likely	Minor	Low		Likely	Minor	Low				
Catastrophic Bushfire	Extreme weather event or uncontrolled burn	Possible	Critical	Severe		Unlikely	High	Medium				

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Management Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
	causing habitat degradation and loss of biodiversity											
Standard Risks												
The Offset failing (regardless of cause)	Offset area cannot support MNES	Possible	Critical	Severe		Rare	Critical	High				

4.2 On-ground Offset Management

Immediately following completion of offset studies, on-ground offset management will commence. On-ground offset management will involve the following actions to be informed by the results of the offsets studies phase:

- General measures – including signage, access restriction, maintenance of access tracks, control of grazing, restriction of timber and fodder harvesting;
- Fencing – development of fencing standards to restrict stock access and reduce risk of entanglement of MNES species;
- Weed control – develop target species lists, along with relevant controls for each species, develop weed management program;
- Stem density – develop measures to manage stem density to; effect the generation of coarse woody debris, promotion of early flowering species, promotion of trees with dense crowns, and large tree retention to support hollow development;
- Fire and fuel load management – establishment of fire breaks, measure to reduce fuel load, targets for controlled burns, including areas and frequency;
- Pest animal control – develop target species lists and controls proposed for each species.

5.0 Timing of Offset Management Actions

Once the Project is approved, proposed offset studies (as outlined in **Section 4.1**) will be completed within 3 months of commencement of construction. On-ground offset management (as outlined in **Section 4.2**) will commence following the completion of offset studies.

In the first 12 months of on-ground management the approval holder commits to:

- Undertaking field studies required to develop weed and pest management plans, including baseline weed and pest surveys. These plans will set priority actions for weed and pest management activities.
- Procuring services of contractors for on-ground management activities including; fencing, weed and pest management, fire breaks and seed collection (if required).

6.0 Impact Area Habitat Quality Assessment Results

Habitat quality assessment and BioCondition surveys were undertaken in January 2021. Surveys included a total of 40 survey sites within relevant assessment units. The results of the weighted habitat quality assessment scores for each of the relevant values are presented in **Table 6.1**.

Table 6.1 Impact Area Weighted Habitat Quality Scores

MNES	Impact Area (ha)	Weighted Habitat Quality Score
Koala	236.51	7.16
Grey-headed Flying-fox	236.51	5.96
Regent Honeyeater	4.66	7.20
Greater Glider	88.9	6.69
Squatter Pigeon	126.65	7.14
Macrozamia conferta	NA	NA – impacts to individuals proposed to be offset

7.0 Desired Conservation Outcomes

The majority of the proposed offset areas are regrowth. These regrowth areas will be managed so that they return to 'remnant vegetation' status as specified under the Queensland *Vegetation Management Act 1999*. This will require the predominant canopy of the vegetation to:

- Cover more than 50% of the undisturbed predominant canopy;
- Average more than 70% of the vegetation's undisturbed height;
- Be composed of species characteristic of the vegetation's undisturbed canopy.

Once these characteristics have been achieved the vegetation is considered to be generally resilient and self-sustaining. The time period that the regrowth will take to reach 'remnant vegetation' status will vary between assessment units, depending on the age and structure of the regrowth but is expected to be achieved for all areas within 20 years. Throughout this period these areas will also be managed to improve their suitability as habitat for the relevant MNES where these are fauna or flora species are achieved.

Some areas of the offset sites already have the characteristics of remnant vegetation (and are mapped as such on the Queensland Government regional ecosystem mapping). These areas have either never been cleared or are vegetation communities which have regrown over several decades. These areas will be managed to improve their suitability as habitat for the relevant MNES where these are fauna or flora species. These habitat improvements will be achieved within 20 years.

The majority of the offset sites contain regrowth vegetation that has been actively managed over many years. Generally, these areas are the most suitable for grazing pasture production and are often associated with lower slopes in proximity to ephemeral watercourses or, less commonly, broad hill crests. These areas will be managed to improve their suitability for koala, grey-headed flying fox, greater glider, squatter pigeon and regent honeyeater to move between adjoining regrowth and remnant vegetation patches, protect and enhance feed trees, and minimise edge effect impacts upon and threats to relevant MNES within the adjoining patches (e.g. weeds, fire, predation). These habitat improvements will be achieved within 20 years.

The overall habitat quality across each offset site will be improved through enhancing site condition attributes such as increasing woody perennial species recruitment, native plant species richness, tree canopy height and cover, shrub and native grass cover, organic litter and coarse woody debris and reducing weed cover. The quality and availability of food and foraging habitat and shelter, and species mobility capacity for regent honeyeater, koala, grey-headed flying fox, squatter pigeon and greater glider will be enhanced in their respective offsets. The 'Habitat Indicator Tables' in Appendix A provide details of each of the habitat characteristics that will be improved or considered for improvement for each MNES over the 20 year period. The offset site field assessments will enable the improvements in each of these characteristics for each MNES to be estimated.

