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Karara Wind Farm Project Environmental Offsets Strategy

Prepared for:
ACCIONA Energy Australia Global Pty Ltd

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Environmental Offsets Strategy

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Contents

Appendices

Figures

Tables

1.0 Introduction

1.1 Background

CleanCo Queensland Ltd (CleanCo), in partnership with ACCIONA Energy Australia Global Pty Ltd (ACCIONA), proposes to develop and operate the Karara Wind Farm Project (KWF, the Project) with up to 20 wind turbines that are anticipated to generate approximately 114 MW of renewable energy to contribute to the national electrical grid, together with associated ancillary infrastructure.

The Project is located approximately 40 km southwest of the township of Warwick and 70 km southwest of Toowoomba, Queensland. The Project is located within Southern Downs Regional Council and Goondiwindi Regional Council Local Government Areas, and is proposed over four freehold lots.

The Project will be connected into Powerlink's transmission network via a proposed 64 km 330 kV overhead transmission line (OHTL). The OHTL will be shared with the proposed neighbouring MacIntyre Wind Farm (MIWF). Approximately 27 km of the OHTL traverses the KWF and MIWF project areas. The three projects (KWF, MIWF and the OHTL) are being progressed as separate projects due to current or likely future ownership arrangements.

The Project will require a Development Approval under the Queensland *Planning Act 2016* (the Planning Act) and an 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 formed the basis of the EPBC referral. Significant impact assessments were presented in the EPBC referral alongside initial quantification of potential impacts to MNES where impacts have been assessed as significant.

The Project was subsequently declared a controlled action by DAWE for its potential to have a significant impact on listed threatened species and communities, and listed migratory species. A request for information was received from DAWE and some additional ecological studies have been undertaken since the referral was submitted. The results of these additional surveys are presented elsewhere in the Preliminary Documentation Report of which this Offsets Strategy forms a part. The Preliminary Documentation Report also includes updated significant impact assessments and revised quantification of potential impacts to MNES.

1.2 Purpose and Scope

The purpose of this Environmental Offsets Strategy is to demonstrate the feasibility of securing a scientifically robust offset program for the Project in support of securing approval under the EPBC Act.

This Environmental Offset Strategy has been prepared to present:

- An outline of relevant approvals and environmental offset regulatory framework at Federal and State level for the Project;
- A summary of the significant residual impacts to MNES and identification of the Project's environmental offset requirements – noting that a more detailed discussion on the extent of residual impacts is presented elsewhere in the Preliminary Documentation Report;
- The proposed offset delivery approach and timeframes for future stages in the offset program;
- Results of the offset availability analysis;

- Information on the proposed offset site currently undergoing investigation in relation to its suitability to provide the necessary offsets for the Project;
- Proposed habitat scoring methodologies for MNES values to be offset;
- For each MNES value to be offset, a description of the final conservation outcomes being sought, progressive milestones to be achieved to demonstrate progress towards these final outcomes and high-level management measures considered likely to be required to achieve the progressive milestones and final conservation outcomes.

This Environmental Offset Strategy relates only to the Karara Wind Farm Project; separate strategies are being prepared for the OHTL and MIWF.

2.0 Approvals and Regulatory Framework

Environmental offset requirements for the Project occur at the Federal and State level. Relevant legislation and policies are described in the following sections.

2.1 Federal Government Approval

2.1.1 Environment Protection and Biodiversity Act 1999

The EPBC Act is the Australian Government's central piece of environmental legislation that provides a legal framework to manage proposed actions that will or are likely to have an impact on MNES, which includes nationally and internationally important flora, fauna, ecological communities and heritage places.

The Project was determined as a 'controlled action' due to the potential for significant impacts to occur to listed migratory species, and threatened species and communities. It therefore requires approval under the EPBC Act. Due to the likelihood of a significant residual impact on MNES an environmental offset is required to compensate for that impact. Environmental offsets are required to comply with the EPBC Act Environmental Offsets Policy (DSEWPC 2012). This policy outlines the Australian Government's approach to the use of environmental offsets ('offsets') under the EPBC Act. Offsets are defined as measures that compensate for the residual adverse impacts of an action on the environment.

Avoidance and mitigation measures are the primary strategies for managing the potential significant impact of a proposed action. Offsets do not reduce the likely impacts of a proposed action, but instead compensate for any residual significant impact. Where environmental offsets are required for MNES an offsets package should be provided. An offsets package is a suite of actions that a proponent undertakes to compensate for the residual significant impacts to the identified MNES. The EPBC Act requires offsets to be comprised largely of direct (land-based) offsets and other compensatory measures. Offsets should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain (DSEWPC 2012).

2.1.1.1 Direct Offsets

Direct offsets are those actions that provide a measurable conservation gain for an impacted protected matter. Direct offsets are an essential component of a suitable offsets package. A minimum of 90% of the offset requirements for any given impact must be met through direct offset (DSEWPC 2012). Deviation from the 90% direct offset requirement will only be considered where:

- It can be demonstrated that a greater benefit to the protected matter is likely to be achieved through increasing the proportion of other compensatory measures in an offsets package; or
- Scientific uncertainty is so high that it is not possible to determine a direct offset that is likely to benefit the protected matter.

Conservation gain is the benefit that a direct offset delivers to the protected matter, which maintains or increases its viability or reduces any threats of damage, destruction or extinction. A conservation gain may be achieved by:

- Improving existing habitat for the protected matter; or
- Creating new habitat for the protected matter; or

- Reducing threats to the protected matter; or
- Increasing the values of a heritage place; or
- Averting the loss of a protected matter or its habitat that is under threat.

2.1.1.2 Compensatory Offsets

Other compensatory measures are those actions that do not directly offset the impacts on the protected matter but are anticipated to lead to benefits for the impacted protected matter, for example funding for research, implementing priority actions outlined in applicable recovery plans or educational programs. Other compensatory measures should relate to the impacted aspect of the protected matter. For example, research into effective re-vegetation techniques for a particular ecological community may be an appropriate component of an offsets package for an action that involves clearing of that ecological community (DSEWPC 2012).

2.2 State Approval

2.2.1 Planning Act 2016

Under the *Planning Act 2016,* wind farm development is assessable development (a material change of use for a wind farm and Operational Work for clearing native vegetation). In accordance with both Part 4, Division 2, Section 21, Item 2(b)(i) and Schedule 8, Table 4, Item 3(b) of the *Planning Regulation 2017*, the Project requires assessment and decision by the Department of State Development, Infrastructure, Local Government and Planning (DSDILGP), represented by the State Assessment and Referral Agency (SARA), as assessment manager. The Project will be assessed against State Code 16: Native vegetation clearing (State Code 16) and State Code 23: Wind farm development (State Code 23).

The purpose of State Code 23 is to protect individuals, communities and the environment from adverse impacts resulting from the construction, operation and decommissioning of wind farm development. Table 23.2.1 of State Code 23 lists the relevant performance outcomes and acceptable outcomes (as applicable) with which the Project must demonstrate compliance. Offsets must be provided where there is an unavoidable residual impact on Matters of State Environmental Significance (MSES). Offsets must be provided in accordance with the *Environmental Offsets Act 2014*.

2.2.2 Queensland Environmental Offset Framework

Environmental offsets are required when a *prescribed activity* causes *significant residual impacts* on *prescribed matters* of national, state or local significance despite all reasonable avoidance and mitigation measures. This framework provides structure for delivering, monitoring and assessing environmental offsets and is comprised of the *Environmental Offsets Act 2014*, *Environmental Offsets Regulation 2014* and Queensland Environmental Offsets Policy (v.1.9).

Under the Queensland Environmental Offset Framework, an environmental offset may be required when:

- An activity has been identified as a *prescribed activity*;
- An activity will have an impact on a *prescribed environmental matter*;
- The activity will have a *significant residual impact* on a *prescribed environmental matter,* despite all reasonable avoidance and mitigation measures; and

- An environmental offset is an appropriate solution.

The above points must be considered when identifying if a prescribed activity requires environmental offsets and conditions to be imposed.

2.2.2.1 Environmental Offsets Act 2014

The main purpose of the *Environmental Offsets Act 2014* (EO Act) is to counterbalance *significant residual impacts* of an activity on *prescribed environmental matters* at the Commonwealth, State and local level using environmental offsets. This Act states environmental offsets must achieve a *conservation outcome* for the impacted matter. A *conservation outcome* is achieved if, selected and delivered correctly, an offset can maintain the status quo of the *prescribed environmental matter* as if the development and offset had not occurred. The Act defines a *prescribed environmental matter* as:

1. *A prescribed environmental matter is any of the following matters prescribed under a regulation to be a prescribed environmental matter –*
    a) *A matter of national environmental significance*
    b) *A matter of State environmental significance*
    c) *A matter of local environmental significance*

Section 14(1) outlines that an administering agency can impose an offset condition on an authority if:

a) *the prescribed activity will, or is likely to, have a significant residual impact on a prescribed environmental matter; and*
b) *all reasonable on-site mitigation measures for the prescribed activity have been, or will be, undertaken.*

The offset conditions imposed by administering agencies have limitations and are outlined in Section 15(1-4):

1. *An administering agency may impose an offset condition on an authority only if:*

    a) *The same, or substantially the same, impact has not been assessed under a relevant Commonwealth Act; and*

    b) *The same, or substantially the same, prescribed environmental matter has not been assessed under a relevant Commonwealth Act*

2. *Subsection (1) applies whether or not the assessment resulted in the imposition of an offset condition*

3. *However, Subsection (1) does not apply if the prescribed environmental matter to which the condition relates is a protected area*

4. *An administering agency that is a local government may impose an offset condition on an authority only for the following:*

    a) *A matter of local environmental significance*

    b) *Another prescribed environmental matter that is further prescribed by regulation as relevant for this subsection*

The EO Act in accordance with the Policy provides three approaches in which an offset can be delivered and requirements per the delivery. These include a proponent-driven offset, a financial settlement offset or a combination of both. For a proponent-driven offset, an offset delivery plan and an agreed delivery arrangement is required before starting an activity. For a financial settlement offset, the amount payable must be in accordance with this Act and the Policy, and in the way stated in the agreed delivery arrangement. A detailed description of a proponent-driven,

financial settlement or combination offset is provided in Division 4&5 of the EO Act and **Section 2.2.2.3** of this document.

