APPENDIX 7: MHQAT METHODS – GREATER GLIDER

1 GREATER GLIDER MODIFIED HABITAT QUALITY ASSESSMENT TOOL METHODOLOGY

1.1 INTRODUCTION

The following document outlines species-specific Modified Habitat Quality Assessment Tool (MHQAT) methods for assessment of habitat quality for the Greater Glider at impact and offset sites for EPBC referral 2022/09397. This assessment has been conducted following the *Guide to Determining Terrestrial Habitat Quality* (State of Queensland 2017).

Habitat quality is determined based on an assessment of the following attributes:

Site condition + Site context + Species stocking rate = Habitat quality score

The default MHQAT spreadsheet is generalised so it may be applied to a number of species. The Department of Climate Change, Energy, Environment and Water (DCCEEW) require that modifications are made to the MHQAT to suit the unique species characteristics, which are listed in the EPBC Administrative Guidelines on Significance, including the Conservation Advice for the species, and the Guide to Greater Glider Habitat (Department of Climate Change Energy the Environment and Water 2022; Department of Environment and Science 2022).

This methodology has been adopted and tailored / modified to assess the habitat quality score for the Greater Glider at the impact site and offset site. The method is derived from the *Guide to Determining Terrestrial Habitat Quality* (State of Queensland 2017), which provides the base methodology for the Guide to determining terrestrial habitat quality.

The MHQAT methods have been previously modified for the Greater Glider in the draft Offset Management Plan by Terrestria to complete impact and offset site habitat quality assessments and to prepare offset strategy documents.

In preparing the Offset Management Plan, targeted modifications to the methods employed by Terrestria have been applied where necessary to ensure applicability to the species and site context.

Wherever changes have been made to the method, these have been made explicit in the text of the MHQAT method in this document and otherwise methods are consistent with the work of the Draft OMP. For each measure removed, changed or for which an indicator has been chosen, justification has been provided. Changes and justifications have been made by previous consultants and modifications have only been made if necessary for

continuity and simplicity. This document consolidated the methods for clarity and increases exposition to provide a single reference material. The full methodology has been combined in this document for the sake of ensuring that all methods are contained succinctly and clearly in one document for future use.

1.2 MHQAT OVERVIEW

The following section outlines the modifications of the base MHQAT method that have been made for the Greater Glider.

MHQAT modifications must be based on species characteristics. Species information has been drawn from the EPBC Administrative Guidelines on Significance, the National Recovery Plan (NRP) and the Species Profile and Threats Database. In summary, modifications have been made on the basis of the following species characteristics:

- Strong dependence on mature trees with large hollows; "habitat critical to survival" includes high density of large hollow-bearing trees.
- The Greater Glider has a specialised diet of eucalypt leaves and buds and requires preferred food-tree species of sufficient nutritional quality.
- Canopy gaps are a hard functional constraint as comfortable glide distances depend on canopy height, and unvegetated gaps wider than comfortable distances become barriers to daily movement, dispersal and connectivity.
- Females carrying young are likely to have shorter glide distances and be less able to navigate gaps.
- Greater Gliders have a low thermal tolerance to high temperatures, especially under heatwaves and drought conditions.
- Long-isolated patches can have reduced genetic diversity, and small remnants may not support populations indefinitely.

The offset and impact site was assessed as per the *Guide to Determining Terrestrial Habitat Quality* (State of Queensland 2017). In accordance with the guideline, Assessment Units (AUs) within the site were determined. Notably, the number of AUs were reduced[1] from three (3) to two (2) AUs following a field investigation completed by two (2) tertiary qualified ecologists in November 2025. The purpose of the change was to align the observed habitat types, being:

1. Regrowth vegetation (foraging value), and
2. Pasture with scattered trees or shrubs (limited value).

The reason for the modification was to separate the vegetation on the basis of present value for the species. The vegetated areas offer some regrowth foraging value, and cleared areas offer limited value. It was considered unnecessary to further segment the

[1] Compared to the previously submitted draft Offset Management Plan prepared by Terrestria.

regrowth vegetation, which provided the same habitat value. As such, they were consolidated to simplify management and represent the two types of habitats available.