The offsets will result in the following threats being reduced for each MNES:

- Koala – clearing, fragmentation, weeds, fire (impacts upon habitat as well as direct mortality) and dogs;
- Grey-headed flying fox – loss of foraging habitat and entanglement;
- Regent honeyeater – loss of foraging and nesting habitat including through fire;
- Greater glider – habitat fragmentation and loss of hollow-bearing trees from logging activities, inappropriate fire regimes, increased susceptibility to predation and competition;
- Squatter pigeon (southern) – habitat degradation and fragmentation from trampling and overgrazing by livestock, inappropriate fire regimes, increased competition and exposure to predation.

The offsets are over 40 km from the nearest known grey-headed flying fox roosting site. Therefore, it is not proposed that the offsets will aim to provide breeding habitat for this species.

Regent honeyeater and grey-headed flying fox have not been detected in the impact area during any of the Project's ecological surveys to date. There are some historical records (the most recent dating from 2004) of the regent honeyeater in the impact area and within or in proximity to proposed offset areas. It has been conservatively assumed that these two species may temporarily utilise the impact area on a seasonal basis. Similarly, utilisation of the offset areas is likely to be on a temporary and seasonal basis. Due to the paucity of data on these two species, it is not proposed that the offsets will aim to provide an increase in stocking rate for either the regent honeyeater or grey-headed flying fox.

There have been a small number of sightings of koala in the impact area during the Project's ecological surveys and greater glider were identified at several locations from scats. The impact and offset area field assessments will include koala SAT scat surveys to determine the feasibility of aiming for improvements in species stocking rates for koala and greater glider.

8.0 Future Steps

8.1 Offset Management Plans

Following the completion of offset studies (as outlined in **Section 4.1**), final offset management plans will be prepared for submission to DAWE for assessment and approval by the Minister. The management plans will provide details on the performance outcomes to be achieved, specific management actions required on each offset site, an estimate of the costs of management and details regarding the reporting and monitoring of offset actions and outcomes. Offsets include a mix of remnant vegetation and non-remnant areas. The management plans will therefore include details on where active management is required to restore ecosystem function whilst identifying appropriate management actions for remnant areas that require a different mix of management actions. The final management actions recommended will be dependent on the condition of vegetation and habitat, and the nature and type of threatening processes.

Detailed offset management plans will be developed that provide specific information on the following:

- Specific weed mapping across the offset sites;
- Pest animal mapping;
- Detailed assessment / mapping of species composition across all planted and regrowth areas to guide supplementary and enrichment planting;
- Fully quantify tree planting and maintenance requirements;
- Inspect and quantify changes to livestock grazing and pest exclusion fencing;
- Mosaic fire regimes (based on fuel load assessment and time since previous fire events).

Management plans will include cost estimates for all proposed management actions, monitoring and reporting, and detailed logistical program of works to guide implementation of conservation measures. Timing of works to maximise the return from resource and financial investment is considered critical for achieving conservation outcomes.

Management plans will set out an active management period of 20 years; however, all management actions will be guided through monitoring and subsequent reporting. It is anticipated that management efforts will be greatest in the first five years, particularly to establish revegetation areas, new fencing and getting weed populations under control.

8.2 Legal Mechanisms for Securing Offsets

Once the final offset package has been agreed, offset sites would be legally secured for offset purposes following Section 29 of the Offsets Act, through either of:

- An environmental offset protection area under Section 30 of the *Environmental Offsets Act 2014*; or
- An area declared as an area of high nature conservation value under Section 19F of the *Vegetation Management Act 1999* where it is secured for the purposes of an environmental offset

The mechanisms adopted to secure offsets will ultimately depend on the approval of relevant government departments, and landholders or parties with interests over the offset property.

The legal mechanism would remain on title for the offset area in perpetuity, ensuring that conservation gains are protected for the long term.

9.0 References

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Appendix A

Habitat Scoring Indicators

Koala scoring

The koala is endemic to Australia. The species' range extends from north-eastern Queensland to the south-east corner of South Australia. The distribution of the koala and its habitat are influenced by altitude (generally limited to <800 m above sea level), temperature and, at the western and northern ends of the range, leaf moisture (Munks et al. 1996). In the semi-arid regions in the western and northern parts of the species' range, koala distribution and abundance are strongly influenced by the availability of water in soils from which food trees draw water. Given that average annual rainfall is considerably higher towards the coast, the density of the koala population is generally greater there than inland.

Koalas naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by eucalyptus species (Martin & Handasyde 1999). Along the Great Dividing Range and the coastal belt throughout the species' range, koalas inhabit moist forests and woodlands mostly dominated by eucalyptus species. Koalas are habitat specialists and feed almost exclusively on eucalypt leaves which have low nutritional value and are high in indigestible or toxic materials. Therefore, they are selective about which tree species and leaves they consume. In general, soils with higher fertility and moisture holding capacity produce better quality, more palatable browse, which support koalas (Rhodes et al. 2015).