Part 6A of the Act outlines that offset conditions cease to apply when a duplicate condition is imposed at another level of jurisdiction.

2.2.2.2 Environmental Offsets Regulation 2014

The Project can be considered a *prescribed activity* under Schedule 1 Section 4 of the *Environmental Offsets Regulation 2014* as defined by the following points:

1. *Taking a protected plant within the meaning of the Nature Conservation Act 1992 under a protected plant clearing permit granted under the Nature Conservation (Administration) Regulation 2006, section 15 in an area outside a protected area*
2. *Development for which an environmental offset may be required under any of the following State Development Assessment Provisions –*
   a) *module 8 (native vegetation clearing)*
3. *Development for which an environmental offset may be required under any of the following –*
   a) *a local planning instrument;*
   b) *State planning regulatory provision within the meaning of the Sustainable Planning Act 2009*

Schedule 2 Section 5 of the *Environmental Offset Regulation 2014* provides a list of *prescribed environmental matters* of State environmental significance (MSES) some of which the Project may potentially impact. These MSES are listed below:

2. *Regulated Vegetation*
   1) *the prescribed regional ecosystems that are endangered regional ecosystems comprise a matter of State environmental significance.*
   2) *the prescribed regional ecosystems that are of concern regional ecosystems comprise a matter of State environmental significance.*
   3) *a prescribed regional ecosystem is a matter of State environmental significance if it is –*
      a) *a regional ecosystem that intersects with an area shown as a wetland on the vegetation management wetlands map*
      b) *an area of essential habitat on the essential habitat map for an animal that is endangered wildlife or vulnerable wildlife or a plant that is endangered wildlife or vulnerable wildlife*
   4) *a prescribed regional ecosystem is a matter of State environmental significance to the extent the ecosystem is located within a defined distance from the defining banks of a relevant watercourse*
3. *Connectivity areas*
   2) *the prescribed regional ecosystem is a matter of State environmental significance if the administering agency is satisfied, having had regard to criteria in the environmental offsets policy about connectivity areas, that –*
      a) *The connectivity area is of sufficient size or configured in a way that maintains ecosystem functioning; and*
      b) *The prescribed regional ecosystem will remain despite a threatening process within the meaning of the Nature Conservation Act 1992*
6. *Protected wildlife habitat*
   1) *An area that is shown as a high-risk area on the flora survey trigger map and that contains plants that are endangered wildlife or vulnerable wildlife is a matter of State environmental significance*
   2) *An area that is not shown as a high-risk area on the flora survey trigger map, to the extent the area contains plants that are endangered wildlife or vulnerable wildlife, is a matter of State environmental significance*

3) *(only applicable to South East Queensland)*
4) *A habitat for an animal that is endangered wildlife or vulnerable wildlife or a special least concern animal is a matter of State environmental significance*

Under the Policy, an environmental offset for an impact on regulated vegetation can be provided in an ecosystem in the same broad vegetation group. A conservation outcome therefore can be achieved by offsetting an impact on a regional ecosystem, at a site with a similar ecosystem. Furthermore, the offset will have the same regional ecosystem status, occur in the same bioregion and be listed in the same broad vegetation group. The financial settlement formula should use the broad vegetation group scales, depending upon the ecosystem types within the groups, whilst a land-based offset should use the 1:1,000,000 scale.

2.2.2.3 Queensland Environmental Offset Policy v.1.9.

The Queensland Environmental Offset Policy is a decision-support tool used to assess offset proposals and ensure requirements of the EO Act are met. This Policy is relevant to this Project as it provides guidance on offset requirements for impacts on *prescribed matters* at commonwealth, State and local level. Offsets delivered under this policy must achieve a *conservation outcome* for the impacted *prescribed matters*. The Policy proposes three offset delivery options:

- Proponent-driven offset, comprising:
  - A land-based offset;
  - Actions in a Direct Benefit Management Plan (DBMP); or
  - Both; or
- Financial settlement offset; or
- Combination of a proponent-driven offset and a financial settlement offset.

Land-based offset can be an individual or multiple parcels of land being managed to achieve a *conservation outcome* for any impacted *prescribed environmental matters*. To achieve a *conservation outcome,* a land-based offset site must have the following characteristics:

- In relation to endangered and of concern regional ecosystems:
  - Of the same broad vegetation group as the impacted regional ecosystem;
  - Of the same regional ecosystem status; and
  - Within the same bioregion;
- In relation to a plant or animal that is critically endangered, endangered, vulnerable, near threatened and special least concern wildlife under the *Nature Conservation Act 1992*:
  - The offset site must contain, or be capable of containing, a self-sustaining population of that same impacted species;
- For vegetation intersecting a wetland:
  - Of the same broad vegetation group as the impacted regional ecosystem;
  - Within the same bioregion; and

- Associated with a wetland

- For connectivity:
  - A non-remnant ecosystem; and
  - In the same subregion; however, if the subregion is intact, the offset should be in the nearest fragmented subregion
- Maximum four times the area of impact on each MSES
- Provide a gain in 'habitat quality' suitable to compensate the loss of 'habitat quality' at the impact site (habitat quality assessment with The Guide to Determining Terrestrial Habitat Quality)

DBMP offsets is a packaged investment that provides priority actions that address threats and benefits for *prescribed environmental matters*. The Policy requires a DBMP is pre-approved by the Department of Environment and Science (DES) before being considered as part of an offset delivery approach. Pre-approval of a DBMP for MSES can be done by DES, or relevant local government under local government's jurisdiction. DES will only approve a DBMP with endorsement of the plan from the administering agency responsible for the management of MSES.

Financial settlement offsets allow a proponent to provide a payment in accordance with this Policy and meet offset requirements. For financial settlement offsets required by the State, payment amount must be calculated in accordance with the Financial Settlement Offset Calculation Methodology. This methodology must be used when determining a suitable offset payment for impacts on MSES.

Proponent-driven offsets require an offset delivery plan which is subject to further requirements under the EO Act and EO Regulation and finally agreed upon with the administering agency. The Policy articulates these requirements and are summarised below:

- Describe the prescribed environmental matter to which the offset condition relates;
- State whether the offset condition will be delivered wholly or partly on the land where the offset will be delivered;
- Describe how the offset will be conducted and the conservation outcome achieved;
- Description of the land where the offset will be delivered;
- Include information on persons with interest in the land subject to the offset;
- Describe the existing land use of the land subject to the offset, and if this land use will have an impact on the offset;
- Account for and manage the risk of failing to achieve a conservation outcome;
- Ensure the offset provides benefits to the prescribed environmental matter in addition to other benefits provided under a requirement of an Act;
- Transparent government arrangements – offsets are easily measured, monitored and assessed across all jurisdictions;
- Scale and size of offset is proportionate to the significant residual impact on the prescribed environmental matter;
- Statement provided by the authority holder listing:
  - Measures undertaken to secure land subject to offset as a legally secured offset area;

- Measures taken are reasonable and practical;
- The period in which measures will be taken and why this is a reasonable period to secure the land.

A combination of proponent-driven and financial settlement is also an offset option. The Policy's suggested process for delivering this type of offset to achieve offset obligations focusses primarily on proponent-driven offsets, with the outstanding balance being provided as financial settlement.

The Policy outlines additional offset tools including Strategic Offset Investment Corridors (SOICs) and Advanced Offsets. SOICs are pre-defined areas of land that contain MNES and MSES that are not subject to high development pressure or zoned for urban activities. Advanced offsets are parcels of land reserved for the future potential use as an offset site for impacted matters. Proponents are encouraged to seek SOIC opportunities with landholders because of the landscape-scale benefits to prescribed matters.

2.2.3 Nature Conservation Act 1992

The purpose of the *Nature Conservation Act 1992* is to provide for the conservation of nature whilst enabling indigenous people to be involved in the management of protected areas. This Act is triggered under Schedule 1 s[4](5) of the *Environmental Offset Regulation 2014* in that '*taking a protected plant within the meaning of the Nature Conservation Act 1992 outside a protected area'* is a *prescribed activity* and will *'require a protected plant clearing permit granted under the Nature Conservation (Administration) Regulation 2006*'.

2.2.4 Vegetation Management Act 1999

The purpose of the *Vegetation Management Act 1999* is to regulate the clearing of vegetation whilst managing for environmental effects caused by clearing. The Project involves operation works, that is clearing native vegetation, which is otherwise prohibited if not for a relevant purpose (*Planning Regulation 2017*). However, under Section 22A(2)(d) of the *Vegetation Management Act 1999*, the Project is considered a relevant purpose; '*for relevant infrastructure activities and clearing for the development cannot reasonably be avoided or minimised*'. The clearing of native vegetation will require an environmental offset under State Code 16: Native vegetation clearing (State Code 16) of the SDAP under the Planning Act.

2.3 Environmental Offset Hierarchy

Until the Queensland Environmental Offsets Framework has been recognised by the Australian Government, for the purposes of the EPBC Act, the framework is not applicable to impacts on MNES and jurisdiction responsibility remains with the relevant Federal agency (QOEP Guidelines v.1.2). For MSES, the Queensland Government has jurisdiction over offset requirements. Local Government has jurisdiction over MLES which must be specified in a local government planning scheme and be approved by the state in accordance with the Minister's Guidelines and Rules under the *Planning Act 2016*.

To avoid duplication of offset conditions across jurisdictions, the EO Act requires agencies to consider existing offset conditions that have been applied to the activity. The EO Act requires that the State cannot impose an offset condition that is the same or substantially the same impact, if DAWE has assessed an activity as a controlled action and decided that an offset is, or is not required. In addition, the EO Act requires that a MLES cannot be the same or substantially the same as an MNES or MSES, therefore duplication of MLES offset conditions with MNES or MSES offset conditions should not occur.

3.0 Project Environmental Offset Requirements

3.1 Ecological Values of the Project Area

The Project is located on agricultural land that has been extensively cleared and fragmented over generations of intensive sheep grazing. Despite this, the Project areas retains patches of remnant vegetation with high ecological value for native flora and fauna. The Project area is immediately south of the Durikai State Forest which retains large stands of Eucalypt woodland that provide habitat for a range of flora and fauna including conservation significant species.