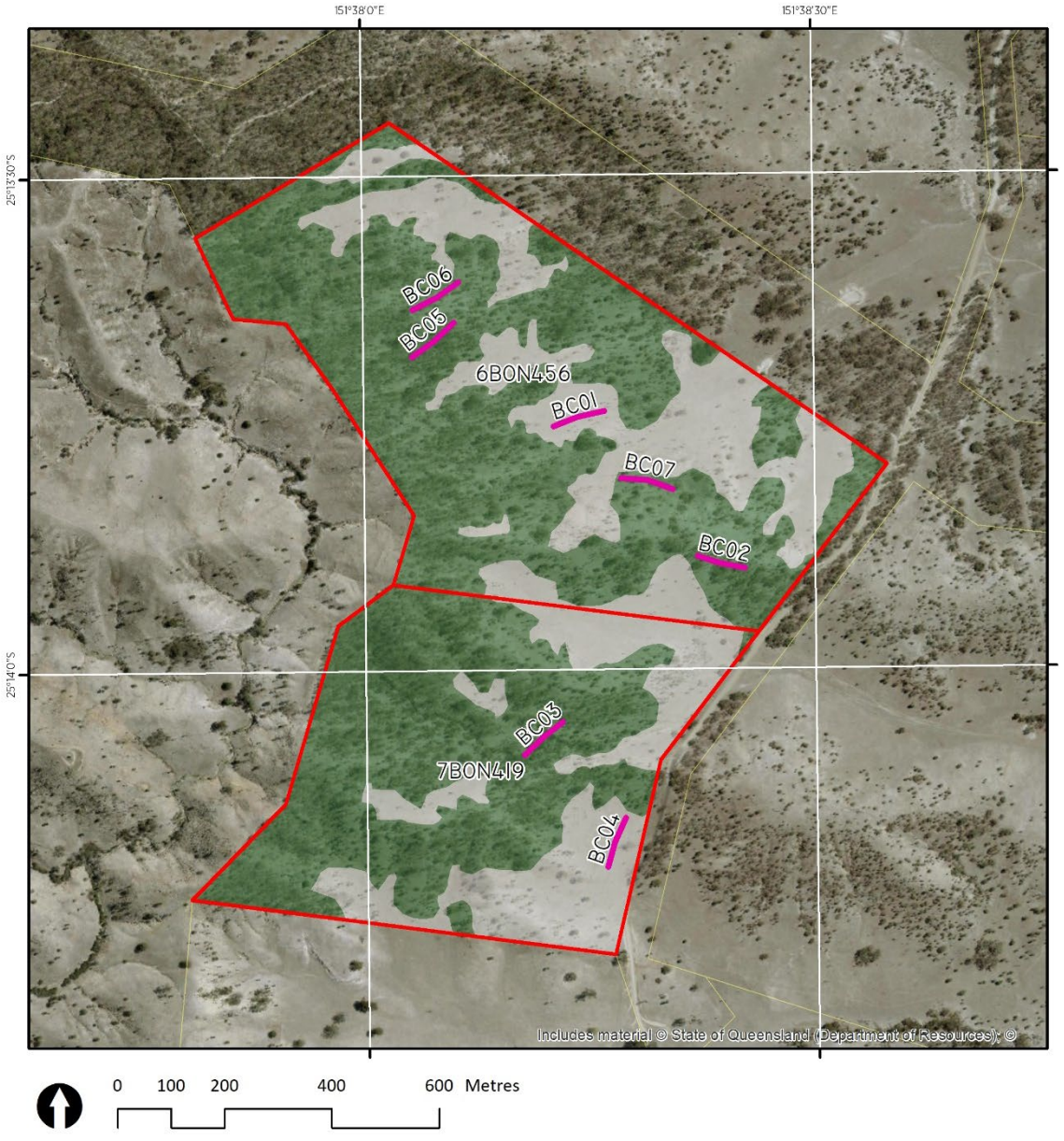

FIGURE 1: ASSESSMENT UNITS WITHIN THE OFFSET SITE.

1.3 OVERALL WEIGHTINGS

This section outlines the weightings of the three components of the MHQAT. The purpose, default weighting, proposed weighting, and justification for each is provided in Table 1.

TABLE 1: MHQAT CATEGORY DESCRIPTIONS, DEFAULT WEIGHTINGS AND PROPOSED WEIGHTINGS, AND JUSTIFICATION FOR PROPOSED WEIGHTINGS.

Category	Description	Default Weighting	Proposed Weighting	Justification
Site Condition	Site condition measures the characteristics of the vegetation community compared to an undisturbed community of the same type (State of Queensland 2017).	3/10	3/10	As an arboreal mammal that relies on old-growth eucalypt woodland habitats with hollows, site condition weighting is considered appropriate in the default state.
Site Context	The surrounding landscape and adjacent land uses can directly influence the quality and security of habitat through edge effects, environmental buffering, or threatening processes.	3/10	3/10	The Greater Glider has small home ranges (typically 1 – 4ha), disperses poorly and their distribution may be patchy even in continuous areas of habitat. The default Site Condition weighting is considered appropriate in the default state.
Species Stocking Rate	A suitable offset must demonstrate that the species occurs in the area, and the site can support the reproduction and continued existence of species. Species stocking rate measures the capacity of a site to support a species.	4/10	4/10	As Species Stocking Rate captures functional habitat occupied by the species, the default Site Condition weighting is considered appropriate. Occupied Greater Glider habitat is more important than unoccupied habitat.