The species-specific habitat indicators for koala are presented below.

Koala Habitat Scoring Indicators

Habitat Indicator		Scoring
Quality and availability of food and foraging habitat		
Number of non-juvenile Koala habitat trees per ha	% of non-juvenile Koala habitat trees based on BioCondition benchmarks for the relevant RE into 3 classes.	1: < 25% of benchmark 5: 25-75% of benchmark 10: > 75% of benchmark
Richness of non-juvenile Koala habitat trees	The richness of non-juvenile Koala habitat tree species that can occur within a particular regional ecosystem as a % of those found in regional ecosystem technical descriptions.	1: < 25% of benchmark 5: 25-75% of benchmark 10: > 75% of benchmark
Moisture and nutrient content of leaves	Riparian areas, areas with alluvial or colluvial soils, or areas on lower slopes with moisture expression	1: Low 5: Medium 10: High
Number of juvenile koala habitat trees per ha	% of juvenile koala habitat trees based on the BioCondition benchmarks for the relevant REs (S1 & S2 layers) into 3 classes.	1: < 25% of benchmark 5: 25-75% of benchmark 10: > 75% of benchmark
Quality and availability of shelter		
Non-juvenile Koala habitat tree benchmark	% of non-juvenile Koala habitat trees based on BioCondition benchmarks for the relevant RE into 3 classes.	1: < 25% of benchmark 5: 25-75% of benchmark 10: > 75% of benchmark
Non-juvenile tree species with dense foliage per ha	Tree species with closed or dense canopies may provide shelter during extremes of weather (heat, heavy rain periods) based on BioCondition benchmarks for the relevant RE into 3 classes.	1: < 25% of benchmark 5: 25-75% of benchmark 10: > 75% of benchmark

Habitat Indicator		Scoring
Species mobility capacity		
Coarse woody debris	High abundance of coarse woody debris limiting site scale species mobility based on BioCondition benchmarks for the relevant RE into 4 classes.	1: >200% of benchmark 4: 150-200% of benchmark 7: 100-150% of benchmark 10: 100% of benchmark
Number of refuge trees	Presence / abundance of trees to provide refuge from predators (dogs) within the site based on BioCondition benchmarks for the relevant RE into 4 classes.	1: no large trees present 4: 1-25% of benchmark large trees 7: 25-50% of benchmark large trees 10: 51-100% of benchmark large trees
Non-native plant cover	Presence of high threat weeds that have potential to affect species mobility at the site scale include dense swards of large exotic pasture grasses, thicket forming woody weeds or presence of dominant weedy vines.	1: >50% cover of high threat exotic species 4: 25-50% cover of high threat exotic species 7: 5-25% cover of high threat exotic species 10: < 5% cover high threat exotic species
Role of site location to species overall population in the State		
		1: not or unlikely to be critical to species' survival 4: likely to be critical to species' survival 5: critical to species' survival
Threats to species		
		1: high threat level (i.e. likely to result in death, irreversible damage) 7: moderate threat level 15: low threat level (i.e. likely to survive)

Grey-headed Flying-fox scoring

The grey-headed flying-fox is Australia's only endemic flying-fox and occurs in the coastal belt from Rockhampton in central Queensland to Melbourne in Victoria (Tidemann 1998). However, only a small proportion of this range is used at any one time, as the species selectively forages where food is available. As a result, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years (DoEE 2019).

Grey-headed flying-fox form two different roosting camps, summer camps and winter camps (Nelson 1965). Summer camps are used from September to April or June. In these camps, they establish territories, mate and reproduce (Nelson 1965). Winter camps are used from April to September. The sexes are separated in winter camps and most behaviour is characterised by mutual grooming (Nelson 1965). Summer camps are considered "main camps", while winter camps are referred to as "transit camps".

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. The primary food source is blossom from eucalyptus and related genera but in some areas, it also utilises a wide range of rainforest fruits (Eby 1998). 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 (Duncan et al. 1999; Eby 1996; Eby 1998; Nelson 1965; Parry-Jones & Augee 1992; Spencer et al. 1991 as referenced in DoEE 2019).

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 (van der Ree et al. 2005). Roost vegetation includes rainforest patches, stands of melaleuca, mangroves and riparian vegetation (Nelson 1965; Ratcliffe 1931), but colonies also use highly modified vegetation in urban and suburban areas (Birt et al. 1998; Tidemann & Vardon 1997; van der Ree et al. 2005). The species can maintain fidelity to roost sites for extended periods (Lunney & Moon 1997), although new sites have been colonised (DoEE 2019).

Based on the National Flying-fox Monitoring Program (NFMP) the total population of grey-headed flying-fox was estimated to be 700,000 in 2018.

The species-specific habitat indicators for GHFF are presented below.