Desktop analysis and seven ecological field assessments have been completed for the Project between 2018 and 2021 to support an understanding of the environmental values that are present. These studies informed a likelihood of occurrence assessment that returned the following EPBC Act listed species and communities confirmed present or considered likely to occur within 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:
  - *Macrozamia conferta* (vulnerable);
  - *Eucalyptus infera* (Durikai mallee) (vulnerable); and
  - *Tylophora linearis* (endangered)
- Seven bird species:
  - regent honeyeater (*Anthochaera phrygia*) (critically endangered);
  - squatter pigeon (southern) (*Geophaps scripta scripta*) (vulnerable);
  - white-throated needletail (*Hirundapus caudacutus*) (vulnerable, migratory);
  - painted honeyeater (*Grantiella picta*) (vulnerable);
  - swift parrot (*Lathamus discolor*) (critically endangered);
  - fork-tailed swift (*Apus pacificus*) (migratory); and
  - rufous fantail (*Rhipidura rufifrons*) (migratory)
- Three mammal species:
  - koala (*Phascolarctos cinereus*) (vulnerable);
  - central greater glider (*Petauroides armillatus*) (vulnerable); and
  - grey-headed flying-fox (*Pteropus poliocephalus*) (vulnerable).

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

3.2 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 (GHD 2021) 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; and
- Spread of invasive species.

As part of the EPBC referral, 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:

- 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;
- Central greater glider (*Petauroides armillatus*) (vulnerable) – due to the impact on habitat critical to the survival of the species;
- Regent honeyeater (*Anthochaera phrygia*) (critically endangered) – due to the cumulative contribution to the loss of habitat a critical to the survival of the species;
- Grey-headed flying-fox (*Pteropus poliocephalus*) (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.

3.3 MNES Offset Requirements

A summary of the MNES required to be offset under the EPBC Act is provided in **Table 3.1**.

Table 3.1 Offset requirements

MNES	Threat Status	Impacted Habitat Proposed to be Offset (ha)
Threatened Fauna		
Koala (*Phascolarctos cinereus*)	Vulnerable	52.40
Central greater glider (*Petauroides armillatus*)	Vulnerable	13.13

MNES	Threat Status	Impacted Habitat Proposed to be Offset (ha)
Regent honeyeater (*Anthochaera phrygia*)	Critically Endangered	0.62
Grey-headed flying-fox (*Pteropus poliocephalus*)	Vulnerable	52.40
Squatter pigeon (southern) (*Geophaps scripta scripta*)	Vulnerable	12.10

4.0 Offset Delivery Strategy

Direct land-based offsets are proposed for all MNES assessed as having significant residual impacts associated with development of the Project. This section provides detail on how the proposed offset package will be delivered.

It is intended that the offset package detailed in this report will deliver 100% of the MNES and MSES offset requirements for the Project. Offsets for impacts to fauna habitat values will use the EPBC Act offsets calculator to determine the total area required for each value using data obtained from habitat quality assessments as outlined in the following sections. Data from impact areas will be compared against offset areas to determine the areas required for each value.

4.1 Habitat Quality Assessments

Field-based habitat quality assessments have been underway at both impact and proposed offset sites since the start of 2021. A range of site-based habitat quality data are being 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* (EHP 2017) and incorporating 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 five 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 4.2**.

4.1.1 Desktop

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.

4.1.2 Field

Before undertaking BioCondition assessment, consideration needs to be given to the optimal timing of the field survey, as explained broadly in Section 3.3 of the BioCondition Assessment Manual and in the recommended survey guidelines for specific MNES. Field assessment steps are described below, specific to each MNES.

4.1.2.1 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.

4.1.2.2 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;

4.1.2.3 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 feed 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*
    - Yellow box, *E. melliodora*
    - White box, *E. albens*
    - Yellow gum, *E. leucoxylon*
    - Spotted gum, *Corymbia maculata*
    - Swamp mahogany, *E. robusta*
    - Needle-leaf mistletoe, *Amyema cambagei* on River Sheoak, *Casuarina cunninghamiana*
    - Box mistletoe, *A. miquelii*
    - Long-flower mistletoe, *Dendropthoe vitellina*
    - Flowering of associated species such as thin-leaved stringybark (*E. eugenioides*) and other stringybark species, and broad-leaved ironbark (*E. fibrosa*) can also contribute important nectar flows at times.
- 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.

4.1.2.4 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:
  - 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 central greater glider habitat move to the next site. Note: that while the site may not suit central 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;

4.1.2.5 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.

4.2 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 are listed in **Table 4.1**.

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		

Attribute	Methodology	Notes
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 • Ecological corridors score 0, 4 or 6 *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 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

Attribute	Methodology	Notes
		• 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* • Section 6.2 Undertaking a site context assessment, Table 4 – Species habitat index scoring guide • Scores 1, 7 or 15	This attribute is scored by identifying and scoring species-specific and site-specific threat factors. *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)		

Attribute	Methodology	Notes
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 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.
Key source population for dispersal		
Necessary for maintaining genetic diversity		
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* • For Ecological corridors, maximum score is provided in Table 3 in 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 score is provided in Table 4 in the *Guide to determining terrestrial habitat quality*
Score for sampling site	*Guide to determining terrestrial habitat quality*	For each sampling site: • Total all site context scores

Score	Methodology	Notes
	– Section 8 Determine the final habitat quality score	• 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	
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 three MNES are presented in **Appendix A**.

4.3 Threat Assessment

Threat assessment (absence of threats) for impact and offset sites is based on the Queensland Habitat Assessment Guide Ver 1.3. Threats for each of the relevant MNES were derived from the relevant conservation advice:

- Approved Conservation Advice: *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (Koala Northern Design Table Unit), (DSEWPC, 2012);
- South East Queensland Koala Conservation Strategy 2020–2025 (DES 2020);
- *Nature Conservation (Koala) Conservation Plan 2006* and Management Program 2006 – 2016 (EPA, 2006);
- Ranking the feeding habitats of Grey-headed flying foxes for conservation management (Ebby & Law, 2008);
- Flying-fox Heat Event Response Guidelines (Bishop et. al., 2018);
- National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus* (DAWE 2021);
- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (DoE 2016);
- Approved Conservation Advice for Greater Glider (*Petauroides volans*) via The Action Plan for Australian Mammals 2012 (TSSC 2016; Woinarski et al. 2014).
- Approved Conservation Advice for Squatter Pigeon (southern) (*Geophaps scripta scripta*) (TSSC 2015).

A range of potential key threats were identified for each of the MNES and the threats relevant to the Project on which the threat assessments were based are provided in the following sections.

4.3.1 Koala

Several of the threats to koala are interactive. For example, invasion of habitat by non-native plant species has the capacity to increase fire fuel loads, reduce species mobility and limit the establishment of koala forage species whilst fragmentation by urban development is associated with increased predation by domestic dogs and potentially disease prevalence with increased environmental stress. The threatening processes described in **Table 4.3** are intended to address the major known threats in a format that relates to the habitat assessment method and the management practices proposed for offset sites.

Table 4.3 Key Threats to Koala

Threat	Description
Loss of habitat	Clearing of habitat associated with anthropogenic disturbance such as urban development and agricultural particularly in areas of high fertility
Fragmentation of habitat	Fragmentation of habitat associated with anthropogenic disturbance, urban development
Weed invasion	Reduction in species mobility and contributing to reduced habitat quality and altered fire regimes.
Fire	A direct threat to related to fire related mortality and potentially causing habitat degradation.
Vehicle strike	Mortality caused by the intersection with traffic where koalas are drawn into remnant areas that occur in association with roads.

Threat	Description
Disease	Infection of populations by Chlamydia, Koala Retrovirus and other diseases leading to reduced fecundity.
Predation by dogs	Domestic and/or feral dogs constitute a key threatening process

4.3.2 Grey-headed Flying-fox

The processes that threaten grey-headed flying foxes are most prevalent in coastal areas north from Sydney, coinciding with areas that support the greatest natural diversity of food plants and the most consistent presence of the species outside metropolitan areas (DAWE 2021). Key threats are described in **Table 4.4**.

Table 4.4 Key Threats to Grey-headed Flying-fox

Threat	Description
Loss of foraging habitat is considered the primary threat to the species	Loss of diet plants that provide winter and spring foraging resources: *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculate, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum austral, Corymbia citriodora citriodora, C. eximia, C. maculate, Grevillea robusta, Melaleuca quinquenervia*
Habitat fragmentation	Fragmentation of habitat affecting species mobility
Camp disturbance	Direct and indirect impacts to known camps
Heat stress	Mortality to individuals caused by daytime temperatures >40C and impacted by habitat condition, proximity to water, camp conditions, population demographics, timing and human conditions.
Entanglement	Mortality of animals due to entanglement in netting, barbed wire fences (especially associated with water sources) and other anthropogenic structures.
Climate change	Climate change has the potential to affect food availability and head-related mortality in grey-headed flying foxes. Climate change may put further pressure on alternative food sources, commercial food crops, and urban and botanical gardens.
Bushfire	The 2019/2020 bushfires across southern and eastern Australia affected large areas of foraging habitat for the grey-headed flying fox and the species has been included in DAWE's provisional list of 119 animal species requiring urgent management intervention as a result of the bushfires.
Electrocution	Grey-headed flying fox are prone to electrocution on power lines in urban areas.

4.3.3 Regent Honeyeater

Based on the literature review, key threats to regent honeyeater have been defined as per **Table 4.5**.

Table 4.5 Key Threats to Regent Honeyeater

Threat	Description
Increased competition	Larger aggressive honeyeaters including noisy miners *Manorina melanocephala*, noisy friarbird *Philemon corniculatus*, and red wattlebird *Anthochaera carunculate* exclude regent honeyeater from food sources especially in degraded open habitat adjoining eucalypt woodland as this is suitable habitat for these species – negatively impacting breeding success. Increased competition results in lower reproductive output (Ford et al. 1993)
Loss of foraging and nesting habitat	Historical clearing for residential, agricultural, and industrial developments has resulted in severe fragmentation and degradation of foraging and nesting habitat. Remaining habitat is subject to further decline of mature trees through senescence, dieback, use as fenceposts, timber and firewood, and inappropriate fire regimes. Fragmentation and degradation expose species to increased competition and predation and hinders dispersal (Webster and Menkhorst 1992).
Eggs and nestling predation	Sugar glider (*Petaurus breviceps*), squirrel glider (*P. norfolcensis*), noisy miner (*Manorina melanocephala*), Australian ravens (*Corvus coronoides*), pied butcherbird, magpie (*Cracticus tibicen*) and pied currawong (*Strepera craculina*) have been recorded attempting to prey on adults and/or successfully preying on eggs, and the impacts of this may be significant (Szabo 2016; Crates et al. 2017; Fulton and Ford 2001).
Inappropriate fire regimes	Frequent fire reduces flowering events and maturation of nectar rich species hence reduced foraging habitat (Woinarski and Cullen 1984)
Disease and reduced genetic diversity	Small, fragmented populations can bottleneck and be subject to Allee effects (Crates et al. 2017) whilst captive-bred birds can carry internal and external parasites which could impact wild populations
Climate Change	Species habitat is susceptible to increased risk of fire and drought which can suppress flowering events, potentially exacerbating habitat loss (DoE 2016; Birdlife International 2018)

4.3.4 Central Greater Glider

Cumulative effects of land clearing and logging activities, current burning regimes and the impacts of climate change are a major threat to large hollow-bearing trees on which the central greater glider relies. The species is particularly susceptible to threats because of its slow life history characteristics, specialist habitat requirements (and hence mature forests), and relatively specialised dietary requirements (Woinarski et al. 2014). The key threatening processes are defined as per **Table 4.6**.