The following sections of the report provide further justification on the measures of habitat quality that comprise the above categories.

1.4 SITE CONDITION

Site condition is assessed using a suite of attributes to describe the structure and function of the vegetation community and is benchmarked against the expected range for a relatively undisturbed community. The MHQA methodology for Site Condition incorporates:

- From the *Guide to Determining Terrestrial Habitat Quality* (State of Queensland 2017) a BioCondition assessment is applied (Qld), and,
- Species-specific measures of the MHQAT (Cth), including:
  - The quality and availability of food and foraging habitat, and
  - The quality and availability of shelter.

The relative weightings of BioCondition (30%), food and foraging habitat (35%), and shelter (35%) have been modified from the original methodology. Modifications have been made to improve the focus on foraging trees and canopy composition and minimise focus on shrub and understory measures with minimal habitat relevance for the target MNES. A summary of the relative site condition scores is provided in Table 2.

TABLE 2: SITE CONDITION DEFAULT AND PROPOSED MEASURES.

Default			Proposed		
Measure	Max. Score		Measure	Max. Score	
BioCondition					
Recruitment of woody perennial species in EDL	5		Recruitment of woody perennial species in EDL	5	
Native plant species richness – trees	5		Native plant species richness - trees	5	
Native plant species richness – shrubs	5		Native plant species richness - shrubs	5	
Native plant species richness – grasses	5		Native plant species richness – grasses	5	
Native plant species richness – forbs	5		Native plant species richness - forbs	5	
Tree canopy height (average of emergent, canopy, sub-canopy)	5		Tree canopy height (average of emergent, canopy, sub-canopy)	5	
Tree canopy cover (average of emergent, canopy, sub-canopy)	5	80	Tree canopy cover (average of emergent, canopy, sub-canopy)	5	**30** [(Score/80) *30]
Shrub canopy cover	5		Shrub canopy cover	5	
Native grass cover	5		Native grass cover	5	
Organic litter	5		Organic litter	5	
Large trees (Eucalypt plus Non-eucalypt)	15		Large trees (Eucalypt plus Non-eucalypt)	15	
Coarse woody debris	5		Coarse woody debris	5	
Non-native plant cover	10		Non-native plant cover	10	
Species specific site condition / habitat attributes					
Quality and availability of food and foraging habitat	10		Preferred tree species	10	35 [(Score/20) *35]
			Target tree density	10	
Quality and availability of shelter	10		Target tree size metrics (species richness (5), canopy cover (5), canopy height (5), and large trees (15)).	30	**35** [(Score/30) *35]
Total weightings					
Total score	**100**		**Total score**		**100**

The scoring method for each measure is provided in the following sections.

1.4.1 BIOCONDITION

BioCondition has been designed to measure a range of site-scale attributes. Not all attributes may be relevant to the target species. The site condition assessment under the MHQAT is assessed using the following condition characteristics:

- *recruitment of woody perennial species in EDL*

- *native plant species richness – trees*
- *native plant species richness – shrubs*
- *native plant species richness – grasses*
- *native plant species richness – forbs*
- *tree canopy height (average of canopy, sub-canopy)*
- *tree canopy cover (average of canopy, sub-canopy)*
- *native grass cover*
- *organic litter*
- *large trees*
- *coarse woody debris*
- *non-native plant cover*

For the Greater Glider, the above measures have not been modified in terms of function or weighting from the original *Guide to Determining Terrestrial Habitat Quality* (Version 1.2 April 2017). Refer to this document for the applied methodology and scoring method for each of these measures.

1.4.2 SPECIES SPECIFIC HABITAT FEATURES

Species specific attributes do not have a 'default' measure as they are not part of the *Guide to Determining Terrestrial Habitat Quality* and are additions of the federal EPBC Act offsets process. They are 'species specific' because suitable shelter and food vary between species.

Species specific habitat attributes must be selected by the consultant and suited to the target species. In the original context, the quality and availability of food and foraging habitat, and the quality and availability of shelter, refer to the extent to which a site provides sufficient, accessible, and ecologically appropriate resources and structural features to support the survival, growth, and reproduction of a species across relevant life stages.