Grey-headed Flying-fox Habitat Quality Attributes Scoring

Habitat Indicator		Scoring
Quality and availability of food and foraging habitat		
Availability of Food Trees Presence of food species within the site, as defined in Eby and Law (2008) Benchmarked against the technical description for the relevant RE (species and cover %).	Density per hectare Blossom diet species: forage species from *Eucalyptus*, *Corymbia* or *Angophora* genus. Fruit diet species.	1: < 25% of potential density 5: 25-75% of potential density 10: > 75% of potential density
Availability of High Yield of Food Trees Habitat wt p*r score indicates the yield of food tree species based on a measure of productivity and reliability (Eby & Law 2008). Benchmarked against the technical description for the relevant RE (species and cover %).	Density per hectare Density of species with a high (>0.65) wt p*r score	1: < 25% of potential density 5: 25-75% of potential density 10: > 75% of potential density

Habitat Indicator		Scoring
Richness of Feed Species Blossom or fruit diet tree species reflecting potential richness for the relevant RE based on the technical description for that RE.	Blossom diet species: forage species from *Eucalyptus*, *Corymbia* or *Angophora* genus. Fruit diet species.	1: < 25% of potential density 5: 25-75% of potential density 10: > 75% of potential density
Quality and availability of shelter		
NA	Not scored	This attribute was not scored because there are no known camps within the project area (the nearest recorded camp is approximately 35km to the northeast) and because the capacity of a site to provide resources during important breeding and food shortage periods is dealt with by meeting richness benchmarks outlined above in quality and availability of food and habitat required for foraging.
Species mobility capacity		
Proximity to nationally important camps Reducing the distance the species has to travel to forage	Distance in km Distance from nationally important flying-fox camps to mid-point of assessment unit.	1: > 50km 4: 30-50km 7: 20-30km 10: < 20km
Presence of large-scale objects preventing dispersal Physical structures that prevent dispersal or access to the assessment unit or site	Presence or absence of structures Scored on the basis of presence or absence of structures that prevent access	1: structures present 10: structures not present
Role of site location to species overall population in the State		
		1: not or unlikely to be critical to species' survival 4: likely to be critical to species' survival 5: critical to species' survival
Threats to species		
		1: high threat level (i.e. likely to result in death, irreversible damage) 7: moderate threat level 15: low threat level (i.e. likely to survive)

Regent Honeyeater Scoring

The regent honeyeater is listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Nature Conservation Act 1992*, having undergone more than 80% population decline within three generations (Garnett et al. 2011).

The regent honeyeater is identified by its black head, neck and upper breast, with its yellow back and lower breast scaled black, and underparts grading into a white rump. The wings have conspicuous yellow patches, and a black tail, edged yellow. The male of the species has yellowish warty bare skin around the eye and the female is generally smaller, with a bare yellowish patch under the eye and less black on the throat (Pizzey 1981; Menkhorst 1993).

The regent honeyeater is endemic to south-eastern Australia. It has a patchy distribution which extends from 100 km north of Brisbane, through NSW and the ACT, to central Victoria. Records are widely distributed across its range, but it is only found regularly at a few localities in NSW and Victoria where most recent sightings are now recorded (Menkhorst et al. 2017).

The species is considered partially migratory or dispersive post the breeding season with evidence of movement into southern Queensland and northern NSW in early autumn (Franklin et al. 1989). It is thought these birds are moving out of cooler climates in search of nectar supplies (Franklin et al. 1989, Pizzey & Knight 2012).

Regent honeyeater populations have undergone significant declines in recent decades with a decline of 80% over a period of approximately 24 years prior to 2011. As of 2011, the entire population of mature individuals was estimated to be a maximum of 400 birds. Subsequent surveys suggest the species population is continuing to decline (Garnett et al. 2011). The decline of the regent honeyeater population appears to be primarily due to habitat loss, fragmentation and general degradation (Garnett et al. 2011). The species relies on several different foraging resources and is particularly susceptible to the removal of large mature trees which offer reliable sources of nectar required for successful reproduction (Franklin et al. 1989; Oliver 2000).

Regent honeyeaters occur mainly in dry box-ironbark eucalypt woodland and sclerophyll forest, but also inhabit riparian vegetation and lowland coastal forest areas (DoE 2016) inland of the Great Dividing Range, particularly favouring those on the wettest, most fertile soils, such as along creek flats and broad river valleys. Other forest types regularly utilised by regent honeyeaters include wet lowland coastal forest dominated by swamp mahogany (*Eucalyptus robusta*), spotted gum-ironbark associations and riverine woodlands (Menkhorst 1997; Geering & French 1998; Oliver et al., 1998; Oliver et al., 1999). Habitat adjacent to box-ironbark woodland (Geering & French 1989; Oliver et al. 1998; Oliver et al., 1999) and within 150m of a water source are also preferred (Crates 2019). Remnant stands of timber, roadside reserves, travelling stock routes and street trees also provide important habitat at certain times (Franklin et al. 1987; Franklin et al. 1989; Ley & Williams 1992; Webster & Menkhorst 1992; Oliver 1998).