Table 4.6 Key Threats to Central Greater Glider

Threat	Description
Habitat loss and fragmentation	The species is highly dependent on forest connectivity and large mature (myrtaceous) trees and is particularly sensitive to forest clearance as prime habitat coincides with areas suitable for land clearance. Habitat loss and fragmentation limits dispersal of the species between smaller isolated fragments and subsequently reduces reproductive outputs and population viability. Limited dispersal ability constrains genetic diversity and weakens resilience thus increasing susceptibility to disturbance. The species is slow to recover from major disturbance (Kavanagh 2004).
Timber production	There is a progressive decline in numbers of hollow-bearing trees in production forests as logging rotations become shorter and as dead stags collapse (Lindenmayer et al. 2011).

Threat	Description
Inappropriate fire regimes	Inappropriate and too frequent fire regimes cause population declines in and after high intensity fires (Lindenmayer et al. 2013). The species is sensitive to repeated prescribed burning and abundance is significantly greater in forests that are infrequently burnt (Andrews et al. 1994).
Climate change	The species is florivorous that favours forests with a diversity of eucalypt species and such forest types are susceptible to the effects of climate change that affects fruiting and flowering events, thus exacerbating key threatening processes of the species. Biophysical modelling indicates that the degree of site occupancy is associated with vegetation moisture and water stress from drought affects growth of eucalypt forest and woodlands, therefore limiting the species' food source and causing heat stress and mortality (Lumsden et al. 2013; Matusick et al. 2013). Literature predicts a 3C temperature increase will cause a severe decline in the population, nationally (Kearney et al. 2010).
Increased competition	Sulphur-crested cockatoos (*Cacatua galerita*) have been observed taking over nesting hollows of powerful owls and along with other hollow-bearing wildlife are likely to be competing with the species for hollows (Lumsden et al. 2013).
Predation by owls	The species forms a significant part of both the powerful owl (*Ninox strenua*) and sooty owl (*Tyto tenebricosa*) dietary requirements and have been recorded utilising the same habitat (Bilney et al. 2006). Reduction in the density of hollow-bearing trees increases the threat of predation whilst the species is moving between hollows and localised population declines due to owls have been observed (Lindenmayer et al. 2011).

4.3.5 Squatter Pigeon (Southern)

Based on the literature review, the key threats to the squatter pigeon have been defined as per below **Table 4-7**.

Table 4-7 Key threats to Squatter Pigeon (Southern)

Threat	Description
Habitat loss and fragmentation, increased competition	The subspecies inhabits and relies upon the short, grassy understorey of well-drained sandy or loamy soils that support open-forests to sparse, open-woodlands and scrub that are dominated by *Eucalyptus*, *Corymbia*, *Acacia*, or *Callitris* species, remnant and regrowth within 3 km of permanent water (DAWE 2019; Squatter Pigeon Workshop 2011). The combined effect of habitat loss and fragmentation for agricultural purposes and the degradation of habitat by overgrazing domesticated livestock (sheep, cow) and feral herbivores such as rabbits (*Oryctolagus cuniculus*), have impacted the subspecies' dispersal and breeding success. However, the effect this has upon the subspecies' long-term persistence and recovery in the region is unknown (Garnett & Crowley 2000; Porter 2006 pers. comm.).
Predation by cat and fox	Predation by feral cats (*Felis catus*) and foxes (*Vulpes vulpes*) are likely to be having the greatest impact upon the subspecies as population declines have been associated with areas where cats and foxes are highly abundant (Ayers et al. 1996; EPA 2006; Garnett & Crowley 2000).
Inappropriate fire regimes	Inappropriate, frequent and high intensity fire regimes reduce foraging and nesting habitat of low vegetation and understorey cover hindering reliable food sources and exposing the subspecies to population declines (Woinarski & Cullen 1984).
Climate change	Literature suggests the subspecies is highly sensitive to the effects of climate change as extreme weather events such as drought and bushfires are likely to exacerbate the key threatening

Threat	Description
	processes and contribute to, or accelerate, population declines of the subspecies (Frith 1982; Garnett & Franklin 2014).

4.4 Offset Calculator

Impact area habitat quality scores, along with habitat quality scores for offset sites (existing, without the offset, and with the implementation of the OMP) were entered into the DAWE Offsets Assessment Guide (v1.04) calculator to assess how much of the impact each offset would acquit for each value being offset. Inputs to the calculator included the following:

- Risk of Loss – numbers applied as per *Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act* (DoEE 2017) (Goondiwindi = 7.02%, Southern Downs 2.28%);
- Time Horizon – 20 years for all values;
- Confidence – 90% where there was a 1 point improvement in habitat quality score, 85% for a 2 point improvement, and 70% for a 3 point improvement.

For each offset site, the habitat quality score 'start value' is the same as the 'future value without offset'. The same values have been applied because there are no legislative requirements for landholders to undertake conservation management actions at the offset sites. Specifically:

- Management of pests is not required under the Queensland *Biosecurity Act 2014*;
- The *Vegetation Management Act 1999* in conjunction with the *Planning Act 2016* and subordinate legislation jointly forms the vegetation management framework and regulates the clearing of vegetation in Queensland. Under this framework clearing of non-remnant vegetation is permissible for agricultural purposes.

5.0 Impact Area Habitat Quality Assessment Results

Habitat quality assessment and BioCondition surveys were undertaken in January 2021. Surveys included a total of 15 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 5.1**.

Table 5.1 Impact Area Weighted Habitat Quality Scores

MNES	Impact Area (ha)	Weighted Habitat Quality Score
Koala	52.4	5.65
Grey-headed Flying-fox	52.4	5.53
Regent Honeyeater	0.62	7.64
Greater Glider	13.13	5.38
Squatter Pigeon	12.1	6.97

6.0 Bioregional Offset Availability Analysis

6.1 Methodology

A regional scale desktop analysis has been completed to assess the availability of potential offset sites that could be used as a direct offset for the predicted Project offset requirements. This analysis was intended to establish the total area of forest and regrowth vegetation (associated with each MNES) and potential offset areas available based on tailored ecological criteria within a defined area of the New England Tableland Bioregion. This information provides greater certainty to regulators in assessing the Project that suitable offset areas, in sufficient quantities, are available to acquit the Project's MNES offset requirements.

6.1.1 Area of Investigation

The Project area is situated within the Nandewar Northern Complex sub-bioregion of the New England Tablelands bioregion and is located within the local government areas of Goondiwindi Regional Council and Southern Downs Regional Council. Due to the limited size of the sub-bioregion, ~6,000 km^2, it was considered impractical to limit the Area of Investigation (AOI) for assessing offset availability to the local government area and sub-bioregion. As such the AOI was defined as the outer limit of properties within the Nandewar Northern Complex sub-bioregion, excluding small protuberance in the localities of Brush Creek and Stonehenge, illustrated in **Figure 6.1**.

Attexo

Karara Wind Farm

Offset Investigation Area

Figure 5.1

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

Date: 2020-12-21
Author: TOD
Reviewed: NOD
Project: ACC-005

0 5 10 15 20 25 km

1:500000 @ A3

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

6.1.2 Data Acquisition

Offset availability analysis was undertaken using the most recent geospatial data available to the public within a desktop GIS environment including:

- Vegetation management pre-clear regional ecosystem map - version 11 (DNRME 2019);
- Vegetation management regional ecosystem map - version 11 (DNRME 2020);
- Vegetation management regulated vegetation management map - version 4.06 (DNRME 2020);
- National Forest and Sparse Woody Vegetation Data – version 4 (DoEE 2019);
- Digital Cadastral Database (DNRME 2020);
- Local government area boundaries (DNRME 2020); and
- Queensland mines permits current web map service (DNRME 2020).

6.1.3 Offsetable Vegetation

The National Forest and Sparse Woody Vegetation Data from the National Inventory Reporting derives vegetation mapping using remote sensing analysis techniques from Landsat satellite imagery. Whilst these data are generated primarily for carbon accounting, they provide a robust, consistent, and freely available resource for identifying any remnant or regrowth vegetation across Australia.

Forest woody vegetation is defined as any vegetation with a minimum canopy cover of 20 %, a height of at least 2 m, and minimum patch size of 0.2 ha. Sparse woody vegetation is defined as any vegetation with a canopy cover of 5-19 %, a height of at least 2 m, and minimum patch size of 0.2 ha.

The occurrence of established woody vegetation on a prospective offset site is expected to be in better ecological condition and of an older age, therefore more likely to contain good vegetation community structure and presence of microhabitats such as hollows, leaf litter and woody debris. This in turn reduces the timeframe for the site to provide ecological benefit. Regrowth (sparse woody) vegetation is likely to be in poorer ecological condition (higher level of weeds due to more open canopy) and less likely to have the structural integrity, height, and cover of remnant vegetation. However, over time the sparse vegetation can be enhanced in condition and structure to achieve higher net gains than forest woody vegetation.

A combination of forest and sparse woody vegetation is preferred to achieve a balance between reducing the time to ecological benefit and maximising opportunities to achieve net gains, respectively.

The geospatial intersection of each MNES value's specific search criteria with mapped forest woody and sparse vegetation and cadastral boundaries provides a robust desktop assessment of the abundance and distribution of prospective offset properties that meet the criteria of each value as well as a framework for assessing the opportunities for the colocation of offsets for multiple values within the same property. The total number of properties that satisfy the search criteria for each MNES value is presented in **Section 6.3**.