For the Greater Glider, food, foraging and shelter habitat are related to the canopy, within which they nest in hollows and feed on nectar. Whilst Greater Gliders will feed in trees that are smaller, they are known to prefer to feed on trees > 30cm diameter at breast height (DBH), and usually den in trees >50cm DBH (Department of Environment and Science 2022). In south-east Queensland, they have been found to prefer 2-4 suitable denning trees every 2 ha (Department of Climate Change Energy the Environment and Water 2022); however, studies recommend the use of DBH as a more reliable proxy for habitat than the identification of hollows (Department of Environment and Science 2022). Preferred food trees (identified as dominant trees in preferred regional ecosystems) in Queensland have also been identified, and these consist of the following species:

- *Corymbia trachyphloia,*
- *Corymbia intermedia,*
- *Corymbia clarksoniana,*
- *Corymbia citriodora,*
- *Eucalyptus tereticornis,*

- *Eucalyptus siderophloia,*
- *Eucalyptus portuensis,*
- *Eucalyptus moluccana,*
- *Eucalyptus crebra,*
- *Eucalyptus acmenoides,* and
- *Lophostemon suaveolens.*

Litoria has elected to use a new species-specific method rather than to utilise the assessment in the Draft OMP. The reason for the refinement is to balance metrics that are relevant to habitat with realistic actions that can be made to improve the quality of habitat for the species.

The following sections outline the species-specific methods applied to greater glider habitat to assess food and shelter requirements. These include the following measures which all affect foraging and shelter resources:

- Weighed 35% of the Site Condition score:
  - Preferred tree species, and
  - Target canopy tree densities.
- Weighed 35% of the Site Condition score:
  - Target canopy tree size metrics.

Preferred Tree Species

Greater Gliders show a preference for certain eucalypts species in south-eastern Queensland. Within the constraints of the regional ecosystem, while also considering species observed on the site, the total count of possible preferred trees that could be present in habitat based on the RE and the site forms the benchmark. If in any recorded transect, priority species are observed as part of the tree species richness assessment in accordance with the *Guide to Determining Terrestrial Habitat Quality* (State of Queensland 2017), these trees are counted towards the total possible preferred trees and the score as a percentage is weighted out of 10.

Possible Preferred Food/Shelter Trees		
Species	Impact Site (12.5.4)	Offset Site (12.12.5)
Corymbia trachyphloia	◆	
Corymbia intermedia	◆	
Corymbia clarksoniana		
Corymbia citriodora		◆
Eucalyptus tereticornis,	◆	◆
Eucalyptus siderophloia	◆	
Eucalyptus portuensis		
Eucalyptus moluccana		◆
Eucalyptus crebra	◆	◆
Eucalyptus acmenoides		
Lophostemon suaveolens		

Possible Preferred Food/Shelter Trees		
Species	Impact Site (12.5.4)	Offset Site (12.12.5)
Total (benchmark)	5 species	4 species
Species Scoring	(number of observed trees)/5)*10	(number of observed trees)/4)*10

Target Canopy Tree Density

As the above measure does not account for the density of trees, a secondary measure was introduced to compare observed stem densities of food trees with that expected of the regional ecosystem.

The stem density of potential food trees are recorded within a 20x100m area within the transect. This count is multiplied by five (5) to produce a stem density per hectare in accordance with the stem density count method from *Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland (version 5.0)* (Neldner *et al.* 2020). This number is compared to the benchmark stem density per hectare based on the sum of the T1 and T2 stem densities for the relevant regional ecosystem in accordance with the technical description (Table 3), where the technical description is per the *Technical Descriptions of Regional Ecosystems of Southeast Queensland* (Ryan 2018[2]). It is then scored in accordance with Saunders Havill and the draft OMP scaling density scoring tables where low and excessive stem density is undesired and within a range of the ideal is scored highest.

TABLE 3: BENCHMARK STEM DENSITY FOR THE CANOPY STRATUM.

Benchmark Stem Density			
Site	T1 count	T2 count	Total
Impact (12.5.4)	242	313	555
Offset (12.12.5)	280	400	680

TABLE 4: STEM DENSITY RESULT SCORING TABLE.

Stem Density Scoring		
Score	Impact area (12.5.4 stem count per hectare)	Offset site (12.12.5 stem count per hectare)
2	0-69	0 – 79
4	70-301	80 – 179
6	302-509	180 – 379
8	510-543	380 – 579
10	544-567	580 – 779
8	568-601	780 – 979
6	602-809	980 – 1109
4	810-1041	1110 – 1209

[2] Ryan, T.S. (ed.) (2018) Technical Descriptions of Regional Ecosystems of Southeast Queensland, (10 November 2018) (Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts: Brisbane). * Date shown in footnote of individual descriptions (23/05/2012).

Stem Density Scoring		
Score	Impact area (12.5.4 stem count per hectare)	Offset site (12.12.5 stem count per hectare)
2	>1042	> 1210

Combining Preferred Trees and Density

The two methods outlined above, including measures of preferred trees and tree density, are translated into a score out of 35 in accordance with the short formula provided for species specific attributes in Table 2.