The regent honeyeater requires high volumes of nectar, particularly during the breeding season. It is primarily nectivorous but will feed on other resources such as fruit, lerps (psyllids) and arthropods (Franklin & Robinson 1989). Notably important tree species across its geographical range consists of *Eucalyptus sideroxylon*, *E. melliodora*, *E. albens*, and *E. robusta*, with a lesser reliance on *E. eugenioides* and *E. fibrosa*. The species is also known to exploit the fruit and nectar from multiple species of mistletoe – particularly those within the genus of *Amyema*, and search stands of *Allocasuarina* for arthropods (Franklin & Robinson 1989).

Studies undertaken across 92 sites found the percentage of canopy cover, the density of mistletoe, the density of riparian tree species and a lower density of shrubs over 2m were also positively correlated with the presence of regent honeyeater (Oliver et al. 1999).

The regent honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts, preferably taller and larger diameter trees as these typically produce more nectar (Franklin & Robinson 1989; Webster & Menkhorst 1992; Menkhorst et al. 1999; Oliver 2000). Key eucalypt species include mugga ironbark, yellow box, white box and swamp mahogany. Other tree species may be regionally important.

Key tree and mistletoe species associations for the regent honeyeater include:

- Mugga (or red) ironbark, *Eucalyptus sideroxylon;*
- Thin-leaved stringybark, *Eucalyptus eugenioides;*
- Yellow box, *E. melliodora;*
- Blakely's red gum, *E. blakeyi;*
- Grey box, *E. microcarpa;*
- Broad-leaved ironbark, *E. fibrosa;*
- White box, *E. albens;*
- Yellow gum, *E. leucoxylon;*
- Spotted gum, *Corymbia citriodora subsp.. variegata;*
- Needle-leaf mistletoe, *Amyema cambagei* on river sheoak, *Casuarina cunninghamiana;*
- *Amyema miquelii*;
- *A. pendula;*
- Box mistletoe, *A. miquelii;*
- Long-flower mistletoe, *Dendropthoe vitellina.*

When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings (Geering & French 1998). Particularly when breeding, this includes gum exudate from stems of Eucalyptus and Banksia species, bees, ants and spiders, insects including Hemiptera, Psyllidae, Coleoptera, Carabidae, Scarabaeidae, Elateridae, Bostrychidae, Coccinellidae Chrysomelidae, Apionidae, Diptera, Lepidoptera, Hymenoptera, Tenthredinidae, Chalcididae, Formicidae, Arachnida and Araneae (Barker & Vestjens 1984; BirdLife International 2018).

In Queensland, the regent honeyeater has been primarily recorded from the south-east corner, south of a line between Chinchilla and the Sunshine Coast. There are records from several State Forests, including breeding activity in suitable habitat, particularly in the Warwick-Stanthorpe districts (Hines 2008).

The species breeds between July and January in box-ironbark and other temperate woodlands and riparian gallery forest dominated by river sheoak. Regent honeyeaters usually nest in horizontal branches or forks in tall (>8m) mature eucalypts and sheoaks but also nest in mistletoe haustoria. Within its current distribution there are four known key breeding areas where the species is regularly recorded. These are the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in New South Wales, and the Chiltern area in north-east Victoria. Breeding has also been regularly recorded in the Cement Mills-Durakai area west of Warwick, Queensland and in the Australian Capital Territory (DoE 2016).

Breeding territories contain a nest-tree and surrounding feeding areas can extend 5-40m or more from the nest-tree (Higgins et al. 2001). Nests are usually established in the canopy of mature trees with rough bark including ironbark, sheoaks (*Casuarina*) and rough-barked apple (*Angophora*). Nests can be up to 700m from a resource tree (Geering & French 1998) and distances between nests can range from 40-110m depending on location and habitat (Higgins et al. 2001). Nests position in upright forks between 4-25m above ground at extremity of branches (Oliver et al. 1998).

The major cause for the decline in the regent honeyeater population has been the clearing and fragmentation of woodland and forest containing the bird's preferred eucalypt species. Whilst clearing directly reduces the amount of

available habitat, it can also make remaining remnants unsuitable as they become too small, isolated, or degraded and increase competition with large, aggressive nectivorous species including noisy miners *Manorina melanocephala,* noisy friarbird *Philemon corniculatus,* and red wattlebird *Anthochaera carunculata*. Nest predation by multiple arboreal marsupial and bird species is a significant threat to the species' ability to recruit (DoE 2016). The primary threats to the regent honeyeater are highly interactive and relate to the species' small population size, habitat loss and fragmentation, competition, and degradation of remnant habitat.

The species habitat assessment indicators (see table below) for the regent honeyeater have been determined through the use of information contained within the Species National Recovery Plan (DoE 2016) and scientific investigations into the species habitat and behaviours (as referenced throughout).