For each MNES value, a number of specific desktop search criteria were then applied to the vegetation mapping to identify the total availability of offsetable vegetation in the investigation area and the number of individual properties which contain adequate vegetation to acquit an offset liability.

6.2 Limitations

The offset availability analysis has conducted on a DCDB parcel level. It is not practical to aggregate adjacent land parcels owned by the same landholder into a property holding. As such the potential offset sites may over-estimate the number of landholdings available for establishing an offset site. Conversely, additional sites may also be missed if a number of individual lots do not pass the search criteria but aggregated into a single land holding, they do.

The number of potential offset sites is based on the best available desktop criteria. For several MNES values, the criteria are primarily driven by regional ecosystem associations known to contain floristic elements relevant to the MNES value. Additional survey is essential to confirm the suitability of any site to be used as an offset.

6.3 Offset Availability Results

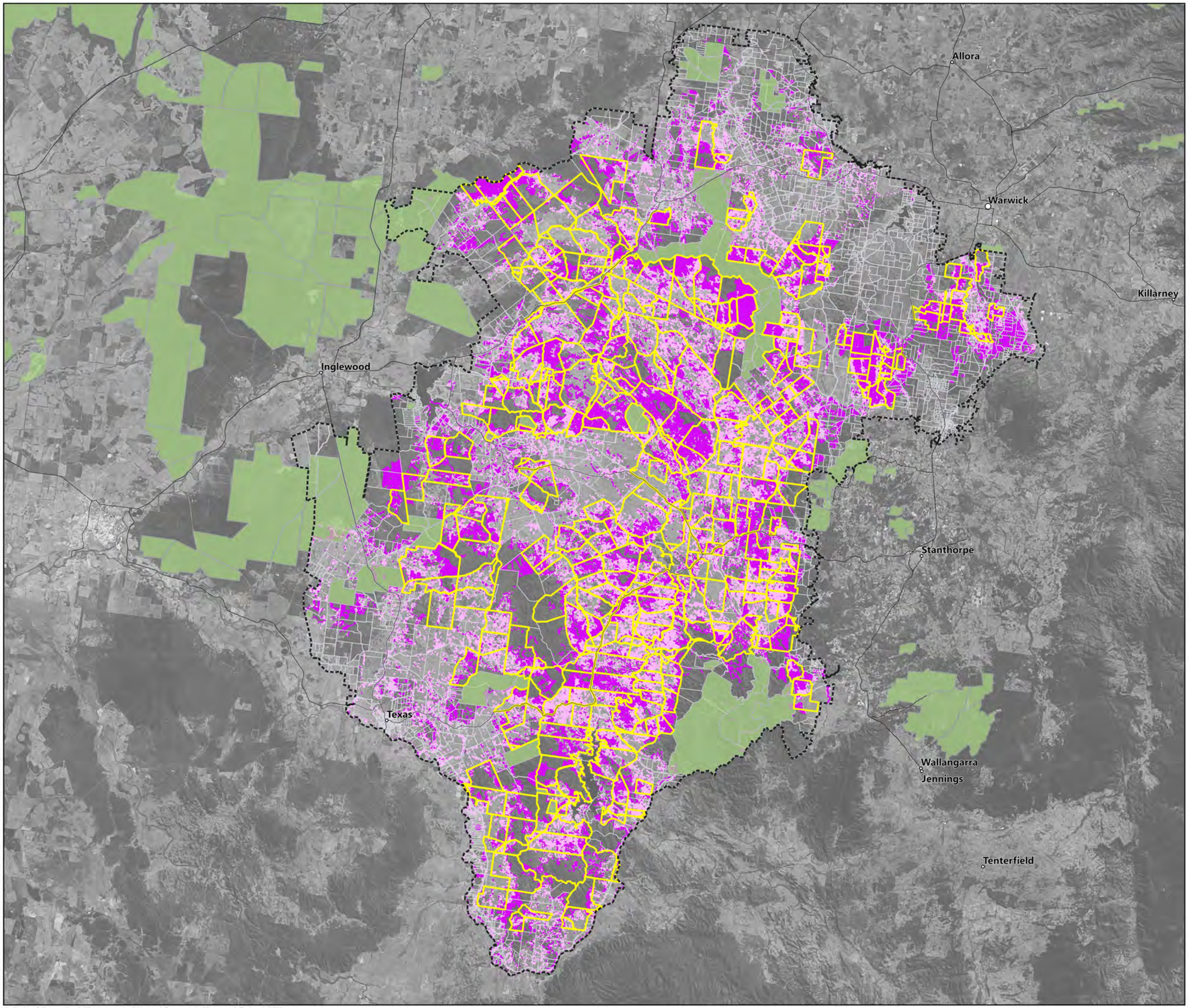
The results of the desktop availability analysis are presented in **Table 6.1**, along with the number of land parcels which meet the criteria and the total extent of forest and sparse woody vegetation within these offset sites.

Table 6.1 Offset availability criteria and results

MNES	Search Criteria	Forest Woody Vegetation (ha)	Sparse Woody Vegetation (ha)	Number of Potential Offset Sites
Listed fauna				
Koala (*Phascolarctos cinereus*)	• Freehold or Lands Lease property within Nandewar Northern Complex sub-bioregion • Preclearing RE containing 11.3.2, 11.3.4, 11.5.1, 11.5.4, 11.7.7, 13.3.4, 13.3.5, 13.11.3, 13.11.5, 13.11.6, 13.11.8 • At least 100 ha of Forest or Sparse woody vegetation present on site mapped as Cat X on DNRME regulated vegetation map (incl. minimum of 50 ha of sparse woody vegetation)	42,590	38,750	263
Grey-headed flying-fox (*Pteropus poliocephalus*)	• Freehold or Lands Lease property within Nandewar Northern Complex sub-bioregion (New England Tablelands) • Preclearing RE containing 11.3.2, 11.3.4, 11.5.1, 11.5.4, 11.7.7, 13.3.4, 13.3.5, 13.11.3, 13.11.5, 13.11.6, 13.11.8 • At least 100 ha of Forest or Sparse woody vegetation present on site mapped as Cat X on DNRME regulated vegetation map (incl. minimum of 50 ha of sparse woody vegetation) • Within 50 km of known roosting camp	40,305	35,650	242

MNES	Search Criteria	Forest Woody Vegetation (ha)	Sparse Woody Vegetation (ha)	Number of Potential Offset Sites
Regent honeyeater (*Anthochaera phrygia*)	• Freehold or Lands Lease property within Nandewar Northern Complex sub-bioregion • Preclearing RE containing 11.3.2, 11.3.4, 11.5.1, 11.5.4, 13.11.3, 13.11.5, 13.11.8 • At least 100 ha of Forest or Sparse woody vegetation present on site mapped as Cat X on DNRME regulated vegetation map (incl. minimum of 50 ha of sparse woody vegetation) • Preference for higher soil water levels, i.e. creek flats, river valleys and lower slopes (land-zone 3) • Preference for within 5 km of a confirmed record	17,700	16,145	115
Central Greater glider (*Petauroides armillatus*)	• Freehold or Lands Lease property within Nandewar Northern Complex sub-bioregion • Preclearing RE containing 11.3.2, 11.5.1, 11.5.4, 11.7.7, 13.3.4, 13.3.5, 13.11.3, 13.11.5, 13.11.6, 13.11.8 • At least 100 ha of Forest or Sparse woody vegetation present, including remnant and regrowth vegetation • Within patch of continuous remnant or regrowth vegetation greater than 156 km^2	159,844	41,407	447
Squatter pigeon (*Geophaps scripta scripta*)	• Freehold or Lands Lease property within Nandewar Northern Complex sub-bioregion • Preclearing RE containing 13.11.3, 13.11.8 within 1km of permanent water (Steam order > 4); OR Preclearing RE containing 11.3.2, 11.3.4, 13.11.3, 13.11.8 within 5 km of a confirmed sighting record. • At least 250 ha of Forest or Sparse woody vegetation present, including remnant and regrowth vegetation	18,207	4401	39

Figure 6.2 through to **Figure 6.4** illustrate the overall availability of potential habitat for each MNES value within the AOI as well as identifying potential offset sites which satisfy the search criteria listed in **Table 6.1**.



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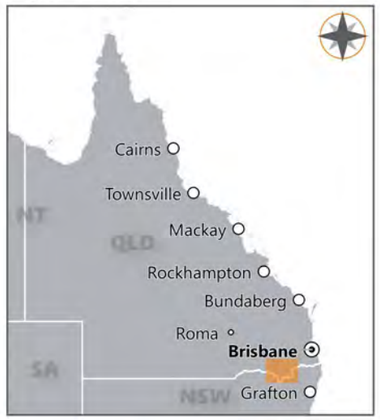
Karara Wind Farm
Koala
Offset Availability

Figure 5.2

- Potential Offset Site
- Woody Vegetation
- Sparse Vegetation
- Offset Investigation Area
- Major Road
- Protected Area
- Lot Boundary

Date: 2020-12-21
Author: TOD
Reviewed: NOD
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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Karara Wind Farm

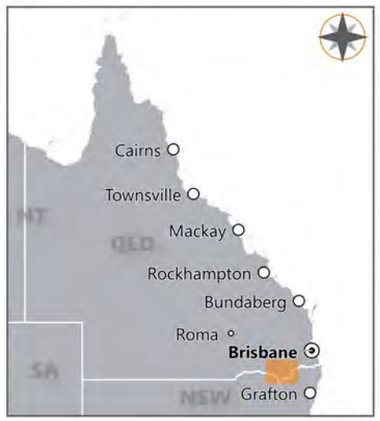
Grey-headed flying-fox
Offset Availability

Figure 5.3

Allora
Warwick
Killarney
Inglewood
Stanthorpe
Texas
Wallangarra
Jennings
Tenterfield

- Potential Offset Site
- Flying-fox camp
- Foraging Range (50km Buffer)
- Woody Vegetation
- Sparse Vegetation
- Offset Investigation Area
- Major Road
- Protected Area
- Lot Boundary