Target Canopy Tree Size

Tree size is a critical aspect of quality Greater Glider habitat as DBH is correlated with hollow and preferential feeding tree availability. Better quality habitat within the constraints of the regional ecosystem (which is comprised of preferred tree species) is likely to meet or exceed the BioCondition benchmarks. For the Greater Glider, canopy tree measures from BioCondition were utilised as a surrogate proxy for a mature canopy stratum, where higher scores will indicate a variety of large or mature tree species options for shelter and food, including:

- Species richness,
- Tree canopy height (average of canopy and sub-canopy),
- Tree canopy cover (average of canopy and sub-canopy), and
- Number of large trees.

For the method of determining the possible score obtained for each measure, refer to the *Guide to Determining Terrestrial Habitat Quality* (Version 1.2 April 2017).

This approach increases the weighting of these canopy tree measures as a standard approach measured against a reputable benchmark for the ecosystem in BioCondition, whilst ensuring minimal deviation from methods applied to other MNES by Saunders Havill. This has been chosen as a goal to provide suitable habitat in terms of maximal tree maturity that is expected for the regional ecosystem. Notably, the regional ecosystem is comprised of preferred trees for habitat in south-east Queensland (*Corymbia intermedia* and *Eucalyptus crebra*) and in a maximal state is accordingly expected to provide suitable habitat for the Greater Glider. To supplement hollow availability, the management measures of the OMP suggest the implementation of nest boxes in connected habitat in the north of the site to provide hollows. The provision of nest boxes are not relied upon to achieve offset completion criteria and is a supplementary offering.

When all four measures are combined, their total achieved score is compared to the total possible score. The score is then translated to a weighted score out of 35. The scoring table is provided in Table 5 below.

TABLE 5: EXAMPLE SCORES AND MAXIMUM POSSIBLE SCORES FOR BIOCONDITION MEASURES RELATED TO THE CANOPY.

Species-specific Habitat Attributes		
Measure	Maximum Score	Weighted Score

Species-specific Habitat Attributes		
Native plant species richness – trees	5	([*Sum of scores*]/30)*35 = [*Final score*] /35
Tree canopy height (average of emergent, canopy, sub-canopy)	5	
Tree canopy cover (average of emergent, canopy, sub-canopy)	5	
Large trees	15	

1.5 SITE CONTEXT

Site context refers to the configuration and location of the habitat and whether the characteristic of the surrounding landscape places the habitat in a favourable or unfavourable context.

Site context is assessed using the following default measures:

- From the *Guide to Determining Terrestrial Habitat Quality:*
  - *size of patch*,
  - *connectedness*,
  - *context*,
  - *ecological corridors*, and,
  - *role of site location to species overall population in the state.*
- Species-specific measures introduced by the MHQAT:
  - *threats to the species*, and,
  - *species mobility capacity.*

The default methodology from the *Guide to Determining Terrestrial Habitat Quality* is applied to the related Site Context measures. Refer to the document (Version 1.2 April 2017) for the methods and scoring tables.

In contrast, the species-specific habitat attributes do not have a 'default' measure as they are not part of the *Guide to Determining Terrestrial Habitat Quality* and are additions of the federal EPBC Act offsets process. They are 'species specific' because threats and mobility capacity vary between species. Species specific habitat attributes must be selected by the consultant and suited to the target species.

The overall weightings of all measures have not been modified from the default (Table 6).

TABLE 6: SITE CONTEXT DEFAULT AND PROPOSED MEASURES.

Default		Proposed	
Measure	Score	Measure	Score
Size of patch	10	Size of patch	10
Connectedness	5	Connectedness	5
Context	5	Context	5
Ecological corridors	6	Ecological corridors	6
Role of site location to species overall population in the state	5	Role of site location to species overall population in the state	5

Default		Proposed	
Threats to the species	15	Threats to the species	15
Species mobility capacity	10	Species mobility capacity	10
Total score	**56**	**Total score**	**56**
Overall weighting	**3/10**	**Overall weighting**	**3/10**

The scoring method for each measure is provided in the following sections.

1.5.1 SIZE OF PATCH

Patch size is the area of vegetation being assessed, including any directly connecting remnant vegetation. Size of patch can influence the quality of habitat through edge effects, habitat security, carrying capacity, and proximity of anthropogenic disturbance (such as vehicles, light and noise).

Patch size is important for the Greater Glider because larger habitat patches are more likely to support sufficient food trees, provide sufficient shelter, reduce edge effects and disturbance, and sustain viable populations.

The method for measuring size of patch has not been altered from the method in the *Guide to Determining Terrestrial Habitat Quality* (Version 1.2 April 2017) (State of Queensland 2017).

TABLE 7: SIZE OF PATCH SCORING TABLE.