Regent Honeyeater Habitat Quality Attributes Scoring

Habitat Indicator		Scoring
Quality and availability of food and foraging habitat		
Availability of Food Trees	Density High Quality Habitat consists of old growth >50-70% (Nature Advisory 2020) with abundance of key food trees: • Mugga (or red) ironbark (*E. sideroxylon),* • Thin-leaved stringybark (*E. eugenioides*), • Yellow box (*E. melliodora*), • Blakely's red gum *E. blakeyi,* • Grey box (*E. microcarpa*), • Narrowleaf ironbark (E. crebra) • Broad-leaved ironbark (*E. fibrosa*), • White box (*E. albens*), • Yellow gum (*E. leucoxylon*), • Swamp mahogany (*E. robusta*), • Spotted gum (*Corymbia maculata*), • River sheoak (*Casuarina cunninghamiana*), And where mistletoe species may be present: • Needle-leaf mistletoe, *Amyema cambagei* • *Amyema miquelii,* • *Amyema pendula* • Box mistletoe, *Amyema miquelii* • Long-flower mistletoe, *Dendropthoe vitellina*	1: < 10% old growth 5: 10-50% old growth 10: > 50% old growth
Quality and availability of shelter		
Availability of nesting trees	Density per hectare Nests are established in the canopy of mature rough-barked trees and in smaller trees with dense crowns: • Ironbark (*Eucalyptus sideroxylon*) • Broad-leaved ironbark (*E. fibrosa*) • Swamp mahogany (*E. robusta*) • River sheoak (*Casuarina cunninhamiana*) • Rough-barked apple (*Angophora*) And where mistletoe species may be present:	1: 0 mature rough-barked trees 5: 10-50 mature rough-barked trees 10: > 50 mature rough-barked trees

Habitat Indicator		Scoring
	• Needle-leaf mistletoe, *Amyema cambagei* • *Amyema miquelii*, • *Amyema pendula* • Box mistletoe, *Amyema miquelii* • Long-flower mistletoe, *Dendropthoe vitellina*	
Species mobility capacity		
The percentage of canopy cover and a lower density of shrubs over 2m	The major cause for the decline in the regent honeyeater population has been the clearing and fragmentation of woodland and forest containing the bird's preferred eucalypt species (DoEE, 2016). Studies undertaken across 92 sites found the percentage of canopy cover, the density of mistletoe, the density of riparian tree species and a lower density of shrubs over 2m were also positively correlated with the presence of regent honeyeater (Oliver et al. 1999).	1: Canopy cover, canopy height <50%, T3 and shrub layers exceed benchmark 5: Canopy cover, canopy height >50%, <100 % T3 and shrub layers exceed benchmark 10: Canopy cover, canopy height 100%, T3 and shrub layers meet benchmark
Role of site location to species overall population in the State		
		1: not or unlikely to be critical to species' survival 4: likely to be critical to species' survival 5: critical to species' survival
Threats to species		
		1: high threat level (i.e. likely to result in death, irreversible damage) 7: moderate threat level 15: low threat level (i.e. likely to survive)

Central Greater Glider Scoring

The greater glider is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Nature Conservation Act 1992*.

The greater glider is an arboreal nocturnal marsupial, largely restricted to old-growth, contiguous open eucalypt forests and woodlands along the Great Dividing Range with patchy distribution from north-eastern Queensland to south-eastern and central Victoria, across an elevational range from sea level to 1200m above sea level (Kavanagh 2000; Smith & Smith 2018). The species is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers (van der Ree et al. 2004). It is typically found in highest abundance in taller, mature, moist eucalypt forests and woodlands with relatively large trees, excluding non-remnant (regrowth) and rainforest habitats (Kavanagh 2000; Eyre et al. 2018; van der Ree et al. 2004; Vanderduys et al. 2012; Van Dyck & Strahan 2008).

The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species, and large hollow-bearing trees are a key habitat feature required within its home range of 1-4 ha to maintain high density populations (Kavanagh 1984, 2000; Eyre 2006; Lindenmayer et al. 2004; McLean et al. 2015). In Queensland, greater gliders preference of habitat is dry, mixed eucalypt forest and woodlands dominated by a variety of hollow-bearing ironbark and smooth bark tree species (Cohen 2019). They feed on the young leaves of eucalypts, and shelter in large hollow branches (TSSC 2016).

Notwithstanding relatively small home ranges, but in part because of low dispersal ability, greater gilders may be sensitive to fragmentation (Eyre 2006; McCarthy & Lindenmayer 2006; Lindenmayer et al. 2000; Taylor & Goldingay 2009), have relatively low persistence in small forest fragments, and disperse poorly across vegetation that is not native forest. Modelling suggests that they require native forest patches of at least 160 km^2 to maintain viable greater glider populations (Eyre 2002). Kavanagh and Webb (1989) found no significant movement of greater gliders into unlogged reserves from surrounding logged areas.

The species habitat assessment indicators (see table below) for the greater glider have been determined using information contained within the Approved Conservation Advice for Greater Glider (*Petauroides volans*) via The Action Plan for Australian Mammals 2012 (TSSC 2016; Woinarski et al. 2014), and scientific investigations into the species habitat and behaviours (as referenced throughout).