Date: 2020-12-21
Author: TOD
Reviewed: NOD
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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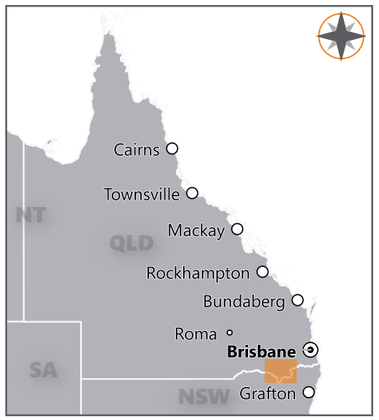
Regent honeyeater
Offset Availability

Figure 5.4

Allora
Warwick
Killarney
Inglewood
Stanthorpe
Texas
Wallangarra
Jennings
Tenterfield

- Potential Offset Site
- Confirmed Record
- 5km Buffer of Confirmed Record
- Alluvial river and creek flats (Landzone 3)
- Woody Vegetation
- Sparse Vegetation
- Offset Investigation Area
- Major Road
- Protected Area
- Lot Boundary

Date: 2021-04-13
Author: TOD
Reviewed: NOD
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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Karara Wind Farm

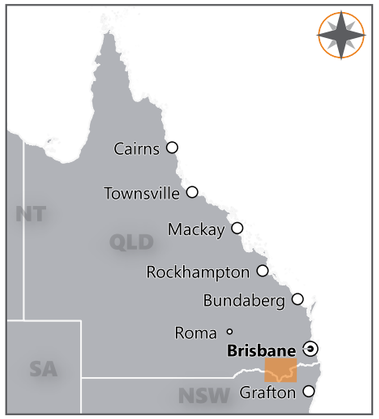
Greater glider

Offset Availability

Figure 5.5

- Potential Offset Site
- Woody Vegetation
- Sparse Vegetation
- Offset Investigation Area
- Major Road
- Protected Area
- Lot Boundary

Date: 2021-08-05
Author: TOD
Reviewed: NOD
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

7.0 Offset Site Selection

The results presented in the offset availability analysis suggest there is a high availability of prospective sites which may contain habitat for the MNES values requiring an offset. However, for several of the affected values the desktop search criteria, such as regional ecosystem associations, are too broad to be relied upon for selecting a prospective offset site. To refine this list down to a more manageable number of sites that can be verified in the field, additional analysis has been conducted to prioritise the sites to be ground-truthed.

7.1 Strategic Offset Investment Corridors

Strategic Offset Investment Corridors (SOICs) are areas of largely intact remnant vegetation, generally linking or associated with protected areas, that have been identified by DES as strategic opportunities for environmental offsets. Under the Queensland Environmental Offsets Policy, proponents are recommended to preferentially seek offset opportunities within a SOIC, which can comprise conservation hubs (generally land adjacent to protected areas or otherwise of high conservation value) and corridors based on the Biodiversity Planning Assessment wildlife corridors.

A SOIC has been described for the Southern Brigalow Belt and New England Tableland, and publicly available mapping and the corresponding report (EHP 2015) have been reviewed to determine whether there are potential offset opportunities for the Project within the SOIC. There are two conservation hubs within the New England Tableland component of the SOIC as described below.

7.1.1 Traprock Hub

The Traprock Hub is located to the southwest of the Project area and covers 55,591 ha. The Traprock Hub provides the following ecological features that provide potential opportunity for environmental offsets:

- 8,334 ha of high value regrowth that has been identified as having a viable opportunity for regeneration and restoration of ecological function;
- Representation of sixteen regional ecosystems of which ten have low and four have no representation on the protected area estate;
- Habitat for ten threatened[1] fauna species: common death adder (NT), spotted-tailed quoll (V), squatter pigeon (V), brush-tailed rock wallaby (V), koala (SL), border thick-tailed gecko (LC), yakka skink (V), collared delma (V), eastern long-eared bat (V), swift parrot (E) and large-eared pied bat (V);
- Habitat for twelve threatened flora species: *Astrotricha roddii* (E), *Leucopogon sp*. (E). *Macrozamia cranei* (E), *Macrozamia machinii* (V), *Pterostylis setifera* (NT), *Thesium australe* (V), *Bertya opponens* (LC), *Lepidium pergrinum*, *Anthochaera phyrgia*, *Eucalyptus virens* (V), *Arthraxon hispidus* (V) and *Paspalidium grandispiculatum* (V).

Although the Traprock Hub provides offset opportunity for the koala and the squatter pigeon, it does not appear to provide opportunities for the remaining MNES that the Project is required to offset, particularly the regent honeyeater.

7.1.2 Sundown Hub

The Sundown Hub Covers is located south of the Project area and covers 13,623 ha. The Sundown Hub provides the following ecological features that provide potential opportunity for environmental offsets:

[1] Note, the threat status listed here is that of the State

- 1,490 ha of high value regrowth has been identified as having a viable opportunity for regeneration and restoration of ecological function;
- Representation of seven regional ecosystems of which three have of concern Vegetation Management status, and one has low and one has no representation on the protected area estate;
- Habitat for eight threatened fauna species: glossy black-cockatoo (V), spotted-tailed quoll (V), squatter pigeon (V), Murray cod (V), eastern long-eared bat (V), brush-tailed rock-wallaby (V), koala (SL) and border thick-tailed gecko (LC);
- Habitat for eight threatened flora species: *Cadellia pentastylis* (V), *Diuris parvipetala* (V), *Homoranthus montanus* (V), *Kardomia granitica* (E), *Lepidium peregrinum* (LC), *Macrozamia occidua* (V), *Macrozamia viridis* (E) and *Melaleuca flavovirens* (NT).

Although the Sundown Hub provides offset opportunity for the koala and the squatter pigeon, it does not appear to provide opportunities for the remaining MNES that the Project is required to offset, particularly the regent honeyeater.

7.2 Co-location Assessment

To ensure direct offsets are delivered in the most cost-effective manner possible, it is necessary to undertake an assessment of the colocation potential of each value requiring an offset to determine the degree of overlap between habitat requirements and the likelihood of being able to utilise the same offset site to acquit a number of values simultaneously. In particular, minimising the number of landholders to negotiate with can improve the likelihood of securing an offset in a timely manner and allow the proponent to focus resources more towards on-the-ground work.

In the case of the regent honeyeater, the limited known distribution of habitat for the species in conjunction with poorly understood habitat requirements made it challenging to identify possible offset sites with any level of certainty unless there were known records nearby. **Figure 7.1** illustrates the distribution of potential offset sites for the four MNES values.

7.3 Preliminary Offset Sites

To increase the likelihood of identifying preliminary offset sites the following additional selection criteria were applied to the potential offset sites to make the best use of previous surveys that have been conducted in the locality of the Project site over the last ten years:

- Proximity to known records of MNES;
- Existing relationship between proponent and landholder; and
- Existing survey data confirming presence of threatened species.

On this basis more than 15 properties were identified that could be used in combination to acquit the Project offset liability, as illustrated in **Figure 7.2**. A number of these properties have been visited to undertake preliminary discussions with the landholder to establish their interest in securing a portion of their property for an offset, as well as to verify the suitability of the site and confirm the occurrence of niche habitat requirements. Several potential offset properties have had detailed BioCondition and habitat quality scoring undertaken.

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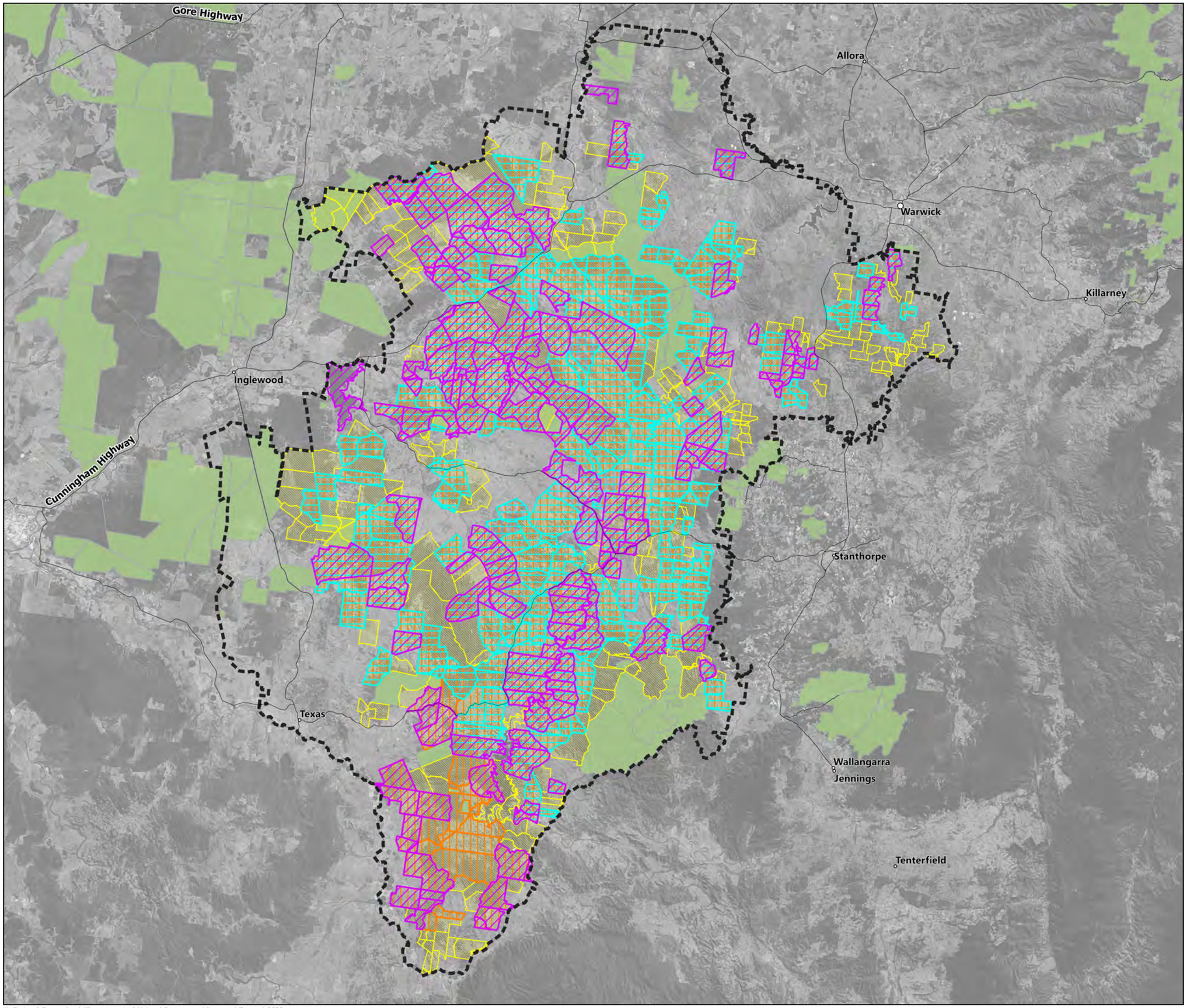
Colocation of Potential Offset Sites