Size of Patch	
Thresholds	Score
<5 ha	0
5-25 ha	2
26-100 ha	5
101-200 ha	7
>200 ha	10

1.5.2 CONNECTEDNESS

Connectedness relates to the capacity for species to disperse through the landscape between suitable patches of habitat as described in the Guide to Determining Terrestrial Habitat Quality (State of Queensland 2017).

Connectedness is important for the Greater Glider because well connected habitat patches are more likely to support sufficient food trees, provide sufficient shelter, reduce edge effects and disturbance, and sustain viable populations.

The method for measuring connectedness has not been altered from the method in the *Guide to Determining Terrestrial Habitat Quality* (Version 1.2 April 2017) (State of Queensland 2017).

TABLE 8: DESCRIPTION AND SCORES FOR CONNECTIVITY IN THE LANDSCAPE

Connectedness	
Thresholds	Score
0-10%	0
>10%–<50%	2
50–75%	4
>75% or >500ha	5

1.5.3 CONTEXT

Context relates to the composition of landscapes surrounding the proposed site. Site context describes the broader landscape setting of a site, including its connectivity to surrounding habitat, degree of fragmentation, and exposure to adjacent land uses and disturbances.

Site context is important for the Greater Glider because connectivity and landscape integrity influence movement between feeding and breeding areas, gene flow, and the species' ability to avoid threats such as roads, urban areas, and habitat isolation.

The method for measuring context has not been altered from the method in the *Guide to Determining Terrestrial Habitat Quality* (Version 1.2 April 2017) (State of Queensland 2017).

TABLE 9: SITE CONTEXT SCORING THRESHOLDS.

Context	
Thresholds	Score
<10% remnant	0
>10–30% remnant	2
>30–75% Remnant	4
>75% remnant	5

1.5.4 ECOLOGICAL CORRDIORS

Ecological corridors relate to habitat linkages that allow fauna to move safely between core habitat areas across a fragmented landscape. Corridors maintain ecological connectivity, enable dispersal and support the long-term viability of species and ecological processes.

Ecological Corridors is important to the Greater Glider because it positions the offset in areas that are designed to act as wildlife and riparian corridors and are more likely to support strategic connected habitat and species strongholds with long term protections.

The method for measuring context has not been altered from the method in the *Guide to Determining Terrestrial Habitat Quality* (Version 1.2 April 2017) (State of Queensland 2017).

TABLE 10: ECOLOGICAL CORRDIORS SCORING THRESHOLDS.

Ecological Corridors	
Thresholds	Score
Not within	0
Sharing a common boundary	4
Within (whole or part)	6

1.5.5 ROLE OF SITE LOCATION TO SPECIES OVERALL POPULATION IN THE STATE

Role of site location to species overall population in the state refers to how important the assessed site is to the long-term survival of the listed species. The method for measuring context has not been altered from the method in the *Guide to Determining Terrestrial Habitat Quality* (Version 1.2 April 2017) (State of Queensland 2017). The site is considered important if it supports critical habitat for the species. The habitat is assessed with regard to the definition of critical habitat for the target MNES.

In accordance with the Conservation Advice for the Greater Glider, habitat critical to the survival of a species is defined as the areas that the species relies on to avoid or halt decline and promote the recovery of the species. Such areas, if identified, would be expected to include habitat occupied and habitat currently unoccupied, areas necessary for population processes and maintenance of genetic diversity and evolutionary potential, and areas required to accommodate future population increase, recolonisation, reintroduction, or as climate refugia. Under the EPBC Act, the following factors and any other relevant factors may be considered when identifying habitat that is critical to the survival of a species:

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

An assessment of the probability that the habitat is consistent with the definition of critical habitat should be made by an expert ecologist. The assessment should consider such factors including but not limited to:

- Direct or indirect species evidence,
- Records of the species on or nearby to the site,

- Other site condition and site context scores (i.e., the quality and connectedness of habitats),
- Population density, strongholds or genetic importance.

TABLE 11: ROLE OF SITE LOCATION SCORING GUIDE.

Role of Site Location to Greater Glider Overall Population in the State	
Thresholds	Score
Not or unlikely to be critical to species' survival	1
Likely to be critical to species' survival	4
Critical to species survival	5

1.5.6 THREATS TO THE SPECIES

Threats to the species is a species-specific habitat attribute that does not have a 'default' measure as they are not part of the *Guide to Determining Terrestrial Habitat Quality* and are additions of the federal EPBC Act offsets process. They are 'species specific' because threats vary between species.

Threats to the species refers to the current and foreseeable pressures that directly affect the survival, reproduction or habitat of MNES at the site and within its broader population context. It requires identifying the type, severity and immediacy of threats.