Central Greater Glider Habitat Quality Attributes Scoring

Habitat Indicator		Scoring
Quality and availability of food and foraging habitat		
Availability of Food Trees Presence of food species within the site, as defined by Eyre (2002), benchmarked against the technical description for the relevant RE (species and cover %).	Density per hectare Species has a specified folivorous diet and prefers foraging from larger *Myrtaceous* tree species. Habitat tree species identified based on local distribution/ locality literature (Smith et al. 2007); • *A. floribunda* • *A. leiocarpa* • *C. citriodora* • *C. citriodora subsp. variegata* • *C. clarksoniana* • *C. intermedia* • *C. tessellaris* • *E. albens* • *E. albens x E. melanophloia* • *E. albens x E. melliodora* • *E. andrewsii* • *E. camaldulensis* • *E. camaldulensis subsp. camaldulensis*	1: <10% of potential tree canopy cover 5: 10-50% of potential tree canopy cover 10: >50% of potential tree canopy cover

Habitat Indicator		Scoring
	• *E. crebra* • *E. fibrosa* • *E. fibrosa subsp. fibrosa* • *E. fibrosa subsp. nubilis* • *E. melanophloia* • *E. melanophloia subsp. melanophloia* • *E. melliodora* • *E. moluccana* • *E. punctata* • *E. sideroxylon subsp. sideroxlon* • *E. tereticornis* • *E. tereticornis subsp. basaltica* • *E. tereticornis subsp. tereticornis*	
Richness of greater glider habitat trees	The richness of greater glider habitat tree species that can occur within a particular regional ecosystem as a % of those found in regional ecosystem technical descriptions.	1: < 25% of benchmark 5: 25-75% of benchmark 10: >75% of benchmark
Site Fertility/ Productivity Increased site productivity leads to an increase in resource availability and vigour of eucalypts, providing greater and extended foraging opportunities for the species (Eyre 2006).	Vegetation community indicative of high site fertility/ moisture	1: Low 5: Medium 10: High
Quality and availability of shelter		
Number of large eucalypt trees Include reference to describe frequency of hollows in mature trees**	Number of mature trees within suitable regional ecosystems (i.e., RE 13.11.6, 13.11.5, 13.11.8) as a % of benchmark	1: <25% of benchmark large trees 5: 25-75% of benchmark large trees 10: >75% of benchmark large trees
Availability of food trees Greater gliders shelter within close proximity to preferred food trees	Density per hectare Species has a specified folivorous diet and prefers foraging from larger *Myrtaceous* tree species. Habitat tree species identified based on local distribution/ locality literature (Smith et al. 2007 etc.); • *A. floribunda* • *A. leiocarpa* • *C. citriodora* • *C. citriodora subsp. variegata* • *C. clarksoniana* • *C. intermedia* • *C. tessellaris* • *E. albens* • *E. albens x E. melanophloia* • *E. albens x E. melliodora* • *E. andrewsii* • *E. camaldulensis* • *E. camaldulensis subsp. camaldulensis* • *E. crebra*	1: <10% of potential tree canopy cover 5: 10-50% of potential tree canopy cover 10: >50% of potential tree canopy cover

Habitat Indicator		Scoring
	• *E. fibrosa* • *E. fibrosa subsp. fibrosa* • *E. fibrosa subsp. nubilis* • *E. melanophloia* • *E. melanophloia subsp. melanophloia* • *E. melliodora* • *E. moluccana* • *E. punctata* • *E. sideroxylon subsp. sideroxlon* • *E. tereticornis* • *E. tereticornis subsp. basaltica* • *E. tereticornis subsp. tereticornis*	
Species mobility capacity		
Number of mature trees	Large mature trees (30-70cm DBH) are preferred and required for arboreal species for mobility, movement, and gliding (Smith et al. 2007)	1: <25% of benchmark large trees 4: 25-50% of benchmark large trees 7: 51-75% of benchmark large trees 10: >75% of benchmark large trees
Role of site location to species overall population in the State		
		1: Not or unlikely to be critical to species' survival 4: Likely to be critical to species' survival 5: Critical to species' survival
Threats to species		
		1: High threat level (results in loss of large hollow-bearing trees, irreversible damage) 7: Moderate threat level (Evidence of infrequent, low intensity fire) 15: Low threat level (No evidence of fire)

Squatter Pigeon (southern)

The squatter pigeon (southern) (*Geophaps scripta scripta*) is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Nature Conservation Act 1992* (NC Act). The subspecies' occurs throughout remnant and regrowth open-forest to sparse open-woodlands and scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species with patchy, tussock-grassy understorey (Higgins & Davies 1996; TSSC 2015). Its current distribution extends from central Queensland, west to Longreach and Charleville, east to the coast between Port Curtis and Proserpine, and south to New South Wales north of 29° S (Cooper et al. 2014). The squatter pigeon (southern) was once common and widespread nationally, however, at present is pervasive in the north-east and north of the QLD state border with rare occurrences in NSW (Higgins & Davies 1996). Populations known to occur in the Warwick-Inglewood-Texas region (including the local population) are important populations for the species under the EPBC Act, given they occur near the southern extent of the species range in an area within which the species has experienced substantial declines (Squatter Pigeon Workshop 2011).