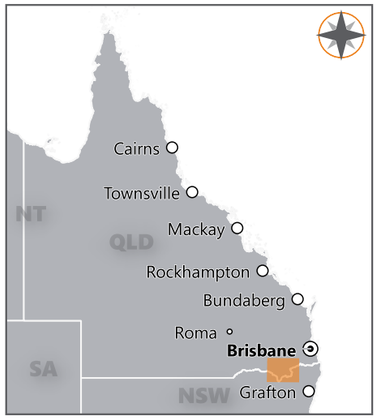
Figure 6.1



Potential Offset Site

- Regent honeyeater
- Grey-headed flying fox
- Koala
- Greater glider
- Major Road
- Area of Investigation
- Protected Area

Date: 2021-08-05
Author: TOD
Reviewed: NOD
Project: ACC-005



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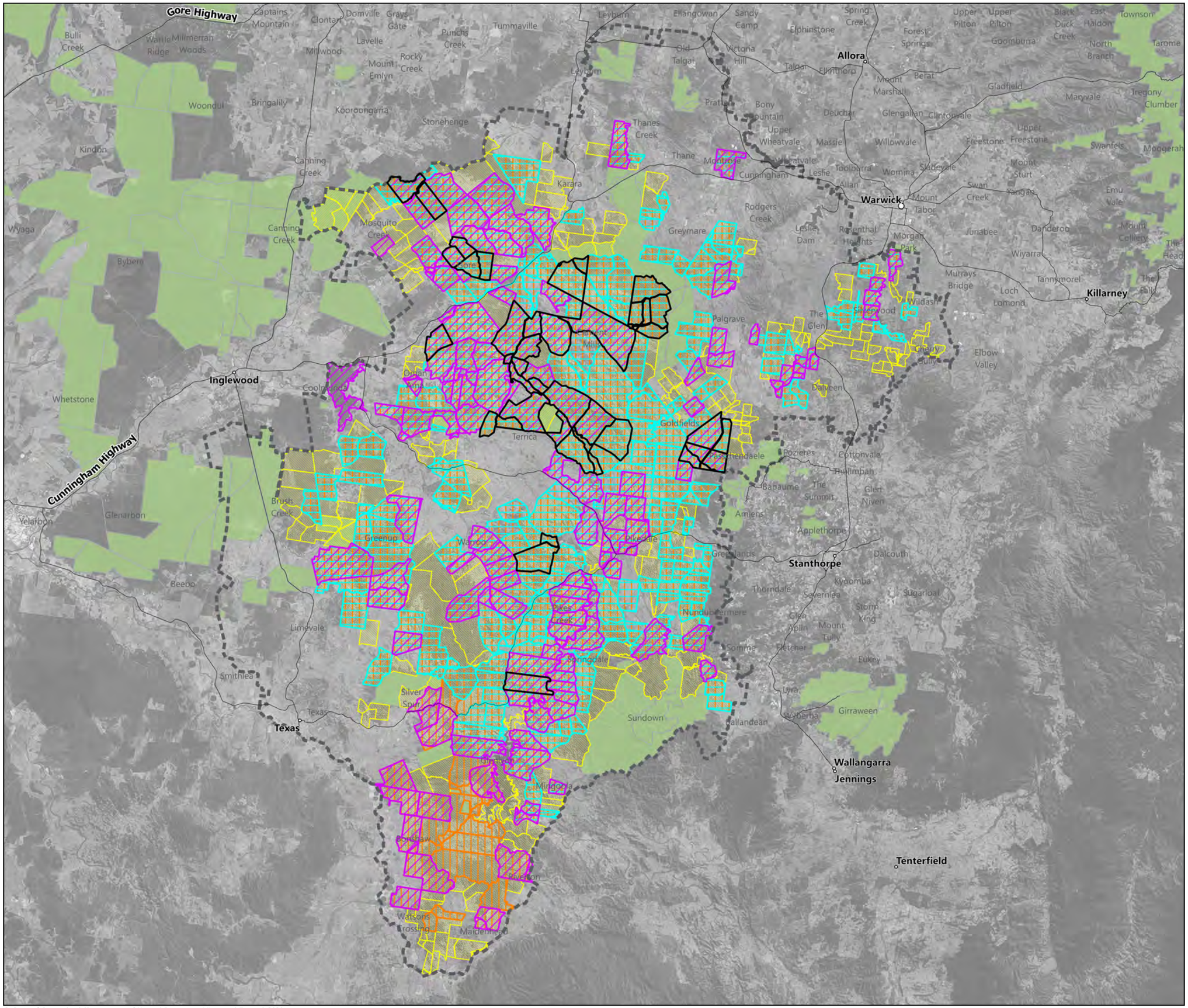
Data Source(s):
DCDB - Department of Natural Resources, Mines and Energy (2020)
Queensland Imagery Whole Of State Satellite Public Basemap Service



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Preliminary Offset Sites

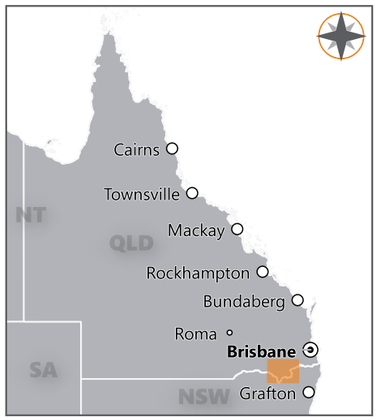
Figure 6.2

- Preliminary Offset Site

Potential Offset Site

- Regent honeyeater
- Grey-headed flying fox
- Koala
- Greater glider
- Major Road
- Area of Investigation
- Protected Area

Date: 2021-08-05
Author: TOD
Reviewed: NOD
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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7.4 Proposed Offset Sites

It is anticipated that the Project's residual impacts can be offset using the two properties described below.

7.4.1 Property One

Property One is located in the east of Goondiwindi Regional Council, in the locality of Cement Mills. It is partially affected by the KWF Project footprint and the landholder has expressed a willingness to enter into discussions regarding the securing of part of the property for the purposes of a land-based offset.

The proposed offset management area is on the eastern portion of the property situated on hills, drainages and lowlands (land zone 11 and land zone 3) and dominated by advanced regrowth of dry woodlands and open woodlands dominated by *Eucalyptus dealbata, Eucalyptus melliodora, E. microcarpa, E. moluccana, Eucalyptus tereticornis and E. crebra* (REs 13.11.3, 13.11.8, 13.3.5). Much of the young regrowth areas are 18 to 24 months old. These areas generally present dense and diverse regrowth.

Evidence of the presence of or usage by the relevant MNES is as follows:

- There is a squatter pigeon record approximately 3.6 km north of the property, dating from 2020 (ALA 2021). Project surveys also recorded the species approximately 1 km to the south.
- There are koala records approximately 6 km north and approximately 8.8 km west of the property, both dating from 2007 (ALA 2021). Project surveys recorded evidence of koala (scat) in the neighbouring property, approximately 3.7 km to the north.
- There is a central greater glider record approximately 13 km east of the property, dating from 2007 (ALA 2021). Project surveys recorded evidence of greater glider (scat) approximately 4.5 km to the north.
- There is a regent honeyeater record approximately 6.3 km northwest of the property, dating from 2004 (ALA 2021).
- As with the impact areas, there are no recent or historical records of grey-headed flying-fox within 20 km of Property One.

A preliminary site visit has confirmed suitable habitat for all MNES.

Strategically, Property One is a good option for a proposed offset as it provides connectivity along a Stream Order four watercourse ultimately joining the Dumaresq River south of Yelarbon.

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.

Proposed management actions will be updated following detailed site inspections and habitat quality assessments, and will be described in more detail in an Offset Management Plan.

Using information from the initial offset site inspections, likely habitat quality scores have been estimated. **Table 7.1** presents habitat quality assessment Property Two for each MNES. This table presents estimated existing scores for the offset site, along with estimated scores for the offset site following the implementation of the Offset Management Plan, and the total percentage of impact offset using the offsets calculator. Additionally, habitat quality scores for the offset site without the implementation of the Offset Management Plan are included. As set out in Section 4.4, there are no legislative obligations for landholders to implement that would lead to an increase in the habitat quality score of the offset site over time.

Table 7.1 Property Two Estimated Habitat Quality Scores

MNES	Offset Area (ha)	Habitat Quality Score – Start Value	Habitat Quality Score – Future Value without Offset	Habitat Quality Score – Future Value with Offset	% of Impact Offset
Koala	956	6	6	7	281%
Grey-headed Flying-fox	956	6	6	7	281%
Regent Honeyeater	39	5	5	8	474%
Greater Glider	956	6	6	7	1,347%
Squatter Pigeon	956	6	6	8	2,089%

7.4.2 Property Two

Property Two is located in the east of Goondiwindi Regional Council, in the locality of Gore. It is partially affected by the KWF Project footprint and the landholder has expressed a willingness to enter into discussions regarding the securing of part of the property for the purposes of a land-based offset.

The proposed offset management area is on the south-eastern portion of the property situated on hills, drainages and lowlands (land zone 11 and land zone 3) and dominated by advanced regrowth of dry woodlands and open woodlands dominated by *Eucalyptus dealbata, Eucalyptus melliodora, E. microcarpa, E. moluccana, Eucalyptus tereticornis and E. crebra* (REs 13.11.3, 13.11.8, 13.3.5). A preliminary site visit has confirmed suitable habitat for koala and regent honeyeater. In this area there is approximately 600 ha of regrowth vegetation proposed for use as an offset of which 26 ha would potentially be suitable for regent honeyeater offset. It is anticipated this management area will be used to acquit the offset liability for foraging habitat for the koala and foraging and nesting habitat for regent honeyeater.