For the Greater Glider, threats to the species within impact and offset sites have previously been assessed using a thresholding model. This methodology has been replaced with the qualitative threat assessment used for the Koala and Greater Glider for consistency. The method has been reapplied within the following framework for a qualitative assessment.

Threats listed in key species resources such as the conservation advice should be understood and each one must be assessed by an experienced senior ecologist with reference to field observations and desktop data. Important threats to the Greater Glider include (Department of Climate Change Energy the Environment and Water 2022):

- Inappropriate fire regimes,
- Habitat clearing and fragmentation,
- Timber harvesting,
- Entanglement in barbed wire fencing,
- Increased temperatures and changes to rainfall patterns,
- Hyper-predation by owls,
- Denning competition from *Cacatua galerita*, and,
- Predation by feral fauna such as *Vulpes vulpes* and *Felis catus*.

Experts consider each threat then complete the assessment by drawing a conclusion based on the likelihood or probability that survival of the Greater Glider would be influenced by threats as outlined in Table 12.

TABLE 12: SCORING TABLE FOR THREATS TO THE SPECIES

Threats to the Species	
Thresholds	Score
High threat level: Many threatening processes are present that are likely to result in stress, death or a local population decline.	1
Moderate threat level: Some threatening processes are present that could possibly contribute to stress, death or a local population decline.	7
Low threat level: Limited threatening processes are present and are unlikely to contribute to stress, death or a local population decline.	15

1.5.7 SPECIES MOBILITY CAPACITY

Species mobility capacity refers to how easily the target species can move across the landscape to access resources, recolonise habitat or avoid threats. It considers the intrinsic movement ability of the species (for example, whether it is highly mobile, moderately mobile or dispersal-limited) and how that interacts with the surrounding landscape condition.

For the Greater Glider, species mobility capacity within impact and offset sites has previously been assessed qualitatively within the Preliminary Documentation (Sounders Havill Grup, February 2024). This methodology has been continued to provide consistency and to avoid exclusions, misinterpretations or errors. The method has been reapplied within the following framework for a qualitative assessment.

Mobility capacity as discussed in conservation advice should be understood and assessed by an experienced senior ecologist with reference to field observations and desktop data. Factors influencing mobility for the Greater Glider are as follows (Department of Climate Change Energy the Environment and Water 2022):

- Logging practices, vegetation clearing or other disturbance resulting in large habitat trees,
- Patch size and connectivity, including the presence and width of corridors,
- Gap distances between habitat patches,
- The composition of the matrix between patches,
- Barriers to movement, including roads, rail, fences or urban development,
- Road density and traffic volume,
- Density of domestic and wild dogs and cats,
- Frequency and intensity of bushfire,
- Climate change and drought conditions,
- Vegetation species composition,
- Presence of shade and riparian corridors.

Experts consider each mobility factor then complete the assessment by drawing a conclusion based on the likelihood or probability that the mobility of the species is restricted at the offset site as outlined in Table 13.

TABLE 13: GREATER GLIDER MOBILITY CAPACITY SCORING TABLE.

Species Mobility Capacity	
Thresholds	Score
Severely or completely restricted (76–100%)	1
Highly restricted (51–75%)	4
Moderately restricted (26–50%)	7
Minor to nil restriction (0–25%)	10

1.6 SPECIES STOCKING RATE

Species stocking rate refers to the typical density or number of individuals of the target species that a given habitat area can naturally support under current ecological conditions. It reflects how well the site can sustain viable numbers of the species, with higher stocking rates indicating higher habitat suitability and contribution to population persistence.

The MHQAT incorporates species stocking rate as an attribute not discussed under the traditional terrestrial habitat assessment methodology. The MHQAT defines scoring thresholds however the consultant must consider how these should be interpreted for the target species.

For the Greater Glider, species stocking rates are estimates of the carrying capacity of the site at the time of undertaking the survey. Given the discreet nature of the Greater Glider, the species stocking rate scoring methodology has been derived through the collation of site-specific surveys and surrounding contextual habitat analysis. Species stocking rate is calculated using the following parameters:

- Species presence on or adjacent to the site,
- Species usage of the site,
- Approximate density of the species on the site, and
- Role/importance of species population on site.

Scoring weighting and the meaning of each measure has not been modified from the original MHQAT. A summary of the Species Stocking Rate scoring tables is provided below in Table 14 and Table 15.

TABLE 14: SPECIES STOCKING RATE SCORING TABLE.

Species Stocking Rate				
Measure	Score			
Presence detected on or adjacent to the site	0	5	10	
	No	Adjacent	On site	
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density	0	10	20	30

Species Stocking Rate				
Measure	Score			
	0%	Low	Medium	High
Role of species population (on the site)*	0	5	10	15
	0	5-15	20-35	40-45
Species Stocking Rate Score (Maximum)				*70*

TABLE 15: SPECIES STOCKING RATE SUPPLEMENTARY TABLE FOR THE ROLE OF SPECIES POPULATIONS ON THE SITE.