Squatter pigeons are not dependent on remnant vegetation communities and often favour thinned habitats where grazing cattle create favourable open patches of ground for foraging, and some introduced pastures (*Urochloa mosambicensis* and *Stylosanthes spp.*) also provide a valuable food source for the species (Crome 1976). Although less common where Buffel Grass (*Cenchrus ciliaris*) dominates the grass cover (Reis 2012). Disturbed areas where the sub-species has been recorded foraging include cattle yards, road and railway easements, and sown pastures with scattered trees (Squatter Pigeon Workshop 2011). Soil type is often a useful indication of their foraging and breeding habitat of which is generally restricted to well-draining, gravelly, sandy, or loamy soils (land zones 5 and 7, and Land Zone 3 when imbedded in Land Zone 5 and/or 7) (Squatter Pigeon Workshop 2011). These typically support a patchy ground layer composed of native perennial tussock grasses or a mix of native perennial tussock grasses and low shrubs or forbs (DoEE 2019b; Squatter Pigeon Workshop 2011). The ground-dwelling subspecies forages on a wide range of seeds from grasses, legumes, herbs, and shrubs, as well as insects with diet varying seasonally depending on food availability (Higgins & Davies 1996). Breeding habitats are typically on stony rises within 1 km of a suitable, permanent waterbody (dams and/or standing water), and nests are usually shallow depressions in the ground, sometimes among, or sheltered by vegetation, including short, dry grass, grass tussocks or bushes (Frith 1982; Squatter Pigeon Workshop 2011).

The subspecies is unlikely to move far from woodland trees which provide protection from predatory birds (Squatter Pigeon Workshop 2011). Where scattered trees still occur, and the distance of cleared land between remnant trees or patches of habitat does not exceed 100 m, individuals may be found foraging in, or moving across modified or degraded environments (Squatter Pigeon Workshop 2011).

The habitat assessment indicators (see table below) for the squatter pigeon (southern) have been determined through the use of information contained within the Conservation Advice (TSSC 2015) and scientific literature of the species behavioural ecology (as referenced throughout).

Squatter Pigeon (southern) Habitat Quality Attributes Scoring

Habitat Indicator		Scoring
Quality and availability of food and foraging habitat		
Availability of suitable habitat	Density Preferred habitat: regrowth and remnant dry open forests, woodlands and scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species	1: <10% or >75% tree canopy cover 5: 10-30% or >50-75% tree canopy cover 10: 30-50% tree canopy cover
Availability of suitable foraging habitat	Projected ground-level cover A patchy, ground-level vegetation cover including native tussock grasses not exceeding 33% total ground area is important for suitable	1: >50% ground cover 5: 33-50% ground cover 10: No more than 33% ground cover

Habitat Indicator		Scoring
	foraging habitat (Squatter Pigeon Workshop 2011)	
Non-native plant cover	Non-native plant cover Invasive plant species outcompete the species' preferred native food plants (TSSC 2015)	1: >5% non-native plant cover 5: 1-5% non-native plant cover 10: <1% non-native plant cover
Quality and availability of shelter		
Tree canopy height	Nocturnal roost tree height Squatter pigeon roost overnight in low trees (TSSC 2015).	1: Ecologically Dominant Layer (EDL) < 50% of benchmark 5: EDL 50-80% of benchmark 10: EDL > 80% of benchmark
Availability of suitable foraging habitat	Projected ground-level cover A patchy, ground-level vegetation cover including native tussock grasses not exceeding 33% total ground area is important for suitable breeding habitat (Squatter Pigeon Workshop 2011)	1: >50% ground cover 5: 33-50% ground cover 10: No more than 33% ground cover
Species mobility capacity		
Availability of suitable movement for foraging and nesting	Extent of understorey vegetation thickening Thick and high density of understorey and ground-level vegetation cover represents unpreferred habitat	1: Severely restricted (>75% shrub, T2, T3 and low T1 cover) 4: Highly restricted (>50-75% shrub, T2, T3 and low T1 cover) 7: Moderately restricted (25-50% shrub, T2, T3 and low T1 cover) 10: Minor restriction (<25% shrub, T2, T3 and low T1 cover)
Role of site location to species overall population in the State		
		1: Not or unlikely to be critical to species' survival 4: Likely to be critical to species' survival 5: Critical to species' survival
Threats to species		
		1: High threat level (results in loss of large hollow-bearing trees, irreversible damage) 7: Moderate threat level (Evidence of infrequent, low intensity fire) 15: Low threat level (No evidence of fire)