Evidence of the presence of or usage by the relevant MNES is as follows:

- There is a squatter pigeon record within the property, dating from 2020 (ALA, 2021). Project surveys also recorded the species approximately 6.6 km to the north and approximately 4.4 km to the south.
- There are koala records approximately 2.4 km north and approximately 8.3 km west of the property, both dating from 2007 (ALA 2021). Project surveys also recorded koala (visual observations and scat) within the property.
- There is a central greater glider 12.5 km east of the property, dating from 2007 (ALA 2021). Project surveys recorded evidence of greater glider (scat) approximately 2 km to the northwest.
- There is a regent honeyeater record approximately 5.3 km west of the property, dating from 2004 (ALA 2021).

- As with the impact areas, there are no recent or historical records of grey-headed flying-fox within 20 km of the offset property.

A preliminary site visit has confirmed suitable habitat for all MNES.

Strategically, Property Two is a good option for a proposed offset as it provides connectivity along a Stream Order four watercourse that ultimately joins the Dumaresq River south of Yelarbon.

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.

Proposed management actions will be updated following detailed site inspections and habitat quality assessments, and will be described in more detail in an Offset Management Plan.

Using information from the initial offset site inspections, likely habitat quality scores have been estimated. **Table 7.2** presents habitat quality assessment Property Two for each MNES. This table presents estimated existing scores for the offset site, along with estimated scores for the offset site following the implementation of the Offset Management Plan, and the total percentage of impact offset using the offsets calculator. Additionally, habitat quality scores for the offset site without the implementation of the Offset Management Plan are included. As set out in Section 4.4, there are no legislative obligations for landholders to implement that would lead to an increase in the habitat quality score of the offset site over time.

Table 7.2 Property Two Estimated Habitat Quality Scores

MNES	Offset Area (ha)	Habitat Quality Score – Start Value	Habitat Quality Score – Future Value without Offset	Habitat Quality Score – Future Value with Offset	% of Impact Offset
Koala	614	6	6	7	180%
Grey-headed Flying-fox	614	6	6	7	180%
Regent Honeyeater	26	5	5	8	316%
Greater Glider	614	6	6	7	865%
Squatter Pigeon	614	6	6	8	1,267%

8.0 Desired Conservation Outcomes

8.1 Final Outcomes

The majority of offset area being investigated supports regrowth vegetation. 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; and
- 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.

In addition to regrowth areas, some sites include areas that already have the characteristics of remnant vegetation (and is 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. 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 and central greater glider will be enhanced. 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;
- Central 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.

Potential offset sites are generally over 40 km from the nearest known grey-headed flying fox roosting site. Therefore, it is not proposed that the offset 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 no historical records of the regent honeyeater in the impact area however there are historical records (the most recent being 1995) in proximity to the proposed offset area. 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 along with one scat from a central greater glider. The impact and offset area field assessments will include koala SAT scat surveys. The results of these surveys will be used to determine the feasibility of aiming for improvements in species stocking rates for koala.

8.2 Interim Milestones

In order to track progress towards the desired final conservation outcomes, interim milestones have been defined. These provisional milestones are currently presented in relation to the baseline condition and will be refined once the detailed habitat quality field assessments have been completed.

The management measures to improve habitat quality at the offset site include:

- Pest and weed management:
  - Demonstrate the extent of weed cover across the offset management areas is < 25% by the end of year 5 and < 5% by the end of year 10, and then maintained at or below this level;
- Stock management:
  - Install fauna friendly stock exclusion fencing around the offset management areas as required, by the end of year 1;
  - Only permit grazing for the purposes of bushfire hazard reduction, to extent required to meet the habitat quality improvement milestones listed below, by the end of year 1;
  - Ensure all livestock are excluded from regrowth offset management areas for a minimum of 5 years, or until a suitably qualified independent expert has determined that any significant cohorts of koala and grey-headed flying-fox feed trees are a sufficient size to withstand grazing by sheep and cattle;
  - Ensure any grazing is managed so as to prevent the risk of injury or mortality of koalas, by the end of year 1; and
- Habitat quality improvement:
  - Undertake ecology work which contributes to improvement of the condition of REs and facilitates natural regeneration within the offset management area, such that the following outcomes are achieved:
    - Average recruitment of woody perennial species in the EDL is > 75% of the benchmark for the relevant RE by the end of year 5 and maintain that level or greater;
    - Maintain average tree canopy height at > 50% of the benchmark for the relevant RE by the end of year 10;
    - Maintain average tree canopy cover at > 25% of the relevant benchmark for the relevant RE by the end of year 10.

As outlined in Section 4.4, proposed offset management actions are all additional to those required under existing legislation.

9.0 Future Steps

9.1 Offset Management Plans

Following field surveys to assess vegetation type, habitat attributes and condition, management plans will be prepared for the offset site. 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.

A detailed offset management plan will be developed that provides 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).

The management plan 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.

The management plan 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.

9.2 Legal Mechanisms for Securing Offsets

Once the final offset package has been agreed, the offset site 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 the offset 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.

9.3 Offset Monitoring and Reporting

The offset management plan will include a monitoring program. It is proposed that monitoring be conducted annually for the first five years, with subsequent monitoring events being conducted bi-annually for a maximum of 20 years or until it can be demonstrated that the objectives of the management plans have been met. Monitoring plans will be developed in conjunction with the detailed management plans and will reflect the management actions at the site.

Vegetation / habitat condition monitoring will be based around the Queensland Government Guide to Determine Terrestrial Habitat Quality, following the baseline assessment used in determining the area of offset required. Other monitoring would include:

- Weed population and extent;
- Pest animal occurrence / abundance;
- Fire fuel load monitoring, fire impact monitoring and associated habitat change;
- Supplementary / enrichment planning monitoring for growth and survival rates; and
- Targeted fauna surveys and fauna utilisation monitoring (against the target species for the sites).

Monitoring reports will be used to inform ongoing management actions and be supplied to regulators as they are completed, to demonstrate progress towards the target conservation gains. Active management and associated monitoring would continue until all conservation gains at the offset site have been achieved.

10.0 Compliance with EPBC Act Environmental Offsets Policy

Table 10.1 lists the principles of the EPBC Act Environmental Offsets Policy and describes how the Project Offset Strategy has been developed to adhere to these principles.

Table 10.1 EPBC Act Environmental Offsets Policy Principles

Principle	Offset Strategy Compliance
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the proposed action	Based on the outcomes of a desktop offset availability analysis, a number of potential offset sites have been identified for the Project as described in **Section 7.0**. The offset site selection and preliminary site inspections have assessed the suitability of each potential offset site to deliver conservations gains for each matter being offset. The next stage of the Project's offset program will involve undertaking habitat quality assessments for the offset areas and uses of the EPBC Calculator to more fully demonstrate that the offset will improve or maintain the viability of relevant MNES.
Suitable offsets must be built around direct offsets but may include other compensatory measures	Direct offsets will provide 100% of the Project's offset requirements for MNES. The offset availability analysis presented in **Section 6.3** demonstrates that there are a large number of properties within the Nandewar Northern Complex sub-bioregion that provide potentially suitable vegetation to meet the Project's offset requirements.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	In the absence of habitat quality measurements for the offset areas, it is not yet possible to fully assess the suitability of the proposed offset sites using the EPBC Calculator. This will be completed during the next stage of the offsets program.
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	Offset availability assessment has incorporated consideration for how the proposed offset will be proportionate to the residual impacts on each of the MNES.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding	It is not yet possible to estimate the risk of the offset not succeeding based on current information; this will be assessed during the next stage of the offset program and presented in the Offset Management Plan, which will also provide further detail on proposed monitoring, reporting and adaptive management.
Suitable offsets must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	As described in **Section 2.3**, the EPBC Act Environmental Offsets Policy takes precedence in relation to MNES and the State cannot impose an offset condition in relation to the same or substantially the same impact, if DAWE has assessed an activity as a controlled action and decided that an offset is, or is not, required. The Project has the potential to result in significant residual impacts to MSES that are not also MNES and it is intended that the proposed offset sites will also fully acquit the State offset requirements for these MSES.
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	It is the proponent's intention to have the offset in place prior to commencement of construction. As part of that process, an Offset Management Plan will be developed in late 2021 which will present the

Principle	Offset Strategy Compliance
	outcomes of the habitat quality assessments and the proposed offset management approach.
Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	The proposed governance arrangements for the offset property will be described in detail in the Offset Management Plan.
In assessing the suitability of an offset, government decision-making will be informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific uncertainty	Noted.
In assessing the suitability of an offset, government decision-making will be conducted in a consistent and transparent manner	Noted.

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Appendix A

Habitat Indicator Scoring

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 Quality Attributes Scoring

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 foraging habitat		
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 grey-headed flying-fox 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 & 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 et al. 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 et al. 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 et al. 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 maculate;*
- Swamp mahogany, *E. robusta;*
- 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*), • 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*),	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: • 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: • Needle-leaf mistletoe, *Amyema cambagei* • *Amyema miquelii,* • *Amyema pendula* • Box mistletoe, *Amyema miquelii* • Long-flower mistletoe, *Dendropthoe vitellina*	1: 0 mature rough-barked trees 5: 10-50 mature rough-barked trees 10: > 50 mature rough-barked trees
Species mobility capacity		
Availability of linear habitat patches	Perimeter-Area ratio	1: = 1 Shape Index 5: 1-2.67 Shape Index

Habitat Indicator		Scoring
	Oliver and Lollback (2010) found higher presence of RHE closer to the edge of linear high quality, well connected remnants, with low proportion of woodland habitat within a 1-2km radius. Ratio follows that of McGarigal (2017) landscape metric 'Shape Index' whereby linearity of a patch is quantified by perimeter-area ratio compared to a standardised shape to account for size dependency: $$Shape\ Index = \frac{p}{\sqrt{a^2}}$$ When *Shape Index* = 1, patch is circular and increasing values represent increasing linearity	10: >2.67 Shape Index Value – based on the min. perimeter and area in Oliver and Lollback (2010) where species presences were highest
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 central 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 1200 m 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 central 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, central 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 & 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 central greater glider have been determined using information contained within the Approved Conservation Advice for Greater Glider 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		
<u>Availability of Food Trees</u> Presence of food species within the site, as defined by Eyre (2002), benchmarked against the technical description for the relevant RE (species and cover %).	<u>Density per hectare</u> 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 central greater glider habitat trees	The richness of central 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 Central 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)