*SSR Supplementary Table		
Measure	Score	
*Key source population for breeding	0	10
	No	Yes/ Possibly
*Key source population for dispersal	0	5
	No	Yes/ Possibly
*Necessary for maintaining genetic diversity	0	15
	No	Yes/ Possibly
*Near the limit of the species range	0	15
	No	Yes
SSR Supplementary Score (Maximum)		*45*

1.6.1 PRESENCE DETECTED ON OR ADJACENT TO THE SITE

Baseline Greater Glider presence was determined through spotlighting transects. The spotlighting transects were conducted in accordance with The Department of Environment, Land, Water and Planning *Forest Protection Survey Program Survey Guideline – Spotlighting and Call Playback* (2020) (version 4.1) and Conservation Regulator Victoria Guidance Note: *Reporting detections of Greater Gliders* (2021). Multiple transects are conducted for each day of survey and exceed the total of 1 km requirement of the guideline over three nights. During the spotlighting surveys, hollows were observed with a spotlight and binoculars.

Results from the spotlighting surveys, as well as species records, are compared against current available published scientific literature to identify an estimated Greater Glider carrying capacity (stocking rate).

On the impact and offset site, the species was not detected on or nearby to the site and the score has been rated accordingly at not detected (0).

1.6.2 SPECIES USAGE OF THE SITE (HABITAT TYPE AND EVIDENCE OF USAGE)

Usage of the site describes what functional aspect of the species' life cycle may take part on the site, from *not habitat* to *breeding habitat.*

For the Greater Glider, this measure has been assessed on the basis of the type, arrangement and quality of habitat and considers whether or not the species has been

detected by field observation or by species records. Though the MHQAT does not define the habitat categories, we have provided an interpretation here utilised for the Greater Glider. For example:

- Not habitat is an area where the species has not been observed that would not be considered habitat nor functional dispersal habitat for the Greater Glider due to lack of vegetation and/or significant barriers to movement.
- Dispersal habitat may be non-forested habitat within the matrix of fragmented patches of Greater Glider habitat (where the species has been observed) and is likely to be used for dispersal.
- Foraging habitat includes areas with sufficient density and maturity of Greater Glider food trees (where the species has been observed) to provide food resources though it may not be suitable for the total life cycle requirement due to threats, fragmentation, or other stressors.
- Breeding habitat is functional, mature Greater Glider habitat comprised of food trees and denning trees in a patch or series of patches (where the species has been observed) of sufficient size to support a population and the full life cycle of the species.

At the impact site, the species has not been recorded, and the habitat has been rated dispersal habitat as the vegetation contains suitable hollows for the species and could be considered potential habitat. The impact site is too isolated to support a viable population.

At the offset site, the vegetated habitat has been allocated foraging habitat, and non-vegetated habitat has been rated dispersal habitat, as the species is known to the locality and the site may provide potential habitat for the species for activities other than denning.

1.6.3 APPROXIMATE DENSITY (PER HA)

Approximate density (per ha) refers to the density of the population of the species on the site compared to expected or average species density.

For the Greater Glider, this has been allocated a density of *low* as the species is known from the locality and the site provides potential habitat for the species for activities other than denning.

1.6.4 ROLE OR IMPORTANCE OF SPECIES POPULATION ON THE SITE

This measure considers how a population that may use the site is important with regard to the rest of the known species distribution. It is measured as a sum of the total of four subcategories, for which the scoring is outlined in Table 15.

For the Greater Glider, this was determined based on the outcome of spotlighting results, and site observations of habitat characters when compared to the criteria for critical habitat. The assessment also considers any direct or indirect species observations, as well as species records (accounting for observer bias).

The categories include:

- Key source population for breeding is the likelihood that there is a persistent breeding population on the site. As the habitat is disconnected from any other habitat area, the habitat is not considered a source population for breeding on the impact site. At the offset site, the habitat does not support the maturity of habitat to provide denning habitat for the species.
- Key source population for dispersal is the likelihood that there is a population on the site that undergoes frequent in or out dispersal. Species usage on the impact and offset site has been assigned dispersal habitat, and at the offset site, habitat is not mature enough to provide denning habitat for the species.
- Necessary for maintaining genetic diversity is the size, location, connectedness of the population, and whether it is likely to be important for genetic diversity (i.e., genetic stronghold, genetic outlier). Both sites are unlikely to support a population important for the maintenance of genetic diversity.
- Near the limit of the species range has been defined as a population that does not have another population considered to be existing in another direction (i.e., the known population is on the outside of the known distribution). Both sites are located centrally within the species total range.

2 REFERENCES

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